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Edited by
Pedro Isaías
Piet Kommers
Maggie McPherson

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THE IMPACT OF PRIOR EXPERIENCE ON COMPUTER SELF-EFFICACY: A META-ANALYSIS

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ABSTRACT

An important stream of IS research on individual differences is the malleability of computer self-efficacy. Within the literature, prior experience appears to be a factor influencing computer self-efficacy. However, there are still some contradictory results about such relation. As a result, this meta-analysis assesses past research on the relation between prior experience and computer self-efficacy from a holistic perspective. The results not only indicate a strong relation between prior experience and computer self-efficacy but also identify several factors that act as moderators of such relation. These moderators include: methodology, the domain of self-efficacy, the type of operationalization of prior experience, and the year in which the research was conducted.

KEYWORDS

IS user behavior, computer self-efficacy, prior experience, meta-analysis.

1. INTRODUCTION

Research on individual differences and reactions to computer technologies has received considerable attention in the Information Systems (IS) field (Compeau, Higgins, & Huff, 1999). Part of this research has focused on how individuals develop their computer-related skills (Vessey & Galleta, 1991). Computer self-efficacy is one of the core concepts within this stream of research. Computer self-efficacy refers to the judgement of an individual's capabilities to successfully perform a computational task (Compeau & Higgins, 1995). Due to the fact that computer self-efficacy is a strong factor influencing computer performance (Marakas, Yi & Johnson, 1998), and taking into account that an individual's lack of confidence with information technology may hamper his/her career success (Smith, 2002a), it is paramount to study the mechanisms that improve computer self-efficacy.

The strongest determinant of computer self-efficacy is prior experience (Bandura, 1977, 1986). Prior experience refers to past practice within a task domain (Bandura, 1977). Therefore, within the Information Systems (IS) environment, the experience of an individual with computers partly contributes to his/her computer self-efficacy (Marakas et al., 1998).

This meta-analysis explores past findings regarding the relation between prior experience and computer self-efficacy. Although the majority of past research has consistently reported an influence of prior experience on computer self-efficacy (Marakas, Yi & Johnoson, 1998), there are still some contradictory results. For example, Compeau and Higgins (1995) found that prior experience was a factor enhancing computer self-efficacy for only one of the two applications (Word Processing and Lotus 123) the participants had to use. Furthermore, it seems that experiences with computers differ in their generalizability to other domains (Compeau & Higgins, 1995). As a result, it is vital to improve our understanding of the effects of prior experience on computer self-efficacy and the conditions under which such relations generalize

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(Compeau & Higgins, 1995).Thus, this meta-analysis contributes to our understanding of prior experience and computer self-efficacy. First, it clarifies the effects of prior experience on computer self-efficacy from a holistic point of view by taking into consideration a substantial number of research articles. Second, this paper provides a quantitative summary (Rosenthal, 1995) of the magnitude of the relation between prior experience and computer self-efficacy, for which past research has not provided any meta-analysis reports. Finally, it points out some opportunities for research by exploring potential moderators of the relation between prior experience and computer self-efficacy, and the practical implications of this study[2].

This paper is organized as follows. First, a brief literature review is presented regarding the theoretical framework for the relation between prior experience and computer self-efficacy. Second, the research questions are proposed. Third, the method used for the meta-analysis is described. Fourth, the results of the meta-analysis are presented. Finally, a discussion of the results and concluding comments are presented.

2. THEORETICAL BASE FOR RESEARCH

Before analyzing the construct of computer self-efficacy in more detail, it is important to look at the origins of the concept. Computer self-efficacy derives from self-efficacy, a notion developed in Social Cognitive Theory (SCT) (Bandura, 1977, 1986). SCT defines human functioning as a triadic, dynamic, and reciprocal interaction of cognitive and personal factors, behavior, and the environment (Bandura, 1977, 1986).

According to SCT, individuals are influenced by the environment where they live, which is in turn affected by that individual (Bandura, 1977, 1986, 1997). Furthermore, behavior is seen as a function of the reciprocal interaction between an individual and his/her environment (Bandura, 1977, 1986, 1997). Finally, the individual and the environment are again influenced by the consequences of the behavior (Bandura, 1977, 1986, 1997). SCT not only acknowledges the importance of the perceived consequences of behavior, it also incorporates perceptions of personal efficacy (Bandura, 1977, 1986, 1997). Thus, self-efficacy is a personal judgement of the ability to apply individual skills to properly organize and execute a target behavior (Bandura, 1977, 1986, 1997). Self-efficacy is important for two reasons. First, it affects an individual's courses of action (Bandura, 1977). Second, it influences an individual's patterns of thought (Bandura, 1977).

Within the IS context, computer self-efficacy is seen as an individual's self-efficacy within the computer environment. Therefore, computer self-efficacy refers to an individual's judgment of his/her capabilities to successfully use computers (Compeau & Higgins, 1995). Furthermore, it is important to acknowledge that computer self-efficacy can operate at the task specific domain and at a more general domain (Bandura, 1986). Thus, while general self-efficacy refers to an individual's judgement of self-efficacy across different domains (Bandura, 1986), task specific self-efficacy is defined as an individual's perceptions of his/her efficacy to perform specific tasks (Bandura, 1986). Within the computational environment, computer self-efficacy operates at the application environment domain (GCSE) and at the application-specific domain (CSE). Thus, CSE is defined as "the perceptions of ability to perform specific computer-related tasks in the domain of general computing" (Agarwal, Sambamurthy & Stair, 2000, p.419). On the other hand, GCSE is defined as individual's self-efficacy across multiple computer related domains (Marakas et al., 1998). In spite of this differentiation, past research has systematically overlooked the different levels in which computer self-efficacy operates (Marakas et al., 1998). Therefore, this meta-analysis, when testing for moderators, will focus on the relation between prior experience and the different levels of computer self-efficacy.

Furthermore, self-efficacy is a dynamic concept that encompasses more than just a judgment about ability (Bandura, 1986). Thus, self-efficacy is influenced by several factors, each of which directly affects an individual's final evaluation of self-efficacy (Bandura, 1977, 1986, 1997). According to SCT, prior experience is the most powerful source of self-efficacy (Bandura, 1977, 1986, 1997; Wood & Bandura, 1986). Thus, an individual's previous experience with a computational environment it is likely to influence his/her computer self-efficacy assessments (Staples, Hulland & Higgins, 1999). However, experiences with computers may not be generalizable to other computer application domains, and additional research is necessary in order to better understand the conditions under which experiences generalize (Compeau &

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[2] The investigator has only found one meta-analysis on self-efficacy: Stajkovic & Luthans (1998). However, Stajkovic & Luthans' (1998) study explores general self-efficacy issues, no computer self-efficacy concerns. Further, Stajkovic & Luthans' (1998) meta-analysis primarily deals with the outcomes of self-efficacy rather than with its determinants and does not explore the relation between prior experience and self-efficacy.

Higgins, 1995). Therefore, this meta-analysis assesses the impact of prior experience on computer self-efficacy across different studies in order to get a better understanding of the circumstances under such relation occurs.

In addition to computer self-efficacy being measured as either CSE or GCSE, prior experience has been operationalized in many different ways within the IS field. For example, Gist et al. (1989) operationalized prior experience as the number of years using computers, while others have employed measures of prior performance using computers (Johnson & Marakas, 2000). As a result, it seems possible that these different measures may lead to different results when assessing their impact on computer self-efficacy. Thus, this meta-analysis also evaluates the influence of the different types of operationalizations of prior experience on computer self-efficacy.

3. RESEARCH QUESTIONS

The purpose of this meta-analysis is threefold. The first objective is to assess whether prior experience has a positive effect on computer self-efficacy. The second and main objective is to determine the size of that effect. It is important for practitioners and researchers to understand the impact of prior experience on computer self-efficacy in order to provide adequate mechanisms to facilitate the gain of positive computer experiences which would in turn, raise computer self-efficacy. Finally, this meta-analysis is also meant to explore and identify potential moderators of the relation at hand. Some of the potential moderators of such relation are:

1. The domain of computer self-efficacy. That is, whether computer self-efficacy is treated in the study as CSE or as GCSE[3].
2. The operationalization of prior experience. That is, whether prior experience is operationalized as the number of years of experience, or as an assessment of the prior experiences with computers.
3. The method used in the study. In this meta-analysis, the method refers to whether the authors conducted an experiment or whether the study took the form of a survey.
4. The different types of respondents. In this case, the studies are divided in two groups based on their respondents. The first group consists of studies which employed staff of universities and hospitals. The second group is formed by studies which sampled employees in private businesses.
5. The years in which the studies were conducted. The studies were divided in those conducted before 1995, and those conducted in or after 1995.

4. METHOD

A meta-analysis is a statistical technique that summarizes and aggregates the results of similar quantitative studies (Lipsey & Wilson, 2001). This technique allows the researcher to analyze and summarize one or more summary statistics, called effect sizes, across several studies (Lipsey & Wilson, 2001). A meta-analysis is an appropriate method for evaluating past research on the relation between prior experience and computer self-efficacy since it provides a method for summarizing and unifying contradicting results regarding this relation.

The methodology for the development of this meta-analysis consisted of the following steps. First, articles exploring or reporting the relation between prior experience and self-efficacy were located. Second, the articles were examined and selected for the meta-analysis based on predetermined criteria[4]. Third, the articles were summarized. Fourth, the information provided in the articles and the characteristics of the studies were coded in Microsoft Excel and SPSS. Fifth, the data were statistically analyzed using the procedures suggested by Lipsey and Wilson (2001) for the analysis of the correlation between two variables. Finally, the results of the study were interpreted and documented.

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[3] Although the articles did not explicitly acknowledge whether they referred to CSE or GCSE, the investigator made this classification taken into consideration all the information available in each article.
[4] The criteria for selecting and including the articles in the meta-analysis are explained in section 4.1. Furthermore, the articles included in the study as well as the coding sheet can be obtained upon request from the author.

4.1 Criteria for Inclusion

The criteria for selecting studies from among those that dealt with computer self-efficacy and prior experience were:
1. Each study had to report the relation between computer self-efficacy and prior experience in the form of a correlation coefficient or statistics that could be converted to a correlation coefficient.
2. Each study had to report the relation between computer self-efficacy and prior experience before a treatment condition and/or computer training was provided to the participants, not afterwards.
3. Each study had to describe the operationalization of prior experience.
4. Each study had to describe the method used to conduct the study (experiment or survey).

All the articles found in the literature search were reviewed against the above criteria. As a result, of nineteen located articles exploring the relation between prior experience and computer self-efficacy only seven were included in the meta-analysis.

4.2 Recorded Variables

Data required for the effect size calculation (correlations, sample sizes, and reliability of measures) were recorded. The studies did not have any missing data. Therefore, no strategies had to be taken to handle missing values. However, the studies where prior experience was operationalized as number of years (Gist, Schwoerer, & Rainer, 1989; Harrison & Rainer, 1992) did not report reliability. For these cases the investigator assumed a reliability of 1 for prior experience since the number of years represents a precise estimate of years of experience. Furthermore, all the effects in the studies with the exception of one (Henry & Stone, 2003) were reported in the form of correlations. Furthermore, the potential moderators were summarized and coded.

4.3 Effect Size Estimators

Table 1. Formulas used in the analyses (from Lipsey and Wilson, 2001)

Statistic	Formula	Statistic	Formula
(1) Effect Size Statistic	$ES_r = r$	(7) Standard Error of the Mean Effect Size	$SE_{\overline{ES}} = \sqrt{\dfrac{1}{\sum \omega_i}}$
(2) Correction for Unreliability - ES	$ES_r = \dfrac{ES_r}{\sqrt{r_{xx}}\sqrt{r_{yy}}}$	(8) Inverse Variance	$\omega = \dfrac{1}{SE^2} = n - 3$
(3) Fisher's Z_r Transformation	$ES_{zr} = .5\log_e\left[\dfrac{1 + ES_r}{1 - ES_r}\right]$	(9) Correction for Unreliability – ω	$\omega = \omega(r_{xx})(r_{yy})$
(4) Inverse of the Z_r Transformation	$r = \dfrac{e^{2ES_r} - 1}{e^{2ES_r} + 1}$	(10) Confidence intervals	
(5) Mean Effect Size	$\overline{ES} = \dfrac{\sum(\omega_i ES)}{\sum \omega_i}$	Lower Limit	$\overline{ES}_L = \overline{ES} - z_{(1-\alpha)}(SE_{\overline{ES}})$
(6) Standard Error of the Effect Size	$SE = \dfrac{1}{\sqrt{n-3}}$	Upper Limit	$\overline{ES}_U = \overline{ES} + z_{(1-\alpha)}(SE_{\overline{ES}})$
(7) Standard Error of the Mean Effect Size	$SE_{\overline{ES}} = \sqrt{\dfrac{1}{\sum \omega_i}}$	(11) Z Test for the Mean Effect Size	$z = \dfrac{\left|\overline{ES}\right|}{SE_{\overline{ES}}}$
(12) Homogeneity Test – Q statistic	$Q = \left(\sum \omega_i ES_i^2\right) - \dfrac{\left(\sum w_i ES_i\right)^2}{\sum \omega_i}$		

After the data were summarized and coded, analyses were conducted in Microsoft Excel. SPSS was used to produce some graphical views of the data. The calculation of the effect size of the correlation between computer self-efficacy and prior experience, as well as other statistics, were calculated following the recommendations by Lipsey and Wilson (2001). The formulas used in the analyses of the data are summarized in **Error! Reference source not found.**. The explanations of how to conduct the calculations are presented in the next section as well as with the description of the strategy used for the correction of unreliability of effect sizes and weights.

5. RESULTS

The effect size of the correlation between prior experience and computer self-efficacy was calculated in three different ways. First, the effect size was calculated taking into consideration the correction for unreliability. However, for one of the studies (Staples et al., 1999), the correction for unreliability of the effect size resulted in a number higher than 1 (exactly, ES = 1.221118). This result presents a problem. Since the transformation for Fisher's Z uses the logarithm function, this number is out of range because logarithms cannot handle numbers higher than 1. Therefore, this effect size was recoded as 0.99 for the rest of the calculations. Second, since the effect size for one of the studies (Staples et al., 1999) when correcting for unreliability was out of range and had to be manually changed, the effect sizes were also calculated without correcting for unreliability. Finally, since the Staples et al. (1999) study reported a very high effect size (r=0.86), this study represented a potential outlier. Therefore, another set of results was calculated excluding the Staples et al. (1999) study in order to provide results without the influence of a potential outlier. Since the majority of the analyses led to the same results, only the first set of analyses is described in this study. Nonetheless, any differences among the three sets of results are pointed out in the paper.

5.1 Descriptive Results

The data on the stem and leaf diagram (see Table 2) shows the effect sizes of each of the seven cases when correcting for unreliability and after transforming each effect size back to the standardized form. As Table 2 shows, there is some variability among the studies in the effect size correlation between prior experience and computer self-efficacy.

Table 2. Stem and leaf diagram of 7 effect size rs when correcting for unrealibity

Frequency	Stem	Leaf
1	1	5
1	2	5
3	3	268
0	4	
1	5	1

Note: Stem width: .10, Each leaf: 1 case

The standard error of the mean effect size (using formulas 6, 7, 8 and 9) resulted in a value of 0.02. Using the formulas (1, 2, 3, 5, 7, 8 and 9) in **Error! Reference source not found.**, the unstandardized weighted mean effect size for all seven cases was computed and resulted in 0.62. This number represents the unstandardized mean effect size of the correlation of prior experience and computer self-efficacy when using Fisher's Z transformations and correcting for unreliability. Further, using formula 10, the upper confidence intervals for the mean effect size was 0.67, and the lower confidence interval was 0.57. The significance of the mean effect size was calculated according to Lipsey and Wilson (2001). According to this procedure, the z score for the weighted mean is calculated using formula 11 in **Error! Reference source not found.**, and resulted in a value of 26.01. According to the z table, for an alpha of .05 the critical z is 1.96. Since the z-score of the weighted mean effect size (26.01) is greater than the critical z (1.96), this effect size is statistically significant. Therefore, there is a correlation between prior experience and computer self-efficacy. However, a Fisher's Z transformed correlation represents an unstandardized value. This means that the interpretation of the transformed correlation is difficult because it does not fall within a standardized range (e.g., from -1 to 1). Therefore, the last step was to inverse the Fisher Z transformation using formula 4 in

order to get the effect size into a standard correlation form. Therefore, the resulted value of the mean effect size correlation for all the articles was 0.55. This number represents a strong correlation between prior experience and computer self-efficacy. According to Lipsey and Wilson (2001), a mean effect size correlation of .40 or greater indicates a large magnitude of effect size.

5.2 Moderators

According to Lipsey and Wilson (2001), in order to determine the potential existence of moderators, a test for homogeneity needs to be conducted. The homogeneity statistic (Q) is calculated using formula 11 of **Error! Reference source not found.**. The Q statistic resulted in a value of 865.99. The homogeneity statistic is distributed as the Chi-square distribution. The degrees of freedom for getting the critical Chi-square are calculated by subtracting 1 from the number of effect sizes (7-1=6) (Lipsey & Wilson, 2001). The critical Chi-Square with 6 degrees of freedom and an alpha of .05 is 12.59. Since the calculated Q (865.99) is greater than the critical Chi-Square (12.59), the homogeneity test is significant, and therefore, the distribution of effect sizes is heterogeneous. This means that the variability among effect sizes is greater than what is likely to have resulted from sampling error alone (Lipsey & Wilson, 2001). When getting a heterogeneous distribution of effect sizes, the investigator can assume that the variance beyond sampling error is partly derived from factors that can be identified and that may act as moderator variables (Lipsey & Wibson, 2001).

Table 3. Potential moderators, mean effect sizes, and observed differences when correcting for unrealibity

Potential Moderator	Group A (n)	ES_r (SE)	Group B (n)	ES_r (SE)	Observed Difference
Method	Survey (4)	0.58989241* (0.02567362)	Experiment (3)	0.25591664* (0.0637995)	Yes
CSE/GCSE	CSE (3)	0.440666* (0.04085)	GCSE (4)	0.581389* (0.027231)	Yes[a]
Operationalization of Prior Experience	Assessment of Prior Experience (5)	0.70860153* (0.03286972)	Years of Prior Experience (2)	0.31565237* (0.0345599)	Yes
Types of Participants	Employees of a Private Business (4)	0.749498* (0.037875)	Employees of Hospital / University (3)	0.370624* (0.030632)	Yes[b]
Year of the Study	1995 or After (4)	0.73275898* (0.03398786)	Before 1995 (3)	0.30544169* (0.03338628)	Yes
Total Sample Size	>250 (4)	0.589892* (0.025674)	<250 (3)	0.255917* (0.0638)	Yes

[a]*Note:* When the Staples et al. (1999) is excluded prior experience has a stronger relation with CSE than with GCSE.
[b]*Note:* There was no observed difference on type of participants when excluding the Staples et al. (1999) study.
*p<.05

In Table 3, there is a summary of the results for the tests for potential moderators. The actual mean effect size is recorded on the top half of each cell and the standard error of the effect sizes is recorded below in brackets. The observed differences in effect sizes are reported in the right hand column and have been compared by observation. Thus, the differences are coded as "yes", when the differences between effect sizes are greater than .10, and as "no", when the opposite occurs[5]. The results indicated that there were observed differences for each of the potential moderators.

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[5] The reader should notice that this criteria for the observed differences is established by the investigator of this paper, and it is not taken as a rule of thumb from a meta-analysis work.

6. DISCUSSION

6.1 Impact of Prior Experience on Computer Self-efficacy

All the results indicated a strong correlation between prior experience and computer self-efficacy. However, no causality can be inferred from this finding. This finding answers the first two and most important research questions of this meta-analysis, whether prior experience relates to computer self-efficacy and the extent of the magnitude of this relation. Moreover, this finding is consistent with SCT, as Bandura (1977, 1986, 1997) stated that the most important determinant of self-efficacy was prior experience.

6.2 Impact of Potential Moderators

The impact of moderators is observed by comparing the mean effect sizes of each group in Table 3. The first moderator is the methodology used in the studies. It appears that survey methods obtain better correlations between prior experience and computer self-efficacy than experiments. Moreover, the second moderator is the level of computer self-efficacy tested in each of the studies. The first two sets of results indicate that prior experience has a greater impact on GCSE than on CSE, whereas when the Staples et al. (1999) study is excluded, prior experience has a stronger relation with CSE than with GCSE. The latter results are taken as better approximation of the actual relation between prior experience and CSE/GCSE since the Staples et al. (1999) is a potential outlier. It can be concluded that prior experience has a greater impact on CSE than on GCSE. This is because individuals need to have an idea of the task they are going to perform in order to build accurate self-efficacy judgments (Bandura, 1977; 1986). Therefore, when building accurate self-efficacy judgments, the influence of relevant and specific prior experience may be greater. Furthermore, Bandura (1986) stressed that general self-efficacy and specific self-efficacy are different constructs. This meta-analysis shows that prior experience has a different impact on CSE and GCSE, and therefore, it suggests that CSE and GCSE may be in fact representing different constructs.

Another potential moderator is the different operationalizations of prior experience. The biggest difference among operationalizations is between those studies which use the number of years of experience and those that employ a more elaborate measure, such as past performance using computers (e.g., Compeau & Higgins, 1995; Johnson & Marakas, 2000), or the assessment of past experiences using computers (e.g., Smith, 2002). This finding is consistent with theory. As explained before, prior experience refers to past practice within a task domain (Bandura, 1977, 1986, 1997). According to Bandura (1986, p.399), "success raises efficacy appraisals; repeated failures lower them". The previous statement by Bandura (1986) identifies prior experience as the assessment of past experience, not as its length. Therefore, operationalizations of prior experience in the form of performance or assessment of past experiences, better capture the construct of prior experience.

Furthermore, the types of participants included in the studies influence the relation between prior experience and computer self-efficacy for the first two sets of results. However, the types of participants do not impact the relation between prior experience and computer self-efficacy when the Staples et al. (1999) study is excluded. Taking the last set of results as better approximation of reality since they are not influenced by potential outliers, it appears that the types of participants do not significantly alter the relation between prior and computer self-efficacy.

The year when the articles were published also moderates the relation between prior experience and computer self-efficacy. This may due to the fact that research is paying more attention to methodological and reliability related issues. However, by looking in more detail at the included studies other possible explanations arise. The majority of the studies published before 1995 operationalized prior experience as number of years of experience and dealt with GCSE instead of CSE. These two factors are also moderators of prior experience and computer self-efficacy, and may be affecting the results in this particular case.

Finally, studies with bigger sample sizes demonstrate stronger relation between prior experience and computer self-efficacy. There are two explanations for such results. First, the sample size is taken into account when calculating the overall effect size. Second, studies with bigger sample sizes used a survey method and studies with smaller samples sizes were conducted in the form of experiments, and therefore the methodology used in the studies may be influencing the results for different sample sizes.

6.3 Limitations and Contributions

This paper has a number of limitations. The first limitation is the lack of another coder for coding the articles. The use of another coder would have enhanced the reliability of this meta-analysis by increasing inter-rater reliability.

A second limitation relates to the "file drawer" problem or the absence of unpublished studies (Lipsey and Wilson, 2001). Given the fact that studies with non significant results are generally less likely to be published, the sample of articles may not be representative of the actual relation between prior experience and computer self-efficacy. Although the investigator of this study contacted several authors asking for non published papers, no responses were obtained.

Moreover, if more articles had been found, studies could have been selected paying more attention to their quality. Furthermore, potential outliers could have been excluded (e.g., Staples et al., 1999). Therefore, the results of this study may be affected by the quality of the articles included in the analyses.

Although the interpretation of the results needs to be cautious, this meta-analysis has achieved two major accomplishments. First, this study, contributes to our understanding of the relation between prior experience and computer self-efficacy. Second, it is consistent with past research and identifies new possibilities for research, as will be explained next.

6.4 Implications

This study has implications for both research and practice. There are three main implications for research. First, researchers should acknowledge the differences between GCSE and CSE when conducting research studies. Second, since the operationalization of prior experience acts as a moderator, it is necessary that researchers provide studies where measures have a strong sampling validity and therefore capture all the dimensions and facets of prior experience. Finally, future research can replicate this study with more published and unpublished works. This would address some of the limitations of this study.

This research has implications for practice since computer self-efficacy has a direct impact on performance (Marakas et al., 1998). Therefore, it is important for practitioners to be aware of the factors that lead to a greater computer self-efficacy. Practitioners should be aware of the importance of providing positive experiences when working with computers. For example, practitioners should facilitate technological designs that enhance successful experiences with computers. Further, managers should assign employees to attainable computational tasks in order to increase their positive experiences with computers.

7. CONCLUSIONS

This meta-analysis has found that there is a strong relation between prior experience and computer self-efficacy. Furthermore, there are some factors that may moderate this relation. Potential moderators include the type of methodology used in the study, the differentiation between GCSE and CSE, the type of operationalization used to measure prior experience, and the year when the articles were published. Furthermore, this meta-analysis has implications for future research. Thus, researchers should be aware of the importance of building quality measures for prior experience, and acknowledge the differences between GCSE and CSE.

ACKNOWLEDGEMENT

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References can be obtained upon request from the author.

DESIGNING AND IMPLEMENTATION OF "REGIONAL CRAWLER" AS A NEW STRATEGY FOR CRAWLING THE WEB

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ABSTRACT

By the rapid growth of the World Wide Web, the significance and popularity of search engines are increasing day by day. However, today web crawlers are unable to update their search engine indexes concurrent to the growth in the information available on the web. This sometimes causes users to be unable to search on recent or updated information.
Regional Crawler that we are proposing in this paper, improves the problem of updating and finding new pages to some extent by gathering users' common needs and interests in a certain domain, which can be as small as a LAN in a department of a university or as huge as a country. In this paper, we introduce the design of the Regional Crawler architecture and discuss its application in search engines.

KEYWORDS

Regional Crawler, Web Crawler Architecture, Information Retrieval

1. INTRODUCTION

1.1 The Significance of Search Engines

Surveys show that the use of Internet is growing worldwide both in servers and in clients. For instance, the number of web sites has grown from 3 millions in 1998 to more than 9 millions by the year 2002 [9]. the number of web pages has climbed from 2.1 billions in 1999 to 16.5 billions in 2003 [16]. The number of Internet users, which was less than 160 millions in 1998, has increased to more than 600 millions by the year 2002 [10].

 Above statistics show the huge amount of information on WWW and the growth of people's desire for this information in different parts of the world. Search engines take users' queries as input and produce a

sequence of URLs that match the queries according to a rank they calculate for each document they have indexed [6 and 7].

1.2 What are Crawlers?

Web crawling is a process to collect the web pages that are interesting to search engine. It is usually a challenging task for general search engine [15]. Web crawler is a program that traverses the internet automatically by retrieving a web page and then recursively retrieving all linked pages [2 and 7].

It takes weeks and months to crawl the entire web because of huge amount of information on it [1 and 3]. Even the largest search engines, like Google and Altavista, cover only limited parts of the web and much of their data are out of date several months of the year [12]. In February 2004, Google announced that it has covered "6 billion items": 4.28 billion web pages, 880 million images and 845 million Usenet messages [16]. Therefore, it will not be possible to cover and update the rapidly changing information such as News that changes hourly or daily. Most of the recent works done on crawling strategies attempt to minimize the number of pages that need to be downloaded, or maximize the benefit obtained per downloaded page [12].

1.3 Regional Crawler Method

Regional Crawling is a crawling strategy based on interests of users in certain domains. The needs and interests are determined according to common characteristics of the users such as geographical location, age, membership and job. Regional Crawler takes advantage of that information for crawling instead of using common strategies like BFS, DFS etc. The more a document shares the common interests of a domain, the more chance it has for being crawled.

2. A WEB CRAWLER DESIGN

The first crawler, Mathew Gray's Wanderer, was written in the spring of 1993, roughly coinciding with the first release of NCSA MOSAIC [3] and [4].
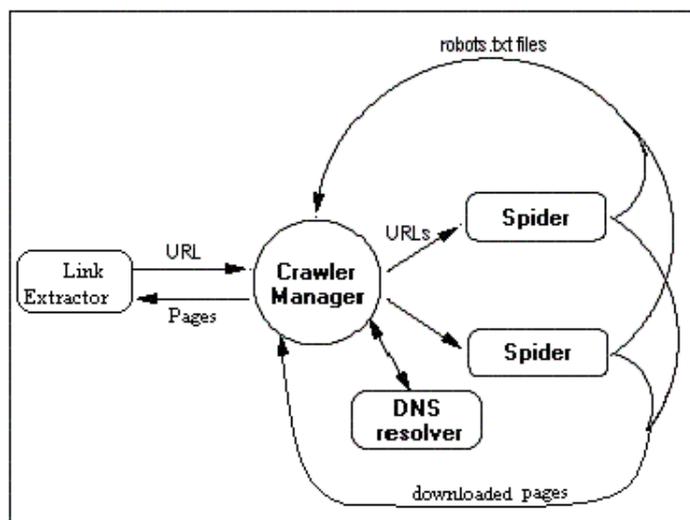
Figure 1. Web Crawler Architecture

Figure 1, shows a simple architecture for a web crawler:

- **Crawler Manager**: takes a set of URLs from Link Extractor and sends the Next URL to the DNS resolver to obtain its IP address. This saves a lot of time because spiders do not have to send requests to DNS every time they want to download a page.
- **Robots.txt file**: are the means by which web authors express their wish as to which pages they want the crawlers to avoid. Crawlers must respect authors' wishes as well.
- **Spider**: downloads robots.txt file and other pages that are requested by the crawler manager and permitted by web authors. The robots.txt files are sent to crawler manager for processing and extracting the URLs. The other downloaded files are sent to a central indexer.
- **Link Extractor**: processes the pages downloaded by the spider, extracts URLs from the links in those pages and sends the URLs to the crawler manager for downloading afterwards.

Any crawler must fulfill the following two issues [12]:
1. It must have a good crawling strategy.
2. It has to have a highly optimized system architecture that can download a large number of pages per second.

Most of search engines use more than one crawler and manage them in a distributed method. This has the following benefits [11]:
- Increased resource utilization
- Effective distribution of crawling tasks with no bottle necks
- Configurability of the crawling tasks

3. USING REGIONAL CRAWLER IN CENTRALIZED SEARCH ENGINES

In centralized search engines [5], there is a central URL store, which sends URLs to the crawler for processing and downloading. The mechanism that leads to the production of a list of ranked URLs to get downloaded, determines the crawling strategy. There are three major crawling strategies for centralized crawlers in the literature [14].

- Best-First crawlers: use a queue in which the URLs are ranked according to their topic similarity and the pages they have been found in.
- Page ranking crawlers: crawl the pages according to PageRank method described in [15 and 13]
- InfoSpider: use neural networks to propagate the error and use the text near the links as page topic.

Regional Crawling strategy is a variation of Best-First strategy.

Figure 2, depicts the main components of a Regional Crawler. In this figure, robots.txt Processor determines the set of permitted URLs under the given IP address and stores them in Valid URLs Queue. URL Ranker takes the set of valid URLs from the Valid URLs Queue and gives a rank to each unranked URL. URL rank is determined by applying a weight scheme to the page related to that URL. Page Processing Unit processes the pages that are pointed to by the URLs and extracts the keywords and passes them to URL ranker for weighting. Ranks reflect the closeness of a web page to the users' interests in a region. So, a page may receive different weights from different Regional Crawlers. Interests are retrieved from Interest Manager, which specifies the interests according to the known characteristics of each region manually, or by learning algorithms. URL Ranker provides the spider with an ordered list of URLs ordered by their priority for retrieval.

In regional crawler, the order of downloading pages depends on users specific interests mapped to a region. For example, if in a region most users are much interested in soccer then regional crawler will crawl soccer related pages more often and if a university is considered as a region then scientific pages will be crawled more often for that region.
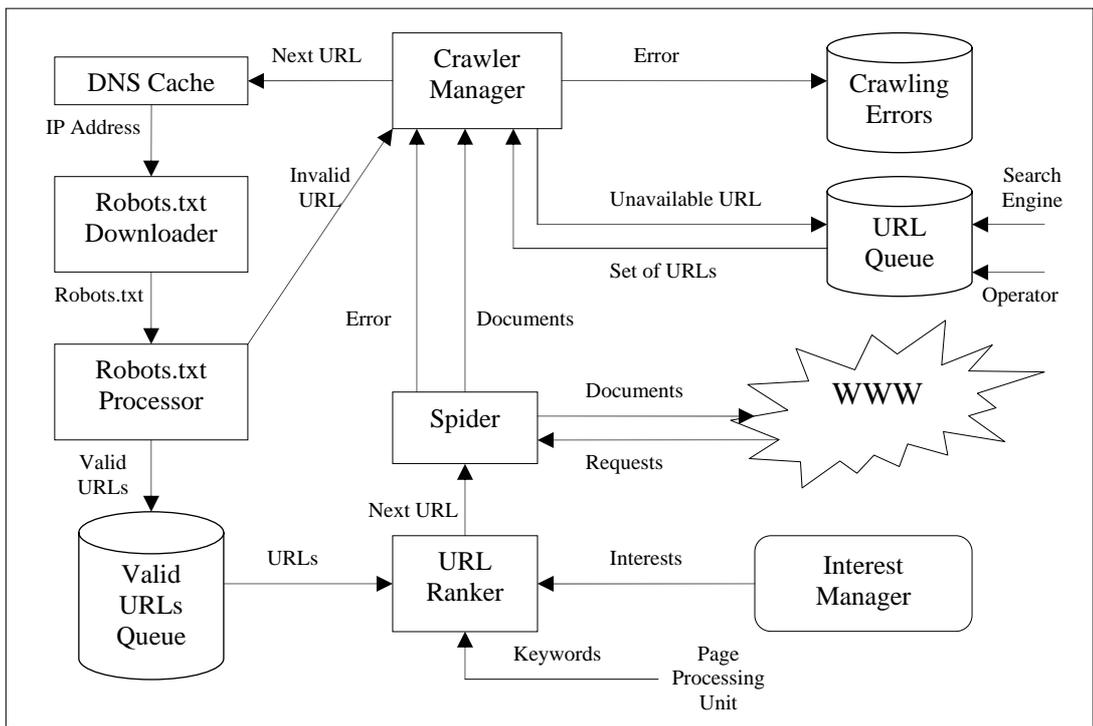
Figure 2. Architecture of a Centralized Regional Crawler

In general, there are two different ways to associate a set of interests to a region (a set of IP addresses)

- Manually
- Learning Methods

In the rest of this section, first, these two models are described and then an experiment showing the advantage of Regional Crawlers is presented.

3.1 Interest Manager in Regional Crawling using Manual User Interest Assignment

Each region in regional crawler consists of one or more IP addresses that represent a group of users. A region's granularity could be as small as a LAN or as big as a country. In the other words, each group of users who share a number of common interests could be taken as a region and their common interests would be considered as region's interests. A good example of a region could be a country for which its people are likely to share common interests about similar subjects relating to their country.

Manual User Interest Assignment is more suitable for situations where one or a handful of individuals are considered as a region. In this case, an administrator can assign the keywords representing the interests of the users to the IP address(es) of that region. Another scenario that might make sense to use this approach is when we are assigning the interest to a very large and diverse region, for example a country. In this case, the number of interests common to groups of users and the number of such groups are so big that considering any combination of them as regional representation would result in downloading a large number of pages. In such cases, an administrator can assign a few interests common to most users to this region in order to provide an efficient update of the pages that cover most common interests like News sites, financial facts, sports etc.

As an example, consider a CS department's LAN in a university as a region. In this region, the probability of requesting pages about computer science articles, other universities web sites and computer related topics, is much higher than a region related to a bank. Table 1 compares Regional interests of two different regions.

Table 1. Region Interests

Region	IP address	Region Interests
Bu-Ali Sina University CS LAN	**163.218.216.1 - 100**	**Computer Engineering, Robocup, Soccer, etc.**
Iran	**Set of Iran IPs**	**Iran Politics, Wrestling**

3.2 Interest Manager in Regional Crawling using Learning Methods

Another approach to specify the interests of users in a region is by learning from user queries or web pages that have been requested. Figure 3, shows the architecture of an Interest Manager for a regional crawler similar to the one introduced in Figure 2.

When a user sends his query to the search engine, the search engine resolves the IP address through the user connection and maps it to a specified region by IP/Region Mapper. IP/Region Mapper is a table that contains the regions and their related IP addresses.

On the other hand, the query is scanned for its main keywords and the keywords and the region are passed to the Interest Learner. The Interest Learner is a learning method that learns the importance of keywords for describing the interests of a region. In its simplest form, it could be a standard Rocchio relevance feedback method [17].

Finally, Interest Learner passes a predefined percentage of highest ranked keywords as interests of the Region to URL ranker. The URL Ranker uses these keywords in matching and ranking URLs of pages and assigning a crawling priority for them. The crawler will use these priorities in downloading web pages.
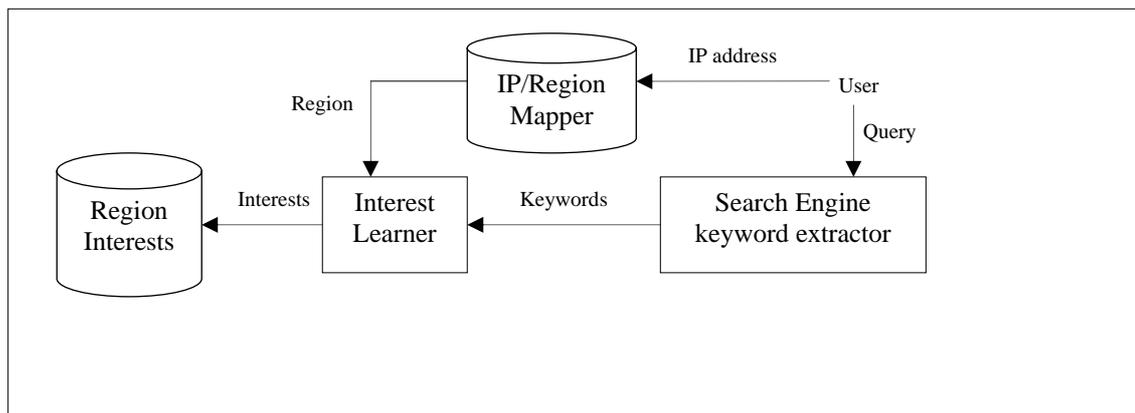
Figure 3. The Structure of Learning Interest Manager

3.3 Implementation and Results

As an example, we considered the country of Iran as a region, and manually specified the set of {Iran, Soccer, Football, Bam, Quake} as her interests. Our crawler had to find relevant pages containing information about the interests of the users of the Iran Region. This means that, we assumed a good percentage of Iranian users are more likely to search for web pages related to those interests. Therefore, the pages related to these interests should be found sooner and updated more frequently than other pages for this region. This does not mean that our crawler will ignore unrelated pages. We claim that in a specific number of crawls, our crawler will find pages that their average probability of being searched is much more than the common crawlers, and it provides the web pages that are requested more frequently. In addition, it will find the new pages that may be related to users needs, much sooner than the normal crawlers. In our test, we ran the crawler after Iran Bam's quake disaster. In those days looking for quake news and surveys about injuries and ruins was so common. Our crawler found a lot of related information about Bam's tragedy in much less period of time than the baseline crawler (a BFS crawler in our test).

For the test, two crawlers namely a BFS and a Regional Crawler have been implemented with Microsoft C# and their performance was compared. Both crawlers started crawling from an initial URL. Our Crawler downloaded the page pointed to by the URL, then calculated its page weight, extracted the hyperlinks in the

page, and repeated this process for each URL in the page recursively. In each step, if there were a hyperlink with the weight higher than the weight of the current URL, then the crawler followed the URL with the higher weight. Otherwise, the crawler followed a link with higher weight from its list of hyperlinks. In this experiment, a weak weighting scheme that could be called nxx.bxx based on [18] was used. In future experiments stronger weights such as Lnu.ltu [19] would be experimented with. Regional Crawler calculates the sum of the term frequencies- tf- of the interest terms in the web page. Then it stores the URL, weight (sum of term frequencies) and a unique id for each page in a Microsoft Access database. We found that the regional crawler found more "relevant and new" web pages than BFS crawler. In this test many new pages, containing news about Bam's earthquake have been found within an hour by the Regional Crawler while it took at least a day for the BFS crawler to locate the same or similar pages.

In other tests, the Regional Crawler has been tested with two different web sites and with different number of web pages. In one occasion, it started from the initial URL and the results for 105 and 770 crawls has been saved.

Table 2. Results for http://gbgm-umc.org/home_page/index.cfm

	For 105 WebPages			For 770 WebPages		
	Average weight	Max weight	Precision	Average weight	Max weight	Precision
Regional Crawler	29	151	48.11%	31.62	474	48.70%
BFS Crawler	4.91	53	5.71%	1.64	39	1.2%

Table 2 depicts the average weight, max weight and precision values for both regional crawler and a BFS crawler. The BFS crawler uses the same scheme for weighting pages as regional crawler. The only difference between the two is in the order in which they select pages for crawling. Precision is calculated as the ration of relevant pages for user interest to all the relevant pages. Relevance judgments are performed by a number of users whose interests were considered for this Regional crawler. As shown in the table, the Regional Crawler has much higher precision than a BFS crawler. This indicates that users of this particular region would have better pages available to them and the search engine would avoid indexing some pages that will not be necessarily wanted by users of this region. Also, the average weight and the max weight in regional crawler are higher than those of the BFS crawler. Since both crawlers use the same scheme, this indicates that on average the regional crawler retrieves pages that more closely match with the specified user interest. Since there is a correlation between the weight and precision of the strategies, then one may conclude that the pages with higher weight should be visited and updated more often than other pages.

We have also tested the Regional Crawler for different initial websites and for different number of iterations. A brief result for one of these tests is collected in table 3.

Table 3. Results for different initial websites

URL	http://www.atimes.com			http://www.worldnews.com		
Number of Iterations	310			2000		
	Average Weight	Max Weight	Precision	Average Weight	Max Weight	Precision
Regional Crawler	5.51	157	15.6%	16.46	456	14.6%
BFS Crawler	0.13	11	0.3%	1.45	272	0.8%

In order to have more reliable results, we have extended our experiments with more number of crawls. As it's shown in Table 3, Average weight of downloaded pages with regional crawler for 310 pages is 5.51 leading to a higher precision in comparison with BFS crawler. Ultimately, for 2000 pages, regional crawler reached the higher precision of 14.6% in contrast to precision of BFS crawler, which was only 0.8%. There were 292/2000 pages interesting for all of our sample region users, which seems to be a reasonable number.

This result shows again that the number of relevant retrieved pages and weights calculated by Regional crawler are higher than those for a BFS crawler. We have preformed several other experiments and the early result of all of them seems to indicate that this approach more closely satisfies the needs of users if we can group them into regions. This approach also saves time and space for Search Engines by not retrieving and not indexing unwanted pages. The weight of documents seems to be a good indication where on can build a model for setting a revisit time. With such a model, the regional crawler can update the needed pages more often than a BFS crawler, providing users with more updated versions of the information they seek.

4. CONCLUSION AND FUTURE WORK

In this Paper we have described a Regional Crawler as a new crawling strategy for search engines and provided architecture for its implantation. The main advantage of Regional Crawler over the other kinds of web crawlers is that Regional Crawler updates and locates the new most important pages according to users groups' needs and interests, providing more up-to-date results for the users. The specific Region's user interest could be learned from their queries.

The more important a page is for a region's interest, the more frequently it will be looked for, updated and become available. This strategy will help the Search Engines to more closely cater to the needs of regions of users.

Early results from our experiments seem very promising, and we intend to widen and deepen our experiments in several dimensions. For example, many improvements can be done on profiling and learning regional user interests by using reinforcement-learning [8] methods. Other interesting things to consider are discovering a shift of interest in some region. For example, a sport event or a political change may spur a lot of request for sites dealing with those issues. These shifts might mean a temporary emphasis on some part of a region's interest or a complete change of interest. An intelligent crawler could detect this shift and respond to it by assigning more weight to those pages and updating them more frequently than usual for a period of time.

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RECOMMENDATION-BASED COLLABORATIVE BROWSING USING BOOKMARKS

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ABSTRACT

The World Wide Web (WEB) has made possible the creation of many applications for computer supported cooperative work (CSCW); however, the most common activity being performed by users everyday, namely browsing (and exploring) its contents, remains an individual rather than a computer supported cooperative, shared or partnered activity. The fact that browsing the WEB has not constituted itself as an on-line collaborative activity and remains mainly an individual activity raises the challenge that there may not be any point in trying to develop tools for computer-assisted collaborative browsing. The proposition is that maybe WEB browsing is intrinsically an individual activity. We propose a lightweight collaboration model for WEB browsing based on recommendations. A pilot study was conducted to assess the usability of computer assisted recommendation based collaborative WEB browsing. We have chosen a collection of peoples' bookmarks as the source for gathering an individual's web surfing experience to the benefit of a group, that is, a group history tool. While this is not a comprehensive or definitive study, it demonstrates the merit in recommendation based co-browsing. Even with such a small collection (15 volunteers), 54% of the volunteers said they would be passing on the recommendations to others and 91% (all except one) said they benefited from URLs visited by others in the group. Additionally, more than 50% of users answered that they already found out about new sites from friends, and 45% said they would find receiving updates in the future useful.

KEYWORDS

Human computer interaction, search, retrieval, privacy.

1. INTRODUCTION

The current acceptance and popularity has turned the World Wide Web (WEB) into THE platform for human interaction and communication. The WEB has made possible the creation of many applications for computer supported cooperative work (CSCW); however, the most common activity being performed by users everyday, namely browsing (and exploring) its contents, remains an individual rather than a cooperative, shared or partnered activity. Browser applications are individual applications and most users with access to the Internet know how to use one. Browsers could extend their functionality by becoming the interface for interaction with peers and friends as well as browsing the WEB. What is needed is a tool that informs users about the activities of others. At present, some browsers offer collaborative or cooperative browsing (co-browsing), essentially through peer-to-peer guided navigation, i.e. one person is in control of the navigation (master) and another person (slave) sees the same thing (Wagner, 2002) while at the same time interaction is facilitated through a chat/voice application. Of course, control can be passed to the other in the team, and the old master becomes an observer, this model is analogous to watching television with one person in control of the remote control.

Recently, Aneiros et al. (2003) proposed that the master/slave model is too restrictive and instead there is a case for *unconstrained* navigation during cooperative surfing sessions, that is, there is no master and every member has equal power and control. This type of browsing can be real-time or non real-time and falls under the category of lightweight collaboration. Lightweight collaboration refers to a collaborative model that is easy to set up, already in use and ubiquitous. Lightweight collaboration is based on information sharing and can be supported with the use of recommendations, see Table 1. Situations where this type of social browsing

will prove useful are in the areas of information retrieval, knowledge management, research, education and e-commerce. Recommendation based co-browsing can help when the following situations arise.

- Users wanting to find information that has been judged positively by others doing similar searches.
- Improving information discovery and accidental learning using the WEB by allowing users to share their findings.
- Users wanting to see traces left by others.

To explore this concept, we have conducted a pilot study that demonstrates the feasibility of computer assisted recommendation based co-browsing. After collecting navigational bookmarks from a group of volunteers, we returned a page of recommended URLs and a questionnaire to assess its usability. Presentation, privacy, and collaboration issues were also briefly explored.

In the remainder of this paper, we will first describe the experiment, then introduce a detailed analysis of the results obtained from this preliminary evaluation. A discussion of related work will follow. We conclude with a summary and discussion of future work.

2. EXPERIMENT

2.1 Background

Information seeking in the real world is not a solitary activity. People often ask one another for pointers to information. The WEB is one more repository where people look for information, and having access to someone's help is often the difference between finding relevant, meaningful information fast and being inundated with thousands of pages that would take days to sort through. On-line collaboration based on information sharing is necessary, however, tools are scarce and, generally, users need to see a benefit to them before they will commit to helping others (Preece, 2000). Finding relevant information with a lower cost than is presently available is one such benefit.

Laurillau (1999) has identified four types of collaborative WEB navigation styles and their characteristics, see Table 1. Of these styles, the first two fall into the category of lightweight collaboration. In software applications, history tools help users by providing a reminding service, as well as user modelling and interface adaptation. Group history tools can be used to extract meaningful information and provide computer assisted lightweight co-browsing (Aneiros et al., 2003).

One type of tool that supports collaboration and information sharing among users is a recommender system. These systems can enhance on-line collaborative browsing by augmenting information about WEB sites, for example, statistics about group members as in Sharon et al. (2003), statistics about the site itself like Hill et al. (1992), or other information such as annotations and ratings left by others as Carenini et al. (2003). Sharon et al. (2003) have experimented with on-line goal driven collaborative browsing, that is, a group of users is finding information about a particular topic with the use of a search engine. They employ a user's homepage to derive the person's interests and produce recommendations.

Individual bookmark collections provide a starting point for any group history tool. They are persistent and users have taken time to save them for future use. Bookmarks represent a user's personal WEB information space. They help users access previously seen WEB pages quickly. Bookmarks correspond to a set of URLs a person judges relevant to their information needs, that is, bookmarking a URL can be interpreted as an implicit positive rating of its contents (Wittenburg, 1995). In addition, people regularly collaborate by sharing their bookmarks, they send them to other known users by email and they often publish them as WEB pages (Abrams et al., 1998). Furthermore, collections of bookmarks can constitute a knowledge base for an organization or a group of people with a common context. However, useful information needs to be extracted if it is to be of value to the members of a group. Using bookmarks for recommendations is not a novel idea, systems like Knowledge Pump (Glance et al., 1998), Siteseer (Rucker and Polanco, 1997) and GroupMark (Pemberton et al., 2000) are based around this premise.

Recommender systems make use of three filtering techniques (or hybrids of these) to recommend items to users: information filtering, collaborative filtering and content-based filtering. Information filtering algorithms develop recommendations from what is known about a user's past behavior, thus, they can be

ineffective if not enough is known. Collaborative filtering algorithms produce recommendations using the behavior of other users with similar taste or interests to the user being given the recommendation, similarly to information filtering algorithms, they can be ineffective if not enough information about users interests is known. Finally, content-based filtering algorithms analyze the contents of documents to find similarity with other documents, thus users behavior is not required. Furthermore, content-based filtering has been used to start and augment the recommendation process (Melville et al., 2001).

Table 1. Collaborative WEB Navigation Styles and Tasks

COLLABORATIVE SYSTEM	NAVIGATION STYLES	CHARACTERISTICS	SUPPORTING FUNCTIONALITY
Lightweight	Relaxed	No Leader	Recommendations
		No Goal (Eg. Surfing)	
		Users united by a common context	
		Independent	Visualizing traces left by others
		Informal	
	Cooperative	No Clear Leader	Real-time
		Goal driven	
		(Eg. Search query)	
		Planned	Non real-time
		Collaborate and obtain (Sharon et al., 2003)	
		Independent	
Heavyweight	Planned	Leader	Leader controls
		Goal driven	
		(Eg. Search query)	
		Divide and conquer (Sharon et al., 2003)	Synchronization
		Independent until called by leader	
		Synchronization can be forced	
	Guided	Master/slave model	Real-time
		WYSIWIS	
		(what you see is what I see)	

Recommender systems can also be divided into two groups, those that use implicit methods and those that use explicit methods to collect their information requirements. Implicit methods are those that impose no extra cost to the user, that is, a user does not have to spend time entering information like his/her profile. Explicit methods require that users invest time and effort into the system in order to produce good recommendations. Systems like Knowledge Pump (Glance et al., 1998) require that users save, rank, annotate and classify bookmarks before any recommendation algorithm is used, that is, it falls under the explicit methods category. Siteseer (Rucker and Polanco, 1997) is based on finding the number of overlapping bookmarks two users have, and using this information to recommend other bookmarks, thus, this system belongs to the implicit methods category. GroupMark (Pemberton et al., 2000), like Knowledge Pump, requires that users spend time in rating bookmarks.

Recommender systems are known to suffer from four types of problems: the critical mass, the cold start, personalization and privacy protection. The critical mass problem refers to people resisting to use new software applications if the benefits do not outweigh the costs. One solution to this problem is to use existing software but add collaborative functionality to it. The cold start problem refers to people resisting to use applications that do not seem useful early on. Recommending items requires that a system processes information about the users of the items and the items themselves, this process needs to generate useful recommendations early to overcome this problem. Siteseer (Rucker and Polanco, 1997) depends on different users having non-empty intersections between their collections of bookmarks, thus, it could suffer from the cold start problem if not enough intersections are found. Personalization is tied to the cold start problem, in that the recommendations produced must be useful, however, they must also be a match to the users' needs. Recommendations must be of better quality than those obtained by other means. Questioning users can only assess solutions to personalization. Finally, privacy protection is one of the fundamental requirements of any recommender system; while most systems have privacy policies in place, more work needs to be carried out in this domain. Questioning users can give more insights into what privacy policies may be needed to make recommendation based co-browsing successful.

Recommending URLs to people, in order to overcome the problems mentioned must use techniques where presentation is simple, easy to follow and recommendations are personalized. Nielsen (1999) reports that users treat hypertext very differently to other forms of printed media. He states:

> "*We have repeatedly found that users do not read online. Instead, they scan the text, picking out highlights and hypertext links and only read selected paragraphs*".

In addition, Amitay (2001) has investigated the patterns found when people arrange language visually in WEB pages. She identified that authors of WEB pages placed hyperlinks in one of four different parts of paragraphs. Furthermore, she found that the most descriptive part of the four was the beginning of a paragraph. She uses these observations to return meaningful, short descriptions of WEB pages (on average four to five descriptions per page) so that search engines can index them better.

Both authors mentioned (Amitay, 2001 and Nielsen, 1999) steered away from analyzing all content of WEB pages, instead they advocate the analysis of hyperlinks and meta-data provide all the information a user needs to decide whether a WEB page is worth reading. By hyperlink analysis, we mean the analysis of links pointing to a WEB page. Finding these *pointer links* is achieved by submitting a query to a search engine of the type 'link:URL', however, finding the description of a page does involve filtering the content of a portion of the results returned (URLs). Our presentation of the recommendations follows these principles. Furthermore, we develop a content-based recommendation algorithm, based on Amitay's (2001) discoveries. Our aim is to show that our content-based recommendations are personalized and a good alternative when faced with a small group of people and/or a small collection. For instance, when a recommender system is starting the likelihood of finding users with overlapping URLs is very small, similarly, not enough information may be known about users past behavior.

Following from the observations mentioned we make these assumptions:

- A URL is rated good if it belongs to a collection.
- Since the volunteers in this case study come from a common academic institution and closely related academic disciplines, we take them as a pre-formed group of users who are to collaborate in using resources on the WEB.
- In their own WEB space, people describe WEB pages (Amitay, 2001).
- People link to the WEB pages they describe with a hyperlink (Amitay, 2001).

Our experiment is based on the model of relaxed collaborative browsing or "surfing" without any clear goal. Relaxed and cooperative collaborative WEB browsing styles seem to be best suited for recommendations. Table 1 has a complete list of styles and tasks. Additionally, our proposal falls into a lightweight collaborative tool. These tools are expected to have more acceptability among users and have a larger impact on a corporation's collaborative browsing practices because they require less input from each user and they use existing software applications. Our study is based on users sharing their bookmarks without any further input, that is, our recommendations are implicit. Similarly, a browser is all that is required to use them.

2.2 Purpose

The purpose of this study was to establish if recommendation based relaxed co-browsing is useful and if so what conditions will make it more acceptable. Therefore, the objectives of this study were:

- To create a collection of bookmarks that formed the basis for a recommendation system.
- To provide personalized recommendations.
- To query volunteers on their use of the recommendations.
- To query volunteers on their collaborative WEB browsing behavior and expectations.
- To develop or improve existing techniques for collaborative WEB browsing based on information sharing.

2.3 Approach

For our preliminary study we sent out a "call for volunteers". The call was emailed to students and academics from two faculties (Faculty of Science and Faculty of Engineering and Information Technology). We received replies from fifteen people and each one of them volunteered their collection of bookmarks/favorites

and a list of words describing their areas of interest. Some collections were pre-classified into hierarchies by their owners. Volunteers' collections ranged in size from 14 URLs to almost 800 URLs. Volunteers were given proper assurances regarding privacy; for example, within this study a number identified each participant.

The complete collection, about 4000 URLs, was processed as follows:

1. All files received were converted to a common format.
2. Each URL was visited. If the link (URL) was alive, the following information was collected: header information (like title, description and author). Then, alive URLs became what we call target URLs. Figure 1 shows a target URL and a section from its header information, title and keywords are highlighted.
3. For each target URL a query was sent to search engines for pointer links (URLs that have our target URL as a hyperlink in them), and approximately the ten most repeated pointer links were visited. Figure 2 shows the link query submitted for the target URL from Figure 1 to the Google search engine.
4. For each visited pointer link, we collected its title information and text surrounding our target URL hyperlink (Amitay, 2001).
5. From the volunteers, if URLs were classified into hierarchies, then the hierarchies' names were also included.

From all this information a set of descriptors was derived for each target URL.

Figure 1. Example of target URL
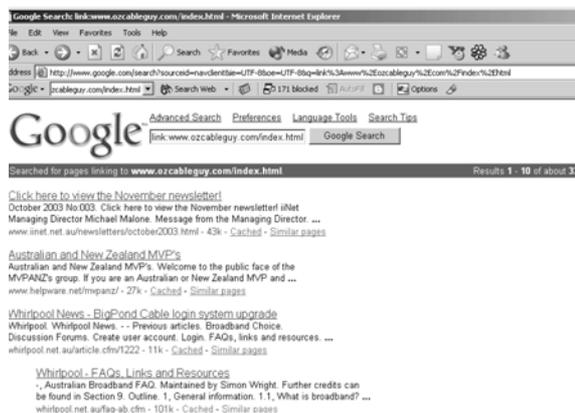
Figure 2. Example of link query on Google

Once all the information was collected, a recommendation algorithm based on the number of matching descriptors for two different URLs was used. The recommendation algorithm produced a personalized *html* file with a list of recommendations as the example shown in Figure 3. Each *html* page was created from the matches found to URLs the user had volunteered to the collection. If a user had employed a classification to sort their bookmarks, then the name given to the class was used as the title for each group of matches. In Figure 3, the title *JOURNALS* was one such class. Otherwise, the URL given by the user (target URL) was used as the title for the group of matches.

The recommendations were sorted according to the classes or URLs a volunteer had given us and the number of matching words, that is, URLs with higher number of matching words were presented first. A string of colored stars before the URL and title of the recommended page was used to indicate how good the match was thought to be. Additionally, hovering above the stars produced the list of matching keywords presented in a ToolTip style. Furthermore, a paragraph containing the description of the recommended page followed.

The recommendations were emailed to the volunteers with a brief explanation of the meaning of the symbols and presentation used. A questionnaire was emailed a few weeks later; it contained 37 questions on the topics of usability, presentation, collaboration and privacy. Thirty-two questions had 5-point scale answers, the others were multiple-choice questions, as per results are shown in Figure 4. Twelve questionnaires were received back and their analysis follows.

3. SUMMARY OF RESULTS

Users were asked to evaluate the recommendations given with a variety of questions. On the question of how often they were using them, the replies were as follows (also refer to Figure 4) only one respondent replied that he was using some of them once a day, 36% answered that they were using some of them a few times a week, while 45% said they had used them a few times overall, and one respondent said he had not used them at all. Thus, 91% (all except one) of the subjects in the study benefited from URLs visited by others in the group. One user was very enthusiastic upon receipt of his recommendations and replied with the following comment: "*Thanks Maria, I've had a look at these bookmarks, and they're great!*". On the question of passing on the recommendations to others 54% replied that they probably would, while 36% said they probably would not and one respondent answered that he was not sure, see Figure 4. These responses indicate that the majority of the recipients found the recommendations useful.

One of the questions asked users to speculate on the usefulness of recommendation updates within a time frame, the majority of users, 55%, responded that they were not sure, while the remainder of the users picked a time frame, see Figure 4. Users were equally divided as to whether they thought it most useful to receive weekly or monthly updates with both of these categories receiving 18% of the answers, while one respondent said that he would like real-time updates. However, one user did express his concern regarding constant interruptions and wrote down the following comment: "*I would probably think that lots of URL recommendations coming in all the time would add to my information overload and not overall be of much use*". This comment raises the issue of whether recommendations should only happen when users explicitly indicate they want them, maybe, at personal frequency intervals or at least be able to turn them off. All these issues remain for further exploration.

Users were asked many questions on the presentation and usability of the recommendations, in total 17 questions dealt with usability. Due to the small number of replies to the questionnaire (12), we have submitted the answers to a sign-test. A sign-test is recommended when faced with a small sample and perhaps a non-normal distribution (McClave and Dietrich, 1994). Based on the 5-point scale answers, the null hypothesis is that the median value of the distribution is smaller than or equals to *3,* that is, our recommendation-based collaborative WEB browsing is not usable. The alternative hypothesis is that the median value of the distribution is greater than *3,* that is, recommendation-based collaborative WEB browsing is usable. Therefore, H_o: $\theta_o \leq 3$ and H_a: $\theta_o > 3$ at $\alpha = 0.05$. Table 2 shows the medians for all 17 questions.

Table 2. Medians for Usability Questions

Median	3.5	3	3.5	4	3	3.5	4	4	3	4	3	3	2	3.5	3	3	4
Sign	+		+	+		+	+	+		+			-	+			+

Based on Table 2 there are 9 positives (S+) and 1 negative signs (S-), the p-value = Probability (S+ $\geq$ 9) = 0.0107. Thus, we reject the null hypothesis at the 0.05 level and conclude that our recommendation-based collaborative WEB browsing is usable.

There were two questions where users were completely polarized. Question 6 asked users to agree or disagree with the following statement: "*I would prefer recommendations organized as a hierarchy of topics*". The average score for this question was 4.27. Question 31 asked users to agree or disagree with the following statement: "*I should be able to indicate which of my bookmarks can be submitted to the group's pool*". The average score for this question was the same as Question 6, however, the confidence intervals for Question 31 were larger. Responses to Question 31 indicate that the members of this group generally want to have control of what information is passed on to others.

Another group of questions dealt with issues regarding privacy. Questions 23, 28, 29 and 30 were some of the lower scoring questions. Question 23 asked users to agree or disagree with the following statement: "*I would prefer to know the identity of the people who had the original bookmarks*", its average score was 2.33, thus, indicating that members of this group are generally not interested in knowing the identity of people making the recommendations. Question 28 asked users to agree or disagree with the following statement: "*For collaboration purposes, my identity should be provided when recommending my bookmarks to others*", its average score was 2.33, indicating that users do not like to provide their own identity when making recommendations. According to Preece (2000) users don't help one another all the time; they are more likely

to provide their identity if they can see this will benefit them in the future. Question 29 asked users to agree or disagree with the following statement: "*It is essential to be aware of the identity of the people who will have access to my bookmarks*", again this question gave a very low average score of 2.16. Finally, Question 30 asked users to agree or disagree with the following sentence: "*Using my bookmarks, to develop recommendations for others, is an invasion of my privacy*", its average score was 2.33. It seems that this group of subjects may have been pre-conditioned to accept that it is not an invasion of privacy to develop recommendations for others out of their own bookmarks, since they had volunteered to participate in this study. But this makes even more remarkable that they were strongly against recommendations of URLs with the name of the source person. That is, people do care about privacy and have specific ideas of where the line is in this case. This also gives us insight into what can be done to facilitate unconstrained asynchronous collaborative browsing while respecting privacy concerns.
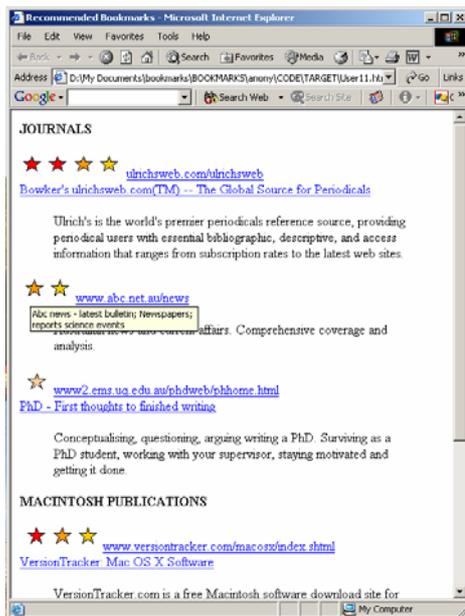
Figure 3. Recommendations Page
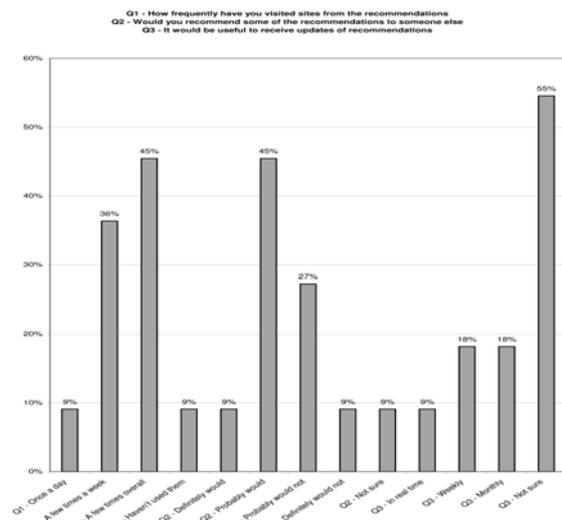
Figure 4. Multiple Choice Questions

Of the people questioned in this study, 58% said that they found out about new pages/sites from friends. Thus, users are already achieving co-browsing without any assistance from their browsers. While this is not a comprehensive or definitive study, due to the small number of participants, it suggests a set of hypotheses, which could be explored in the future to determine their generality.

4. CONCLUSIONS AND FUTURE WORK

The fact that browsing the WEB has not constituted itself as an on-line information sharing collaborative activity and remains mainly an individual activity raises the challenge that it may not be any point in trying to develop tools for computer-assisted collaborative browsing.

This pilot study demonstrates that there is some merit in recommendation based co-browsing. Even with such a small collection, 54% of the volunteers said they would be passing on the recommendations to others and 91% (all except one) said they benefited from URLs visited by others in the group. Additionally, people are willing to share if there is not much effort required, both on releasing their surfing experience to others and on using the experience of others. The focus of concern is privacy issues, but otherwise, relaxed collaboration is achievable if the system is lightweight. Our results illustrate that users have more marked opinions when privacy is concerned. We have found out that assurances about privacy are important conditions for making collaborative browsing more acceptable.

We have chosen peoples' bookmarks as the source of collecting an individuals web surfing experience to the benefit of a group, that is, a group history tool. The volunteers from this preliminary study want good recommendations, presented by a hierarchy of topics and they prefer to receive them with good descriptions, however, control of frequency needs to be explored further. The members of this pilot group were not interested in knowing the identity of the people that had added bookmarks to the collection, and they did not agree that their own identity should be provided for the benefit of others. Users were aware that they were releasing their bookmarks and therefore they were not concerned about their disclosure to others. However, they had strong opinions about privacy, as the more polarized answers to questions show.

More than 50% of users answered that they already found out about new sites from friends, furthermore, 45% said they would find receiving updates useful. These figures show that *unconstrained* co-browsing is being practiced at present, however, users do not have any help from their browsing applications. Potential future work for this project includes efforts to explore these issues further by adding this functionality to a browser and conducting more thorough empirical evaluations.

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HOW TO IMPROVE RETRIEVAL EFFECTIVENESS ON THE WEB?

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ABSTRACT

We explore the question of combining link analysis, content analysis and classification-based techniques to improve retrieval performance on the Web. We show the potential of fusion and that relatively simple implementation of combination does improve the retrieval performance.

KEYWORDS

Fusion, Retrieval Information, Classification

1. INTRODUCTION

How do we find information on the Web? It is an old question far from being solved. Web information is distributed, decentralized and huge in size. The Web can be viewed as one big virtual document collection. The findings from traditional Information Retrieval (IR) research (traditional IR means text-based approaches), however, may not always be applicable in the Web setting. The Web document collection, massive in size and diverse in content, context, format, purpose and quality, challenges the validity of previous research findings based on relatively small and homogeneous test collections. Also, some traditional IR approaches may be applicable in theory, but may not be possible or practical to implement in a Web IR system. For instance, the size, distribution and dynamic nature of information on the Web make it difficult, if not impossible, to construct a complete and up-to-date data representation required for an ideal IR system. In addition, conventional evaluation measures, such as precision, recall, and even relevance, may no longer be applicable to Web IR, where a test collection representative of dynamic and diverse Web data is all but impossible to construct.

To further complicate the matter, information seeking on the Web is quite diverse in characteristics and unpredictable in nature. Web searchers come from all kinds of reasons motivated by all types of information need. The wide range of experience, knowledge, motivation, need, and purpose of Web searchers means that searchers can express wide ranges of information needs in a wide variety of ways with various criteria for satisfying their needs.

At the same time, the Web is rich with new types of information not present in most previous test collections. Hyperlinks, usage statistics, document markup tags and bodies of topic hierarchies such as Yahoo present an opportunity to leverage the Web-specific document characteristics in novel approaches that go beyond the term-based retrieval framework of traditional IR.

This paper explores the question *of combining link analysis, content analysis, and classification-based techniques to improve retrieval performance* and is divided in 7 sections. Firstly, we introduce the problem, secondly we describe individual retrieval systems, thirdly we talk about combination formulae, fourthly we present our results, fifth we discuss results and finally we present our conclusions.

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2. BASIC RETRIEVAL SYSTEMS

The two main elements of any combination experiments are *components* and *formulae*. Components are the individual components to be combined, which can be sources of evidence, retrieval methods, or both (i.e. retrieval methods that leverage sources of evidence). *Formulae* refer to methods of combining components, which can be applied at retrieval time.

As the source for these experiences we use the WT10g collection [1], which is a ten-gigabyte subset of the 1997 Web crawl by the Internet Archive, consists of 1.7 million Web documents, 100 TREC queries (topics 451-550), and official NIST relevance judgments. The WT10g collection also includes the connectivity data, which provides lists of inlinks and outlinks of all documents in the collection.

As classification systems for the Web lack an ideal Web directory, we use Yahoo <http://yahoo.com> due to its size and popularity. Yahoo is the largest and the most widely used Web directory, and consists of 14 top categories with over 645,000 sub-categories that contain almost 3 million Web pages, which are classified and annotated by over 150 professional Yahoo cataloguers.

The text-based retrieval component is based on a Vector Space Model (VSM) using the SMART length-normalized term weights as implemented in OpenFts <http://openfts.sourceforge.net/>. For implementation details, see [2]. From text, tags are removed; stop words and weights are based on Lnu document term weight (1):

$$d_{ik} = \frac{(1 + \log(f_{ik}))\big/(1 + \log(avg\_f_i))}{(1.0 - slope) * p_i + slope * t}$$
(1)

with the slope of 0.3 for document terms [3], where f_{ik} is the number of times term k appears in document i; avg_f_i is the average in-document frequency for document i; t is the number of unique terms in the collection and p_i is the average number of unique terms in a document i. The formula for *ltc* query term weight is:

$$q_k = \frac{(\log(f_k) + 1) * idf_k}{\sqrt{\sum_{j=1}^{t}\left[(\log(f_j) + 1) * idf_j\right]^2}}$$
(2)

where f_k is the number of times term k appears in the query; and idf_k is the inverse document frequency [4] of term k. The denominator is a document length normalization factor, which compensates for the length variation in queries. Documents were ranked in decreasing order of the inner product of document and query vectors,

$$\mathbf{q}^{\mathrm{T}}\mathbf{d}_i = \sum_{k=1}^{t} q_k d_{ik}$$
(3)

For feedback, we use the top ten positive and top two negative weighted terms from the top three ranked documents of the initial retrieval results. These terms were used to expand the initial query in a pseudo-feedback retrieval process based on the adaptive linear model. The basic approach of the adaptive linear model, which is based on the concept of preference relations from decision theory [5], is to find a solution vector that will rank a more-preferred document before a less-preferred one [6]. The solution vector is arrived at via an error-correction procedure, which begins with a starting vector $\mathbf{q}(0)$ and repeats the cycle of "error-correction" until a vector is found that ranks documents according to the preference order estimation based on relevance feedback [7]. The error-correction cycle i is defined by

$$\mathbf{q}_{(i+1)} = \mathbf{q}_{(i)} + \alpha\mathbf{b}$$
(4)

where α is a constant, and $\mathbf{b}$ is the *difference vector* resulting from subtracting a less-preferred document vector from a more preferred one [8].

We tested 36 VSM based on the combination of four parameters (notation;p/m/l;c/t/d;0/1;0/1): query length (small(p), medium(m), large(l)), term sources (body (c), header (t), document all (d)), phrase use (1-yes;0-no) and feedback use (1-yes;0-no).

The HITS system's algorithm was modified by adopting a couple of improvements from other HITS-based approaches. As implemented in the ARC algorithm [2], the root set was expanded by 2 links instead of 1 link (i.e. expand S by all pages that are 2 link distance away from S). All intrahost links and stoplist URLs were eliminated from the hub and authority score computations. Stoplist URLs, defined as Web pages with

very high indegree, were selected from the list of URLs with indegree greater than 500. Also, the edge weights by [9], which essentially normalize the contribution of authorship by dividing the contribution of each page by the number of pages created by the same author, was used to modify the HITS formulae as follows:

$$a(p) = \sum_{q \to p} h(q) \times auth\_wt(q, p) \tag{5}$$

$$h(p) = \sum_{p \to q} a(q) \times hub\_wt(p, q) \tag{6}$$

In the formulae above, *auth_wt(q,p)* is 1/*m* for page *q*, whose host has *m* documents pointing to *p*, and *hub_wt(p,q)* is 1/*n* for page *q*, which is pointed to by *n* documents from the host of *p*. To compute the edge weights of the modified HITS algorithm as well as to eliminate intrahost links, one must first establish a definition of a host to identify the page authorship (i.e. documents belonging to a given host are created by the same author). Though host identification heuristics employing link analysis might be ideal, we opted for simplistic host definitions based on URL lengths. Short host form was arrived at by truncating the document URL at the first occurrence of a slash mark (i.e. '/'), and long host form from the latest occurrence. We tested 6 Hits systems based on 2 parameters:

host definition (short (p), long (l)); seed set from VSM systems ((p) Vpc10, (m)Vmc10, (l)Vlc10).

The Web Directory search was implemented based on the Term Match (TM) method. TM takes a simpler approach of finding categories in which query terms occur by extending the typical category search implementation of Web directory services.

The first phase of the TM method, which produces a ranked list of categories for a query, matches query terms to terms in the Yahoo sitemap files (i.e. category labels, Yahoo site titles and descriptions, URLs) to find a set of matching nodes in the classification hierarchy and generates a ranked category list in the following manner:

1. For each matching category, (i) compute *tfc* (number of unique query terms in the category label); (ii) compute *tfs* (number of unique query terms in the site title and description) in all its sites; (iii) compute *pms* (proportion of sites with query terms in the category).

2. Rank the matching categories in the descending order of *tfc*, *tfs*, and *pms*.

Note that categories ranked via sorting by multiple variables in such an order that the terms in category labels, which are likely to be highly "powerful", are given precedence over terms in site titles or descriptions. This ranking approach is similar to how Yahoo ranks its search results except that it combines the category and site match results while collapsing the site match results to their parent categories.

The second phase of the TM method is to expand query vector (the class centroid in the TM method) that is built from the best matching categories to produce a ranked list of the WT10g documents. The expanded query vector of the TM method is a vector of selected category terms with normalized term-category association weights. The parameters tested for the TM systems are the number of top categories used, the WT10g term index and terms for pseudo-feedback. The combination of the parameters (3 top categories (1/2/3), 4 WT10g term index (body text, no phrase (*1*) body text, phrase (2) body+header, no phrase (3) body+header, phrase (4), 2 for feedback use(1-yes,0-no)) resulted in 24 TM systems.

3. HOW TO IMPROVE IR

We explored the question of combining text-, link- and classification-based retrieval methods for the purpose of improving IR performance on the Web. In order to investigate the effects of various evidence source parameters, 36 text-based systems based on the Vector Space Model, 6 link-based systems using the HITS algorithm and 24 classification-based systems using Yahoo category term matching approach were implemented to produce 66 sets of retrieval results for each of the 100 WT10g topics. Combinations are performed based on two main formulae, the Similarity Merge (SM) and Weighted Rank Sum (WRS) formula.

SM, originally introduced by Fox and Shaw [10] and refined by Lee [11,12], computes the combination score of a document by the sum of normalized component scores boosted by the retrieval overlap

$$CS = (\sum NS_i) * \frac{olp}{m(i)} \qquad (7)$$

where: CS = combination score of a document; NS_i = normalized score of a document by system I; olp = number of systems that retrieved a given document; $m(i)$ = number of systems in a method to which system i belongs. The normalized document score, NS_i, is computed by Lee's min-max formula [11,12], where S_i is the retrieval score of a given document and S_{max} and S_{min} are the maximum and minimum document scores by system i.

$$NS_i = (S_i - S_{min}) / (S_{max} - S_{min}) \qquad (8)$$

The Weighted Sum (WS) formula attempts to compensate for the deficiencies of the SM formula by weighting the contributions of combination components according to their relative strengths and computing the combined estimate of a document's relevance to a query (i.e. retrieval status value) by the weighted sum of individual estimates.

Weighted Rank Sum **(WRS)** formula, which uses rank-based scores (e.g. 1/rank) in place of document scores of WS formula, was tested:

$$CS = \sum(w_i * RS_i) \qquad (9)$$

where: w_i = weight of system i, RS_i = rank-based score of a document by system i. Although WRS formula aims to weight the contributions of individual combination components to the retrieval outcome by their relative strength, it does not explicitly differentiate between overlapped and non-overlapped instances.

Overlap Weighted Rank Sum **(OWRS)**, attempts to leverage overlap while compensating for the differences among combination component systems by weighting rank-based scores by overlap partitions. For the *Rank-Overlap Weighted Rank Sum* (**ROWRS**) we replace w_i of eq. 9, for w_{ikj} = weight of system i in overlap partition k at rank j, which needs a performance estimate at a given rank, overall average precision is not appropriate. Instead, three rank-based measures, namely Precision (P), Effectiveness (F), and Success / Failure (sf) at each rank, were used to compute the weights in three versions of the ROWRS formula. The *F*-value, which is a Dice-coefficient of similarity for the set of documents retrieved and the set of documents relevant to a query, augments the precision value with consideration of recall at a given rank [13]:

$$F = \frac{2r}{n + N_r} = \frac{2}{\frac{1}{R} + \frac{1}{P}} \qquad (10)$$

where: r = number of relevant documents retrieved; n = number of documents retrieved; Nr = total number of relevant documents; R = recall (r/Nr); P = precision (r/n). For both WRS and OWRS formulae, three variations that amplify the contribution of the top performing system were investigated. These variations, in an increasing order of emphasis for the top system, are Top System Pivot 1 (st1), Top System Pivot 2 (st2), and Overlap Boost (olpboost). The basic idea here is to supplement the result of the best performing systems with combination by using a weighting combination function that amplifies the rank-based score of a document retrieved by the top systems while dampening the contributions from worse performing systems. A generalized form of *st1*, *st2*, and *olpboost* can be expressed as eq. 9 where w_i is changed to $w_{kj}(L_i)$ = weighting function of system group L_i in overlap partition k at rank j.

4. RESULTS

First, we will discuss the results of single systems by combinations (§4.1) component methods, which will be the baseline for combinations runs. Internal combination method results will be reviewed next (§4.2), followed by inter-method fusion results. Intra-method fusion refers to combining systems within a given method (e.g. VSM system 1 and VSM system 2), whereas inter-method fusion refers to combining systems across methods. In both intra- and inter-method fusion, results by the Similarity Merge (SM) and Weighted Rank Sum (WRS) fusion formulae were examined. While fusion runs discussed in these two sections resulted from a general fusion approach that produced many possible fusion component combinations of interest in a given fusion domain, the next section, called "top system fusion", examines the results of

combining a handful of "best" systems from each method. In top system fusion, the results of WRS formula variations were compared to the baseline formula of SM.

4.1 Individual Systems

The best performing VSM system, measured by average precision, was vlc10 (long query, body text, phrase, and no feedback). The best HITS system was hpm (short host, seed set system of vmc10) for topics 451-500 and hpl (short host, seed set system of vlc10) for topics 501-500. The best TM system, which differed over topic sets as HITS did, was t221 (top 2 categories, body text, phrase, no feedback) for topics 451-500 and 501-550.

In general, the most influential system parameter appears to be the query length. It is interesting to note that VSM and HITS systems benefit from longer queries, whereas TM systems perform better with shorter queries. Host definition, which determines the elimination of intrahost links and computation of link edge weights, seems to be a crucial parameter for HITS systems.

We used the following combinations:
− Internal Systems (combination of internal parameters of each system).
− External Systems (combination of different systems).
− Top Systems (On top systems (simple, internal and external systems) identified we tested different formulae combinations). In each of the four possible combinations of the three methods, combination was conducted in a similar manner as the internal system combination to investigate the general combination tendencies of cross-method combination rather than to focus specifically on potentially advantageous system combinations.

4.2 Internal Systems

Comparing the best performances of SM and WRS fusion with the best baseline system reveals some interesting patterns of interplay between the fusion formula and the retrieval method. In both VSM and TM fusion, WRS closely shadows the baseline system while SM falls below the baseline performance. In HITS fusion, however, SM results are the best by all performance measures while WRS seems to overtake and surpass the baseline performance at lower ranks. In VSM fusion, the best WRS system achieves a higher average precision than the best baseline system in topics 501-550, although the difference is only marginal (less than 1%). R-Precision of WRS is also slightly better than baseline in both topic groups. In fact, WRS and baseline results are almost identical in TM fusion. SM fusion, on the other hand, significantly degrades the baseline performance in TM fusion, while falling slightly below the baseline performance in VSM fusion.

Notation for figures 1 and 2: F means parameter combination; a at end means "combination by SM formula"; b at end means "combination through WRS formula"; RRN = Total Number of Relevant documents; avgP =average precision averaged over queries; optF = optimum F (Optimum F, which is the maximum of F-value (Equation 10) over all ranks);R-P = R-Precision (R-Precision compensates for precision's insensitivity to the size of the relevant document pool by computing precision at rank R, where R is the total number of relevant documents for a query); P@k = Precision at rank k.
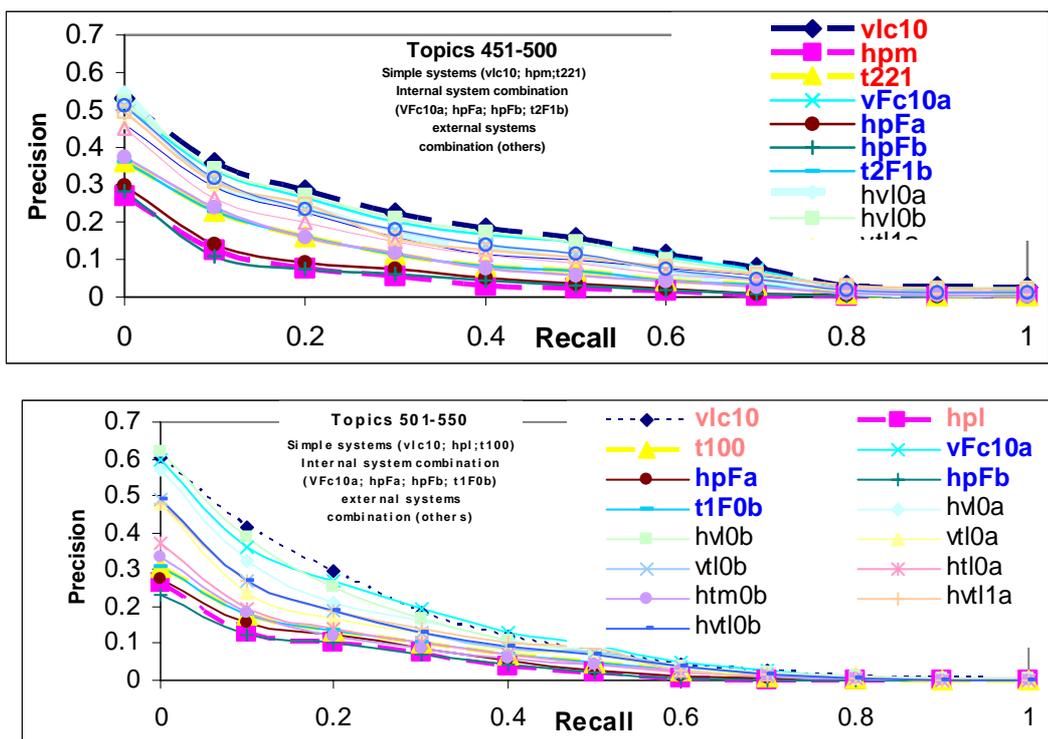
Figure 1. Results of best simple systems and internal and external combination. RRN on secondary axis
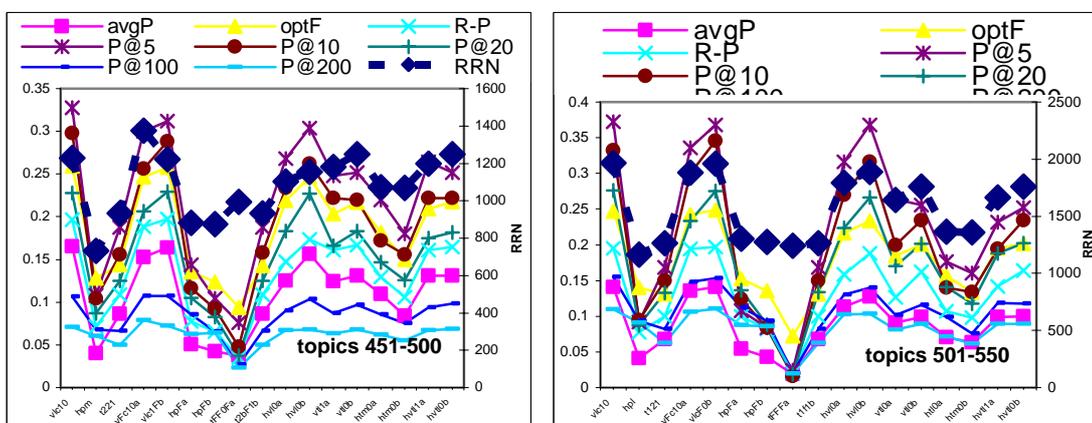
Figure 2. Recall-Precision Curve of best simple systems, internal and external combination

Interestingly enough, SM fusion sometimes hurt early precision but retrieves more total number of relevant documents in VSM and TM fusion (topics 451-500 of VSM fusion, topics 451-500 of TM fusion). One possible explanation is that SM in some situations retrieves more relevant documents at lower ranks, which the recall-precision graphs of TM fusion runs seem to suggest. One possible explanation for this phenomenon may be that the combined solution space of HITS systems is much larger than that of the best individual HITS system, while the best system dominates the combined solutions space in VSM and WD methods.

4.3 External Systems

Observations from internal systems combination mostly held true in external systems combination, although combination seemed to degrade the best single system performance more in inter-method fusion than in intra-method fusion. In all but the HITS-TM method combination, the baseline systems act as upper and lower bound performance thresholds and fusion results fall nicely between them. There is, however, a distinct difference in the level of fusion results, which is nicely illustrated in the recall-precison graphs. The VSM-HITS fusion system results tend to be closer to the upper bound baseline, while VSM-TM results fall towards the middle. VSM-HITS-TM results fall towards the middle of the upper and higher of the two lower bound baseline results (i.e. VSM and TM).

4.4 Top Systems

Results show (figure 3) all top three combination systems retrieved fewer relevant documents and had higher precision at 200 than the baseline, which suggests that the gain in performance came from boosting the ranking of relevant documents at earlier ranks, a document in top systems.

The naming convention for fusion system is the fusion system name $=$ v/h/t, where:

- v for VSM systems with query and phrase parameters, F – all combined, or F2 vlc00 and vlc10 combined
- h for HITS systems with host, query and phrase parameters combined, or F all parameters
- t for TM systems, F all combined, F2 t101 and t121 combined, F3 t10.1, t121, t201 and t221 combined or F4 t121, t221 and t321 combined
- Formulae tested were: WRS (**a**); OWRS: *no pivot* (**b0**), st1 (**b1**), st2 (**b2**), *olpboost* (**b3**); - ROWRS-*sf*: *no pivot* (**c0**), st1 (**c1**), st2 (**c2**), *olpboost* (**c3**); ROWRS-*F*: *no pivot* (**d0**) and - ROWRS-*P*: *no pivot* (**e0**)
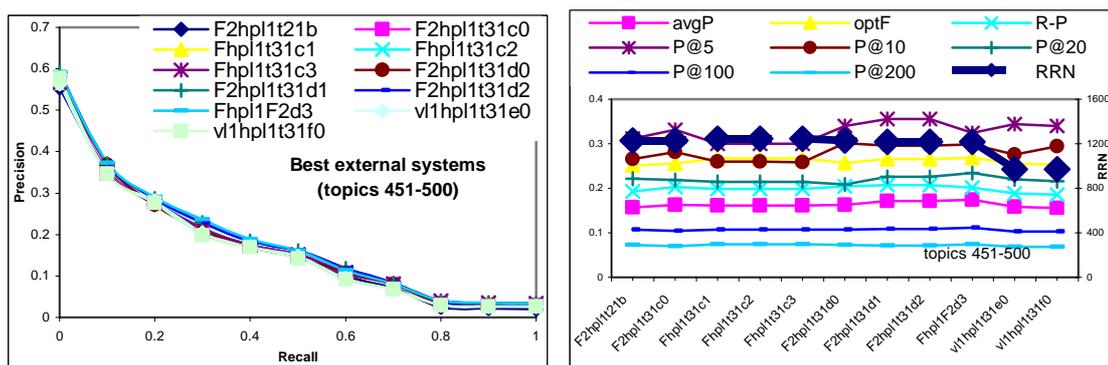
Figure 3. Recall-Precision Curve Results of best systems with different combination formulae for topics 451-500. For topics 501-550 graphics is equivalent

The loss in the number of relevant documents retrieved can be attributed to ROWRS formula's tendency to eliminate uniquely retrieved documents from the result set. Even without the uniquely retrieved relevant documents, ROWRS outperforms OWRS regardless of top-system pivot variations. Results from external systems combinations are similar to the internal systems combinations. There is, however, a distinct difference in the level of combination results, which is nicely illustrated in the recall-precison graphs. The VSM-HITS combination system results tend to be closer to the upper bound baseline, while VSM-TM combination results fall towards the middle. VSM-HITS-TM combination results fall towards the middle of the upper and higher of the two lower bound baseline results (i.e. VSM and WD). Comparison of rank-based measures shows the success/failure measure to be superior to precision- or effectiveness-based measures for ROWRS. As for top-system pivot variations, the ROWRS formula seems to work best with the heaviest emphasis on the top system contribution (*olpboost*), in contrast with the OWRS formula that shows the best results without st1 and st2. The different effects of st1 and st2 between OWRS and ROWRS formulae may indicate the relationship between the rank and the relevance of a document in top systems.

The uneven distribution of relevant documents over ranks means that rank-based weighting is more likely to be effective than weighting based on performance estimates over all ranks, as evidenced by the superior

results of systems that use ROWRS over OWRS formula. It is not immediately clear, however, why the st1 and st2 enhances performance when used with rank-based weights but hurt performance when applied evenly across ranks. It might be that top-system pivot and rank-based weight together boosts the top system contributions over all ranks can both help and hurt the performance contributions more when they are more beneficial, whereas indiscriminate boosting of top-system contributions over all ranks can both help and hurt the performance.

5. RESULTS DISCUSSION

In order to investigate the effects of various evidence source parameters, 36 text-based systems based on the Vector Space Model, 6 link-based systems using the HITS algorithm and 24 classification-based systems using Yahoo category term matching approach were implemented to produce 66 sets of retrieval results for each of the 100 WT10g topics. The retrieval results were then combined in a comprehensive manner within each method as well as across methods using a score-based and a rank-based combination formula. In addition, a handful of the best performing systems from each method were combined with variations of the rank-based combination formulae to explore the optimization of combination parameters. Analysis of results suggests that *query length and host definition are the most influential system parameters for retrieval performance.*

For VSM and HITS systems that use the VSM results as the seed documents, longer queries produced far better results than shorter queries, while shorter queries affected better results in TM systems. The host definition, which directly influences both the elimination of intrahost links and link weight computation of the HITS algorithm, turned out to be a crucial parameter for HITS systems, with the shorter definition is clearly superior to the longer definition.

For HITS systems, the quality of the seed document set, both in the number of relevant documents and the richness of link topology appeared to be vital for their effectiveness. Even the optimum HITS system, using the seed set of all known relevant documents, produced disappointing results due to many queries that produced only a small number of relevant documents and the possibly truncated and spurious link topology of WT10g. In fact, 85 out of 100 seed sets produced by the best VSM system were composed of 85% or more non-relevant documents, which severely handicapped the maximum performance threshold of HITS systems. Among the retrieval systems tested, VSM systems clearly outperformed other systems, with TM systems showing better results than HITS systems. In general, average precisions of VSM systems were roughly twice as good as TM systems and four times the average precisions of HITS systems. The differences in retrieval methods that affected different retrieval outcomes appeared to influence both internal and external combinations systems, where the system results were combined within and across retrieval methods. Interestingly, the only internal combination systems that enhanced the baseline performance of the best combination component results occurred with the worse performing HITS systems. Internal combination of VSM and TM systems behaved similarly in that combination detracted from the baseline performance although combining TM system results degraded baseline results much more severely than VSM combination when using the SM formula.

In HITS combination, the score-based SM formula produced better combination results than the rank-based WRS formula, which was opposite of the VSM and TM combination results. To investigate the possible reasons why combining HITS system results enhanced retrieval performance while combining VSM or TM system results degraded the baseline performance, we examined the degree of overlap in relevant documents in HITS systems in comparisons with VSM and TM systems and found that HITS systems retrieved much more diverse sets of relevant documents than VSM or TM systems and thus had the most to gain by combination.

External systems combinations produced results in between upper and lower threshold performance levels determined by the baseline systems of the methods combined. As was the case in the internal combination systems, introduction of the TM system results into the combination pool degraded the performance level of the combined results in all external combination except in HITS-TM combination, where diverse solution spaces of HITS systems seemed to overpower the potential adverse influences of TM systems to produce the combination results that surpassed the baseline performance level. The combination of VSM and HITS systems, however, did not produce better results than the baseline, because the solution space of HITS

systems, though diverse from one another and from the solution spaces of TM systems, had much overlap with those of VSM systems.

The different outcomes of SM and WRS combination formulae were also observed in internal and external combination results, although the SM formula results seemed to be more stable across methods than WRS formula results. In general, the WRS formula appeared to have an advantage over the SM formula, which worked better with HITS systems. Instead of optimizing the combination formula, we considered as potential causes for the different outcomes the main differences between SM and WRS formulae, which were SM's tendency to differentiate between documents in rank proximity, SM's heavier emphasis on the overlap count, and the WRS weighting of combination component contributions based on past performance.

In top system combination WRS formula variations tested, st1, st2 and the overlap boost, which emphasized progressively the contributions of overlapped top system documents showed the best results, which suggests that leveraging overlap in conjunction with the rankings of the best performing systems is an advantageous combination approach. The gain in performance by top system combination, however, was marginal at best, but also came at the cost of recall (i.e. the number of relevant document retrieved). The decrease in recall was due to the loss of uniquely retrieved relevant documents because top system combination formulae considered only documents that were retrieved by multiple systems.

6. CONCLUSIONS

This paper confirms the viability of combination for Web IR by not only determining the existence of the combination potential in the combined solution spaces of text-, link-, and classification-based retrieval methods but also by demonstrating that relatively simple implementation of combination does improve the retrieval performance.

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FRAMEWORK FOR OPTIMAL ACCESSING OF DESTINATION KNOWLEDGE INFORMATION (DKI) FOR E-MELAKA

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ABSTRACT

It has been known for a long time that web-sites have never been designed with information users in mind. Those who search for useful information (destination knowledge information – DKI) will either have to go through masses of useless information or have to rely on search engines which will lead to the useful information after many adhoc steps. This paper proposes a technique which will allow DKI to be accessed in an optimal manner. This technique is developed through three year's experience in the construction of the Integrated e-Melaka Website (IEMW) that is http:// www.emelaka.gov.my which has been a tool to develop the K-Economy of the Melaka State Community . The research focuses on the information needs of two distinct groups of users , viz housewives and old age pensioners .

KEYWORDS

Information Seeking Techniques, Information Clusters, Access Mapping.

1. INTRODUCTION

The launching of **Year 2003 as ICT Year for Melaka State** marks the commencement of a State Government-led effort to develop ICT skills of Melaka Rural Community numbering 400,000 out of Melaka State population of 680,000 . The development of ICT skills is one of the main activities of e-Melaka Programme which is implemented directly by the K-Economy Division, Melaka Chief Minister's Department.

The study takes into consideration several ideas which relate to improvement on information seeking techniqus through the website for housewives and old age pensioners . It has been necessary to identify DKI's for housewives and old age pensioners and build information clusters which will allow differentiation between the information needs of these two user groups and other user groups.

1.1 e-Melaka Program

The objective of the e-Melaka Programme is to educate and guide Melaka Rural Community to use ICT in their everyday lives and to create catalysts which can bring about the K-Economy development for the State of Melaka. The Programme helps the Community to be more knowledgeable and provide them with all necessary skills to manage their family and community life as well as to solve any problems which they may encounter . The Programme focuses on encouraging the Community to come up with innovative ways to upgrade their standard of living.

In order that the activities of e-Melaka Programme can bring about economic change , the implementation of this Programme is such that it draws on all the cooperative efforts of the Community, the Government and the Private Sector which in this particular case are the Cyber Cafes and the Multimedia Training Centres.

In the year 2003 , the Program succeeded in training and educating 14,760 housewives and old age pensioners with the help of   84 cyber cafes and Multimedia Training Centres. In the year 2004, Melaka State Government is in the process of training another 30,000 rural folks especially housewives and pensioners. It is hoped that by the end of the year 2004, Melaka State Government will have trained 44,760 rural folks, that is 10% of the Melaka Rural Community.

There are two reasons which have driven the Melaka State Government to implement the e-Melaka Program:

(i)   To bring about ICT and internet literacy for Melaka Rural Community. Housewives and Old Age Pensioners have been targeted because they are the two segments of the community with ample free time at their disposal.

(ii)   To motivate Melaka Rural Community to use   ICT and internet as a tool to access knowledge and information which can enhance their ability to generate income , thus contributing towards Melaka State Government's effort in eradicating poverty.

As Melaka Rural Community are not well equipped to work in the English Language, it has been necessary to develop a knowledge and information accessing platform based on Malaysian Language and which contains all essential information needed by the Melaka Rural Community . This platform is the one integrated website which has an url address http://www.emelaka.gov.my/ driven by the   12 e-Melaka flagships which act as the engine. This platform will subsequently be referred to as the Integrated e-Melaka Website (IEMW).

These 12 e-Melaka flagships are e-community, e-government, e-mosque, e-commerce, e-education, e-tourism, e-security, e-youth, e-health, e-politics, e-media, e-women.

1.2 The Development of Integrated e-Melaka Website (IEMW)

Since, housewives and old age pensioners are each a subset of the Melaka Rural Community, IEMW are constructed to cater for three types of users. They are the general public , Housewives and Old age pensioners. Initially IEMW consists of   a bundle of hyperlink connecting to many existing websites which are useful to the Melaka Rural Community . Through continuous research work and many field trials this IEMW is fine-tuned and many value-added characteristics are incorporated so that it is more user-friendly, simple, interactive and facilitates creative system content development.

1.3 Proposed Technique

It has been necessary to develop a technique in which Melaka Rural Community (especially housewives and old age pensioners) can access knowledge and information   efficiently . So that they can zoom in to appropriate and correct answers to their questions in the minimum number of steps and paths; and in the correct thinking logic cycle . It has also been necessary to work on a knowledge and information accessing platform which becomes a one-stop-centre. The platform has two components. That is

(i)   Passive component : That is Melaka Rural Community find the answers through several hyperlinks and search engines incorporated in the IEMW

(ii)   Active component: That is Melaka Rural Community find answers through e-mail, sms and voice messages via the Omni Information/Complaint Centre which is incorporated in the IEMW.

The passive system is the focus of this paper. Subsequent sections will elaborate on how the passive components of IEMW are put in place and how the Melaka Rural Community have responded to this facility.

1.4 Important Issues

A method of structuring web sites using audience class hierarchies have been proposed by Sven Casteleyn et al. [3] recently . In this structure websites are designed in such a away that several underlying problems caused by poor underlying design , or by oversubscribed data and organization driven view can be avoided. This has prompted the idea of using social network analysis [5] [9] in designing websites.

The idea of using IEMW has been through necessity. The State Government of Melaka has the desire to build Melaka Rural Community who have the skill and the capability to access, use and benefit from information wherever they are and whenever these information are needed. In this way it is hoped that the State Government of Melaka can create the right environment and resource to spur the K-Economy growth of the State [2].

However, several issues have to be resolved.

- How to identify the **Destination Knowledge Information (DKI)** which are needed and useful to the three types of users ?
- How to build information clusters which will allow differentiation between the information needed by each of these three users?
- How to formulate the access path mapping to access DKI from each cluster, bearing in mind that as the general public , the housewives and the old age pensioners are human beings , there are bound to be appreciable overlaps between these clusters?

2. PASSIVE COMPONENT

2.1 Destination Knowledge Information (DKI)

The term Destination Knowledge Information (DKI) in this paper refers to the useful information which can benefit the housewives and old age pensioners so that they can manage their social and religious life in an orderly and efficient manner as well as to enhance their ability to improve their income generation skills and increase their standard of living .

2.2 Social Networks Analysis

With the mass popularity of Internet and world wide web, many social activities have moved to online activities that are mediated by computer systems. These human computer interaction activities require the process to sieve through a huge amount of records. In social network approach , DKI can be zoomed in through the relations or interactions among social entities, and on the patterns, structures and implications of these relationships [4] . Such process is not a serial search where first-in-first-out (FIFO) process is undertaken but one in which there is an element of random access where the DKI is zoomed in through an optimization procedure.

The housewives and old age pensioners are the building blocks or the key factors that sustain and define the structure of the Melaka Rural Community [9] [8]. The patterns and social structure associated with IEMW browsing will help to form the cluster which can uniquely define DKI . Hence with such entity relationship it will be possible to upgrade the design of IEMW
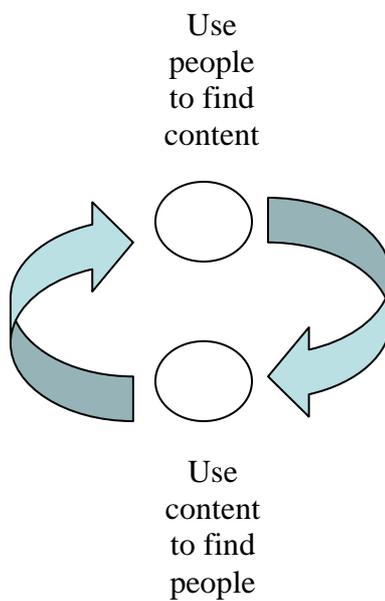
Figure 1. Relationship between people and content
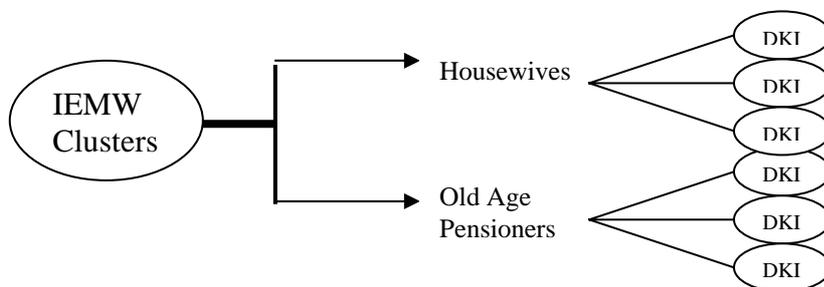
Figure 2. The DKI Clusters will be based on browsing activities of housewives and old age pensioners in IEMW

2.3 Cluster Techniques

Cluster techniques have being used to divide the elements of a set into related subsets based on a distance metric among elements [10]. In this paper , cluster techniques have been used to focus on the character attributes of housewives . These character attributes are
- The Business Housewife,
- The Educated Housewife,
- The Active Housewife,
- The Spiritual Housewife,
- The Concerned Housewife,
- The Sensual Housewife,

- The Practical Housewife,
- The Creative Housewife,
- The Independent Housewife.

The character attributes for the old age pensioners are based on the types of ideals [6] for the life of senior citizens such as

- Volunteer to Society,
- Being Absorbed In Hobbies,
- Time with Family and Grandchild,
- As a member of Resident's Association,
- Living Independent without Family,
- Undertake New Challenge,
- Playing Sport For One's Health,
- Taking Long Journeys,
- Raising Plants and Animal.

2.4 Interviews

The housewives and old age pensioners picked from the main set of Melaka Rural Community were interviewed and then using the interview information gathered they were then locked up on to their browsing activities in the website. These dataset from browsing activities such as the paths for DKI will show the relationships between the users and the attributes.

   From   this data set, several analytical procedures were done . The author is in the process of designing the m-tuple variable look up table to formulate access mapping for each DKI to ensure optimal accessing of DKI.

3. RESULTS

IEMW has been in use for over 2 years. At the same time the Melaka State Government has put in place training programmes for housewives and old age pensioners in the use of computers and ICT to enable them fully use IEMW. Clearly (Figure 3), IEMW has not been unable to encourage housewives and old age pensioners to generate some kind of income from IEMW **.** Perhaps it takes more than just IEMW to enable housewives and old age pensioners to generate income from their knowledge of ICT. However, many IEMW users are at ease when using e-Community (Figure 4). House wives who use e-Women are concerned about their children's school
Welfare from the number seen to be using e-learning (Figure 5) and old age   pensioners who use e-Health are also interested in using IEMW for their religious activities (Figure 6). Thus far IEMW has managed to encourage the use of ICT and the internet more than before.

y=2.653+0.014*x+eps
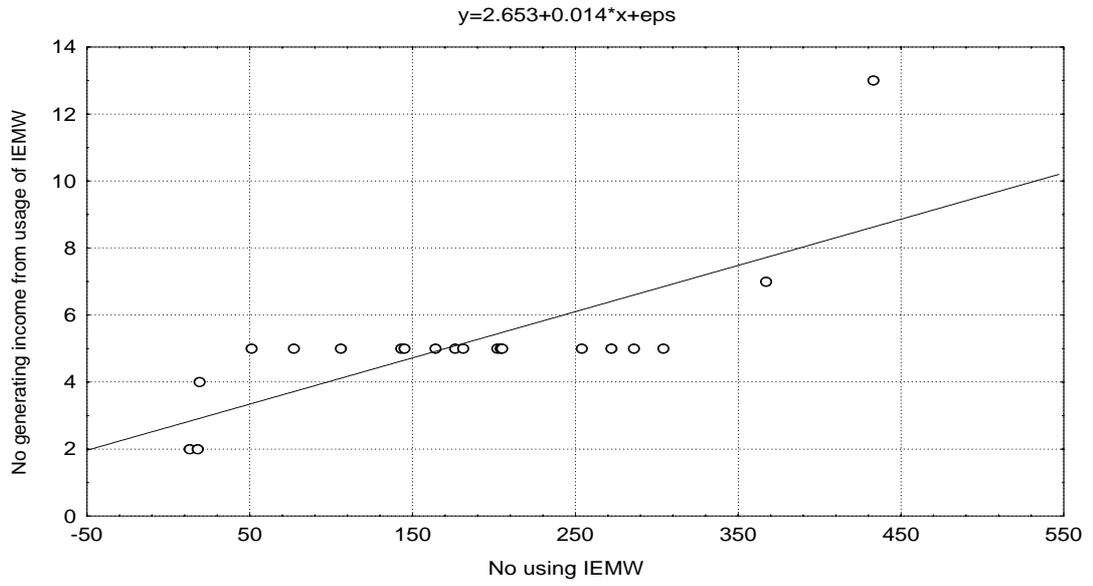
Figure 3. Graph shown No of generating Income Vs No of Using IEMW

y=-3.117+0.391*x+eps
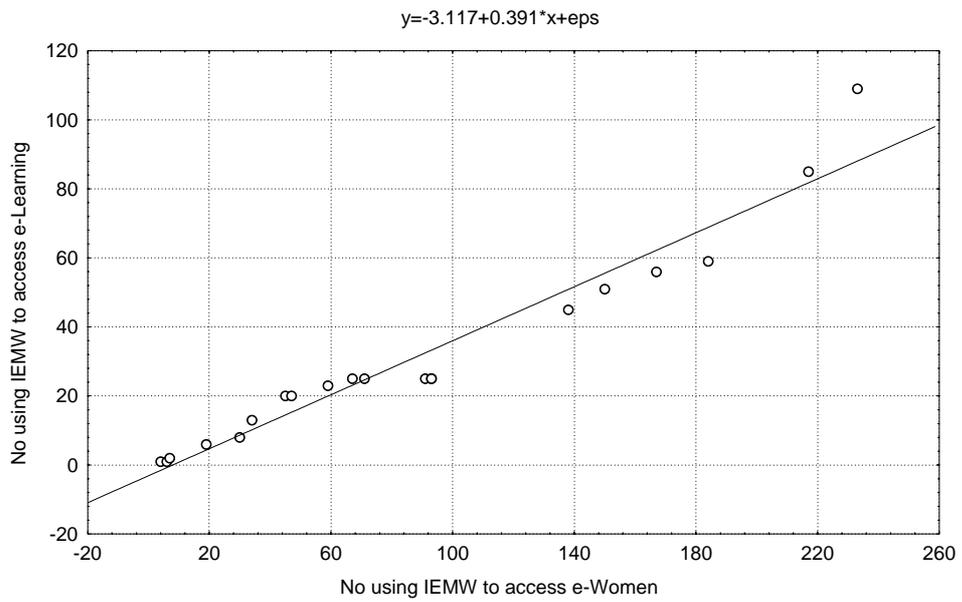
Figure 4. Graph above shown no using IEMW to access e-Learning Vs to access

e-Women

$$y = 0.994 + 0.025 \cdot x + eps$$
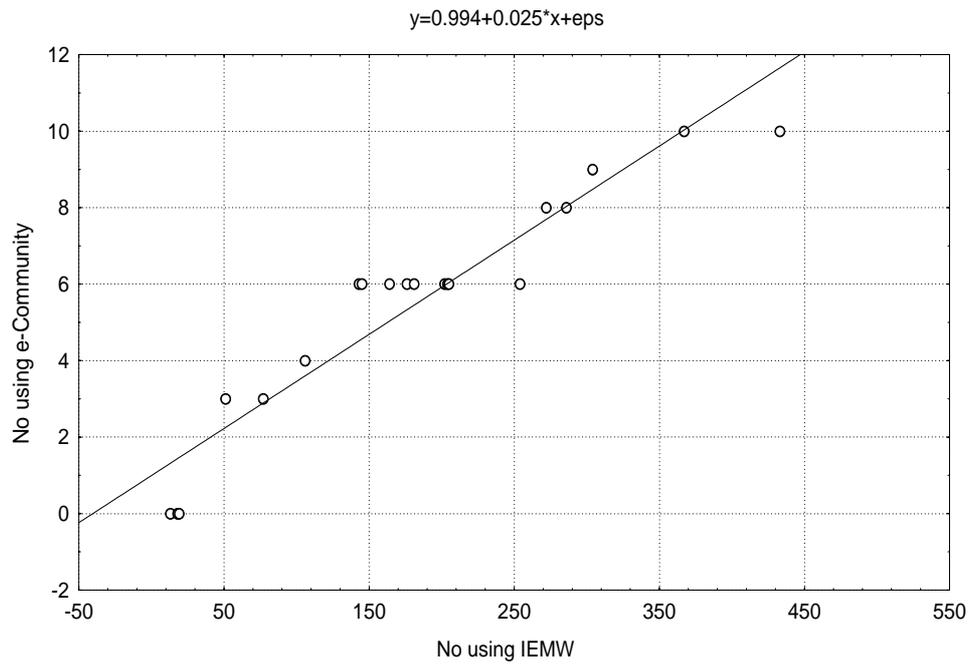
Figure 5. Graph above shown no of using e-community Vs no using IEMW

$$y = 1.254 + 0.2 \cdot x + eps$$
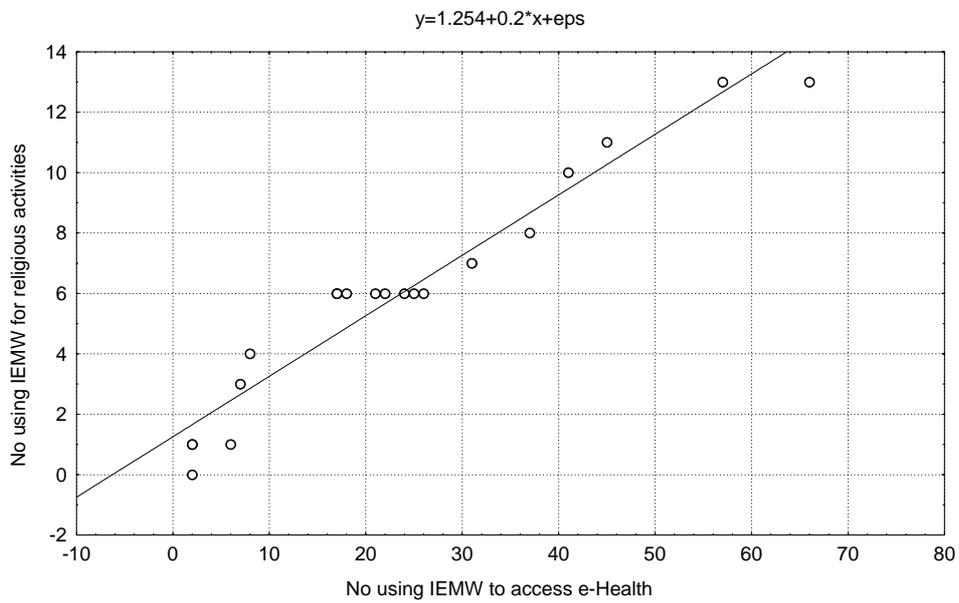
Figure 6. Graph above shown no using for religious activities Vs no using IEMW to access e-Health

The table below shows the encouraging effects of IEMW.

Use of IEMW to access the following facilities	Number per 1,000 population getting information from the internet & using the e -services after the introduction of IEMW	Number per 1,000 population getting information from the internet & using the e - services before IEMW
(1) e-Government	42.05	0
(2) e-Politics	25.03	0
(3) e-Women	123.06	0
(4) e-Media	157.48	27.6
(6) e-Commerce	60.81	13.2
(7) e-Mail	180.34	150.0
(8) Word Processing	408.57	323.4

4. CONCLUSION

Melaka State Government is keen to ensure that Melaka Rural Community are able to use the internet and the enabling technology , that is ICT so that the social and economic life of the rural community can be improved. This is in line with the desire to achieve zero poverty and improve family life of the Melaka Rural Community by the year 2004. Many needs to be done to IEMW so that it can be a vehicle to help the Melaka State Government to encourage the Melaka Rural Community to contribute to the K-Economy development of the State.

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TOWARD AN UNDERSTANDING OF KNOWLEDGE SHARING -THE EFFECTS OF FAIRNESS PERCEPTION

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ABSTRACT

This study examines the effects of fairness perception and belief of organizational ownership on an individual's propensity to share knowledge. Based on the theory of information sharing (Constant et al., 1994) and the equity theory (Adam, 1985), a theoretical model was developed and tested using structural equation analysis, and the effects of fairness perception on sharing explicit and tacit knowledge were compared. Results indicate that distributive justice has greater impact on explicit knowledge sharing than tacit knowledge sharing. In contrast, procedural justice is more important than distributive justice in predicting individual's propensity to share tacit knowledge. These findings provide supports that attitude toward knowledge sharing is moderated by the nature of knowledge shared. Also as hypothesized, fairness perception were found to be important predictors of employee's ownership beliefs of knowledge and knowledge sharing propensity.

1. INTRODUCTION

During the past decade, management of knowledge has climbed higher on the agenda of US and European enterprises, and a clear message is that people and their attitudes toward sharing what they know are central to the creation and exploitation of knowledge for competitive advantage. Since knowledge sharing is so important, many practitioners and academics assume that people will share all the required knowledge without problem. However, field studies in diverse settings indicate that employees frequently resist sharing their knowledge with the rest of the organization (Ciborra et al., 1998), regardless of the amount of technology, organizational mandate, and financial incentive.

People are unwilling to share knowledge for a variety of reasons. Of critical concern is whether or not they are motivated to share what they know with coworkers. Another issue that has received much attention in literature is the epistemological impossibility of articulating all knowledge one has. Un-codified or tacit knowledge is hard to articulate or can only be acquired through experience (Polanyi, 1966). It is worth noting that the nature of knowledge may influence an individual's motivation to contribute what s/he knows. However, most previous research discussed the two factors, namely, motivation to share and the nature of knowledge, separately (e.g. Hansen, 1999). The interaction between the two remains a less explored and complex issue.

The primary purpose of this study is to understand attitudes about employees' knowledge sharing in organizations. Build on the equity theory (Adam, 1985) and the information sharing theory (Constant et al, 1994), the present study seeks to enhance understanding of the perceptual determinants of people's

propensity to share knowledge. Specifically, we examined how the nature of knowledge moderates the relationship between employees' fairness perception and knowledge sharing propensity.

2. MODEL AND HYPOTHESIS

2.1 Research Model

This study develops a theoretical conceptual model based on the literature reviewed. Equity theory helps us to understand that perception of organizational fairness may influence the degree of the knowledge to be shared. Information sharing theory distinguishes information product from expertise to explain that people sharing each has a different motivation. The specific variable identified in this study and their relationships are presented in Figure 1. We now turn to a discussion on these relationships.
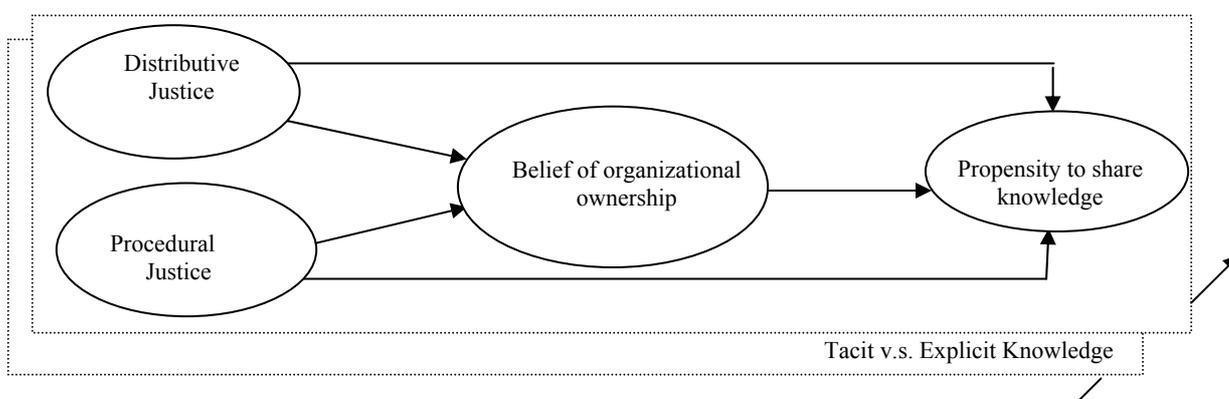
Figure 1. Research Model

2.2 Hypothesis

Beliefs of organizational ownership relate to whether knowledge created by an individual worker is believed to be owned by the organization (Jarvenpaa et al., 2001). A common organizational norm assumes that, either morally or legally, knowledge is owned by the organization, rather than a personal asset (Constant et al., 1994). However, psychologists have found that those who control the asset also tend to assume ownership (Heider, 1958). It is noted that much of the organizational knowledge is controlled in the hands of individual workers (Jarvenpaa et al., 2001). The ownership of knowledge is somewhat within the discretion of the individual worker.

According to the information sharing theory, employees are more likely to share information if they assign organizational ownership rights to their work. If they believe that their idea, invention, or computer program belongs to the organization, they are more likely to share them with co-workers. So we hypothesize:

H1: Beliefs about organizational ownership of knowledge positively affect one's propensity to share.

An important criterion for distributive justice is equity, which relates to whether employees believe the outcomes they have received are in accord with their contributions to the organization (Adams, 1965). If knowledge sharing is considered a work input, then an employee's response to underpayment, perceived as an inequity, could lead to the unwillingness to share knowledge. Thus, when employees cannot get commensurate benefits from their organization, a decrease in beliefs of organizational ownership of knowledge and knowledge sharing would reflect a change to their reward-to-input ratio. The choice of not sharing knowledge with co-workers as a response to unfair distribution seems to be more likely. Thus we hypothesize:

H2: Distributive justice positively affects the belief of organizational ownership of knowledge.

H3: Distributive justice positively affects the propensity toward knowledge sharing.

Procedural justice theory mainly focuses on the influence of decision-making procedures on fairness perception (Thibaut et al., 1975). Employees do not expect every decision outcome to be favorable because they recognize that decision makers must take into account many competing interests and issues. Instead, they seek assurance that decision makers will provide them with reasonably favorable decision outcomes in the long-run. The presence of fair decision-making procedures provides such assurance. Furthermore, Individuals generally have a strong sense of affiliation with organizations of which they are a member, and garner psychological gains such as self-esteem and self-identity from this affiliation. When group leaders use fair procedures, they are conveying respect and indicating to the people affected by the decision that they are valued members of the group, thereby affirming their choice to be affiliated with the group and enabling them to fulfill important self-esteem and identity needs. Thus employees may tend to attach more organizational property rights to their own knowledge to strengthen the sense of affiliation with organization. Further, employees may like to share knowledge because it makes them feel proud or more a part of the organization. The above arguments lead to the following two hypotheses.

H4: Procedural justice positively affects the belief of organizational ownership of knowledge.

H5: Procedural justice positively affects the propensity of knowledge sharing.

Tacit knowledge is personal knowledge that is intangible and hard to formalize or communicate to others. On the other hand, explicit knowledge is easy to transmit between individuals and groups. Constant et al. (1994) proposes that tangible information product and intangible expertise are treated differently, and the two types of information have different meanings to people and different social implications as well. Explicit knowledge is discernible. It is easier for organizations to monitor and track worker's explicit knowledge through information systems and administrative procedures. An employee would feel more obligated to share and be responsible for hoarding. On the other hand, sharing tacit knowledge is more ambiguous than sharing explicit knowledge. An employee has more control over his tacit work regardless of whomever the knowledge belongs to. Thus, the employee would share explicit knowledge because he feels that the organization has a right to it, and they are willing to share tacit knowledge even if the company does not own the knowledge. So we hypothesize:

H6: Belief about organizational ownership predicts the propensity to share explicit knowledge more than to share tacit knowledge.

The motivation to exchange knowledge is affected by whether the decision to share is viewed as primarily economic and motivated by self-interest, or non-economic and motivated by community interest and moral obligation (Wasko et al., 2000). Distributive justice, or the fairness of decision outcomes, is the typical metric for judging the fairness of transactional contracts and economic exchange (Konovsky et al., 1994). A norm of distributive fairness implies that the parties to an exchange give benefits with the expectation of receiving comparable benefits in the short run.

Tacit knowledge is stored within an individual and cannot be transferred as a separate entity. Employees cannot be identified and sanctioned if they hoard their tacit knowledge. Additionally, the contribution of a particular employee's tacit knowledge to an organizational output is hard to measure and compensate. Explicit knowledge, on the other hand, is tradable. Managers are more able to observe how well workers with individual knowledge have performed in this respect, and reward them accordingly. We argue that the rules of economic exchanges are more important when sharing explicit knowledge. People are motivated to share explicit knowledge based more on economic reasons.

H7: Distributive justice is more likely than procedural justice to predict the propensity to share explicit knowledge.

In contrast to distributive justice, fair procedures demonstrates an authority's respect for the rights and dignity of employees. This demonstration of respect indicates that the manager is devoted to the principles of procedurally fair treatment, thus resulting in the employees' trust in the long-term fairness of the relationship and enabling them to fulfill important self-esteem and identity needs. Information as expertise is part of a person's identity and is self-expressive (Constant et al., 1994). The psychological gains such as self-esteem

and self-identity garnered from organization would facilitate the exchange of tacit knowledge among employees.

Since tacit knowledge cannot be codified, sharing it between people is costly, slow, and uncertain (Zander et al., 1995). Sharing complex knowledge incurs personal cost and requires time devoted to either personal interaction, thoughtful documentation of one's expertise, or both. Perception of procedural justice creates feelings of pride in one's group and perceived respect by the group. These feelings of pride and respect should, in turn, lead people to weigh the social good more than personal cost and to show greater willingness to share tacit knowledge. We argue that social exchange characterizes the sharing of tacit knowledge. Hence, the fairness of procedural justice may have greater impact on tacit knowledge sharing than explicit knowledge sharing.

H8: Procedural justice is more important than distributive justice in predicting the propensity to share tacit knowledge.

3. RESEARCH METHOD

Data to test the model and hypotheses were drawn from a cross-sectional field study of on-the-job students. Students from four colleges were chosen in this study as convenient samples. The subjects in our sample were college MIS majors and EMBA students. All of these students attend school at night and have full-time day jobs in different organizations, with various cultures and work climates. The contrastive vignette technique (Burstin et al, 1980) was used to measure the propensity to share in the tacit and explicit knowledge sharing situations. Two variations of the questionnaire for the two situations were randomly distributed. Constructs were measured using multiple-item scales, drawn from pre-validated measures in previous related studies. All remaining scale items used seven-point Likert scales anchored between "strongly disagree" and "strongly agree".

Following the work of Constant et al. (1994), *Belief of organizational ownership of knowledge* and *sharing propensity* were measured through vignettes. To compare attitudes about sharing explicit and tacit knowledge, different versions of the same basic vignette were randomly allocated to different respondents. Subjects read a description of "an employee's encounter with previously unhelpful coworker who subsequently requested help- in the form of explicit or tacit knowledge." The moderating factors (i.e., knowledge type) are altered by insertion or removal of sentences which in theory suggests can impact the individual's choice (Lysonski et al., 1991).

To measure *procedural justice*, the seven-item, seven-point formal procedural scale was utilized (Moorman 1991). This was consistent with the conceptualization of the procedural justice construct in the present study. Finally, *distributive justice* was measured using five items assessing the fairness of different work outcomes, including pay level, work schedule, work load, and job responsibilities. This scale was based on Niehoff et al. (1993) and had reported reliability above 0.9.

4. DATA ANALYSIS AND RESULTS

Two variations of the questionnaires were administrated randomly to students in the classroom, with 522 students voluntarily completed the survey. Students currently not employed were not included in the following analysis, resulting in 491 usable responses. These include 219 responses for explicit knowledge (44.6%) and 272 responses for tacit knowledge (55.4%). We compared the demographic variables between the two groups, using one-way analysis of variance (ANOVAs) and chi-square test. No significant differences were found between the two groups of respondents for any of the variables, at the .05 level.

4.1 Measurement Model

In analyzing the collected data, we estimate and re-specify the measurement model prior to incorporating the structural restrictions. Convergent and discriminant validity of scales were tested with confirmatory factory

analysis (CFA). Each item was modeled as a reflective indicator of its hypothesized latent construct. Due to the fact that χ^2 test is very sensitive to the sample size and the probability of rejecting any model increases as the sample size increases even when the model is minimally false (Bentler 1990), it is suggested that other model fit indices should be used. For the current CFA models, NFI, NNFI, CFI were over 0.9, and $\chi^2//df$ was less than 4 (see Table 1), suggesting adequate model fit.

Table 1. Fit Statistics of the Confirmatory Factor Analysis

	χ^2	df	p-value	χ^2/df	NFI	NNFI	CFI
Explicit Knowledge Group	218.541	86	<0.01	2.54	0.923	0.941	0.952
Tacit Knowledge Group	271.482	86	<0.01	3.16	0.927	0.937	0.949

Convergent validity was assessed based on the criteria that the indicator's estimated pattern coefficient is significant on its posited underlying construct factor. All λ values in the CFA model exceeded 0.7 and were significant at p=.001. Composite reliabilities (ρc) of constructs ranged between 0.84 and 0.96 (see Table 2). AVE (Average variance extracted), ranging from 0.73 and 0.87, was greater than variance due to measurement error. Hence convergent validity was met. Finally, Fornell et al. (1981) recommended a test of *discriminant validity,* where the AVE for each construct should exceed the squared correlation between that and any other construct. The factor correlation matrix in Table 2 indicates that the largest squared correlation between any pair of constructs was 0.50 while the smallest AVE was 0.73. Hence, the test of discriminant validity was also met.

Table 2. Scale Properties and Correlations

Group	Construct	Number of Items	Composite Reliability	AVE	Factor Correlations			
					D	P	O	S
Explicit Knowledge Group	D	4	.923	.750	1.000			
	P	7	.954	.750	0.440	1.000		
	O	2	.866	.764	0.261	0.503	1.000	
	S	2	.846	.734	0.337	0.418	0.475	1.000
Tacit Knowledge Group	D	4	.929	.766	1.000			
	P	7	.955	.753	0.440	1.000		
	O	2	.910	.834	0.284	0.495	1.000	
	S	2	.865	.762	0.339	0.458	0.412	1.000

Legend: D: Distributive Justice, P: Procedural Justice, O: Ownership Belief, S: Sharing Propensity

4.2 Hypotheses Testing

The eight hypotheses presented earlier were tested collectively using the structural equation modeling (SEM) approach. The four constructs were linked as hypothesized. The results were shown in Table 3.

Table 3. SEM Analysis

	Explicit Knowledge Group (n=219)		Tacit Knowledge Group (n=272)	
	coefficient (β)	t-statistics	coefficient (β)	t-statistics
D→O	.335**	4.222	.185*	2.805
P→O	.077	0.996	.371**	5.478
O→S	.346**	4.583	.216**	3.113
D→S	.315**	4.068	.023	.342
P→S	.102	1.438	.400**	5.467
R^2_o	13.88%		22.91%	
R^2_s	34.88%		29.44%	
Fit Index	χ^2= 224.780 (df= 86, p<.001) NFI=0.922 NNFI=0.939 CFI=0.950		χ^2= 273.938 (df= 86, p<.001) NFI=0.927 NNFI=0.937 CFI=0.948	

*p-value < .01   **p-value < .001

Model χ2/df was 2.61(χ2=224.780, df=86) and 3.18 (χ2 = 273.938, df=86), respectively. The strength of the relationships among the constructs are represented by standardized path coefficients. Inspection of these coefficients in both models indicates that belief about ownership of knowledge is significantly related to propensity to share knowledge. Thus, **H1** is supported. **H2** states that distributive justice would predict belief about ownership of knowledge. This expectation is supported by the structural model results. **H3** is partially supported since distributive justice significantly predicts sharing propensity for explicit knowledge, but not for tacit knowledge. For the explicit knowledge group, the influence of procedural justice on ownership belief and sharing propensity of explicit knowledge are not significant. On the contrary, procedural justice has a significant and positive effect on both ownership belief and sharing propensity when knowledge is tacit, which suggested partial support for **H4** and **H5**. These are depicted in Figures 2 and 3 respectively, where the effects of distributive and procedural justice on sharing of explicit and tacit knowledge can be clearly differentiated.
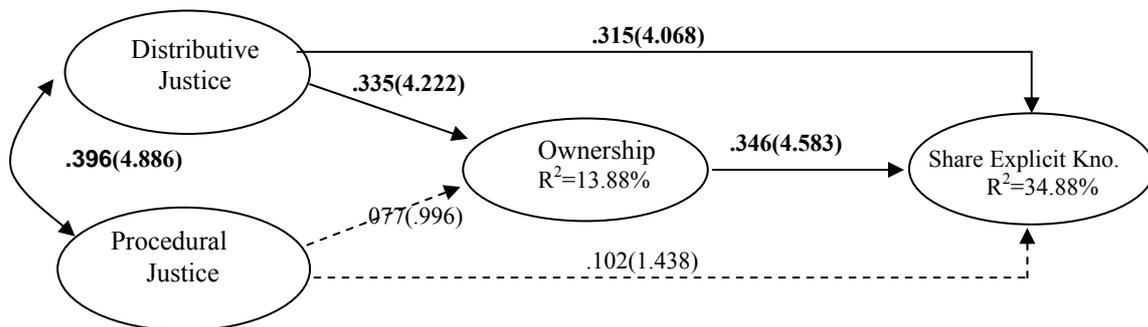
Figure 2. SEM Analysis for Explicit Knowledge Group (n=219)
Model fit: χ^2= 224.780 (df= 86, p<.001), NFI=0.922, NNFI=0.939, CFI=0.950, RMSEA=0.086
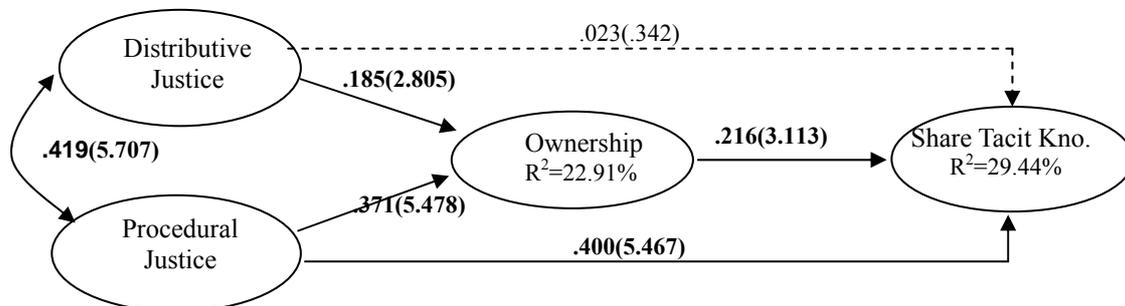
Figure 3. SEM Analysis for Tacit Knowledge Group (n=272)
Model fit: χ^2= 273.938 (df= 86, p<.001), NFI=0.927, NNFI=0.937, CFI=0.948, RMSEA=0.09
[a]: Structural path estimates are the standardized parameter estimates, and the associated t-values are in parentheses. Solid-lines stand for significant paths and dotted-lines for non-significant ones. Measurement model is not shown above for purposes of clarity.

To assess the moderating influence of knowledge type, we performed a multiple-group structural equation analysis (Bollen 1989) to examine whether the parameter estimate differs across the groups of knowledge types. The chi-square statistics for the two types of knowledge are provided in Table 4. Constraining the path from ownership belief to sharing propensity to be equal in both samples (Model 2) does significantly change the model, χ2(1)= 3.538, p <0.1, which suggested **H6** is supported.

The relationships between fairness perceptions and sharing propensity are composed of direct and indirect effect. Hence, equality constraints were first imposed for the direct path between the two fairness perceptions and sharing propensity (Models 3 and 4). Both constraints significantly reduce the fit of the model, χ2(1)= 6.842, p <0.05 for distributive justice→sharing propensity, and χ2(1) = 7.435, p <0.05 for procedural

justice→sharing propensity. We then constrained the indirect paths between distributive justice and sharing propensity mediated by ownership belief to be equal in both samples, resulting in a model (Model 5) that was significantly different from the free model, χ2(2)= 5.113, p <0.1. The next model (Model 6) constrained indirect paths between procedural justice and sharing propensity mediated by ownership belief to be equal across groups, this constraint results in a significantly decrease in fit, χ2(2) = 12.647, p <.05, indicating that the paths are not equal in both groups. Therefore we conclude that both **H7** and **H8** are supported.

Table 4. Multiple Group Analysis of Structural Model

Model	Variables Constrained	Degrees of Freedom	χ^2	χ^2	df	CFI	p
1	None	172	489.589	-		0.950	
2	O→S (Explicit) = O→S (Tacit)	173	493.127	3.538	1	0.950	<0.05
3	D→S (Explicit) = D→S (Tacit)	173	496.431	6.842	1	0.948	<0.01
4	P→S (Explicit) = P→S (Tacit)	173	497.024	7.435	1	0.949	<0.01
5	D→O (Explicit) = D→O (Tacit) O→S (Explicit) = O→ S (Tacit)	174	494.702	5.113	2	0.950	<0.05
6	P→O (Explicit) = P→O (Tacit) O→S (Explicit) = O→S (Tacit)	174	502.236	12.647	2	0.949	<0.01

Legend: D: Distributive Justice, P: Procedural Justice, O: Ownership Belief, S: Sharing Propensity

5. DISCUSSION, LIMITATION AND CONCLUSION

The most interesting finding of this study is the moderating effects of the explicitness of knowledge. Consistent with Constant et al. (1994), individual's attitudes about different types of knowledge are associated with different antecedents. The findings of this study suggest that distributive and procedural justice have different predictive roles, and explicit and tacit knowledge respectively have different psychological meaning to employees. Implications of this result are two folds. First, psychologically knowledge in itself is not an undifferentiated object (Constant et al., 1994). Tacit knowledge is 'sticky' and is not easily shared with others. Conversely, explicit knowledge is tradable and is likely to be looked upon as simply a commodity. Second, the findings of this study seem to imply the proposition that social exchange characterizes the sharing of tacit knowledge, and people are motivated to share explicit knowledge based more on economic reasons. Knowledge sharing attitudes vary according to the context and the nature of the knowledge being exchanged, that is, whether knowledge exchange is viewed as economic or non-economic exchange may depend upon the form of knowledge being exchanged, and different fairness perception governs one's behavior in economic and non-economic spheres of activity.

This study also reveals that employees are more likely to share what they know if, in general, they assign organizational ownership rights to their knowledge. Further, the explicitness of knowledge moderates the relationship between ownership beliefs and sharing propensity. The findings support the hypothesis that beliefs about organizational ownership have stronger effects on individual's propensity to share explicit knowledge than to share tacit knowledge. This is consistent with Constant et al.'s (1994) and Jarvenpaa et al.' (2001) reasoning.

The moderating analyses discussed above are in line with theory of information sharing (Constant et al., 1994), which suggests that attitudes about knowledge sharing depend on the form of the knowledge. Explicit knowledge is different from the meaning of tacit knowledge, and sharing each has different psychological basis. Thus, we conclude that the dynamics of knowledge sharing cannot be understood nor explained purely either by solely motives of self-interest or by social exchange.

Although we believe that our findings provide support for our arguments, there are a number of limitations. First, in this study, knowledge sharing propensity was measured using a vignette due to the sensitive nature of the information sought. However, subjects might not have been able to project themselves fully into the given imaginary situation and not respond as they would have in real life. Second, this study uses cross-sectional design and correlational data which do not provide irrefutable evidence of causation. Third, although we deliberately tried to use part-time students who have full time jobs, the use of students as

informants undoubtedly may limit the external validity of the results. Finally, all of the data are self-reported, giving rise to problems associated with common-method variance.

This study provides a compelling theoretical framework that helps determine the conditions under which perception of distributive and procedural fairness is more or less likely to influence employees' belief about organizational ownership of knowledge and knowledge sharing attitudes. While the study provided several interesting results, more studies are needed to better understand the dynamics of knowledge sharing. We hope this will encourage other researchers to conduct research on this important but neglected area. More studies with other research methods, especially the qualitative ones, may provide different insights into the issue.

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ORGANIZATIONAL ASPECTS OF TRANSFORMATION TO E-BUSINESS: A CASE STUDY

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ABSTRACT

The topic of e-business is increasingly attracting the attention of software engineers, system researchers and, most interestingly, business practitioners. However, the organizational aspects of e-business transformation (e-transformation) have received little attention. Success is strongly related to the effective strategies for planning and managing various key success factors. This paper investigates three of the major organizational aspects of the e-transformation process, related to the core assets of any business: people, technology and business processes. Here, we focus on the effective change management strategies including resistance to change; the successful adoption and diffusion of new technologies; and the successful reengineering of business processes for the new e-business environment. We report empirical results from an industrial case study conducted in a large multinational professional information solution provider in Sydney over a period of two years using the Action Research methodology.

KEYWORDS

Organizational Aspects, E-business, E-commerce, Technology Adoption

1. INTRODUCTION

With the rapidly increasing usage of the Internet and Web technologies, different organizations make use of the Internet in many different ways such as solely advertising, providing services with limited electronic transactions and conducting full collaborative electronic businesses with both customers and partners. In general, the business utilization of the Internet can be classified into four different levels, E-information, E-commerce, E-business and C-commerce.

E-information, *a.k.a. brochureware*, is nothing more than just presenting the business's catalogue of products and/or services online. For example, an airline company could have a web site just to display a timetable with all their flight details without any facilities for making electronic transactions. The next level of utilization is E-commerce, which is typically a two-way transaction, the sell-buy process on electronic networks. For example, the airline company can offer tickets for sale that can be purchased by customers using electronic payment facilities. It is worth noting here that the E-commerce level is restrictive and does not fully encompass the true nature of electronic business. This introduces the next usage of the Internet, E-business, that can be defined as that using electronic mechanisms to conduct business transactions between an organization, their customers and their partners. Rutkowski *et al*. (2002) define this level of usage as the transformation of key business processes through the use of Internet technologies for conducting electronic business with both customers and trading partners. For the above airline company, moving to the level of E-business will enable both customers and trading partners, to do more than just buying a ticket. Consequently, E-business represents a rich set of activities that are much more diverse and technically complicated than E-commerce, having two major foci: Business-to-Business (B2B) and Business-to-Customer (B2C) (Fairchild and Peterson, 2003). The final layer of utilization is the collaborative commerce or 'C-commerce'. Here, many businesses come together via a portal or similar mechanism to create an E-market, thus creating a collaborative network of trade partners who operate more closely and seamlessly as one value chain, connecting their business processes with other companies as a catalyst to strong business growth. C-commerce is still in its infancy stage and is seen by many researchers and practitioners as the second generation of E-business and the next phase of the Internet's impact on business (Kownslar, 2004).

2. KEY BUSINESS DRIVERS OF E-BUSINESS

The numbers of individuals and organizations that are using the Internet and web technologies is not only massive but also rapidly increasing. Sultan and Chan (2000) assert that, over the last 20 years, many of the changes in organizations have been predominantly driven by two factors: globalisation and technology. Burn and Loch (2001) confirm that, in the 21st century, business transformation to globalisation and e-business is one of the major reasons for organizational change. Other key business drivers that have emerged for e-business are trade barriers, collaboration among supply chain partners and environmental changes. Unhelkar (2003) emphasizes the importance of moving to an e-business environment by stating that few businesses will be able to avoid becoming an e-business in the light of such moves by their competitors. Those that do accept the challenge will benefit from implementation of the new business approach.

3. EFFECTIVE CHANGE MANAGEMENT STRATEGIES

A change management strategy covers a variety of disciplines that include planning, managing, scheduling, assigning, monitoring and analyzing the changes (Hammer and Champy, 1993). Often, the creation of a change management strategy is overlooked and the crucial issues related to assisting people in the transition and associated cultural issues that influence the change are not addressed (Serour and Unhelkar, 2003).

An effective change management strategy must include a specific plan for managing the transition period to e-business. The transition period in any change process is probably the most difficult time for most of the people involved. During this period, people have to work harder to keep both the old and new systems running. Management's desire to keep the old system running during the transformation process is a technique for managing the potential risk factors. At the same time, they desire to keep the new system evolving and keep the momentum for the change going.

Human and organizational cultures play an imperative role during any organizational change due to their direct and strong involvement and impact on every business process. Since the e-transformation process includes elements related to human and organizational cultures, then the organizational change management strategies for e-business must include a management plan for effective organizational and human culture change. Here, we examine a number of the human and organizational factors that may strongly impact on the organizational change management strategies of transformation to e-business.

3.1 Human Culture and Resistance to Change

In general, changes are always accompanied by natural resistance, as people are driven out of their comfort zone (Bridges, 1995). Some people perceive the organizational change as a direct threat to their jobs or as a challenge to their competence of carrying out the new jobs. Changing human values and beliefs is proving to be one of the most difficult aspects of any serious attempt to transform business performance (Bridges, 1995). Since e-business is seen as a totally new way of conducting business, people need to change their work culture to be able to move effectively to their new e-business environment. Hence, the human culture and associated resistance to change is considered as one of the foremost human factors that needs to be addressed properly and early during the transition process since resistance to change can negatively influence other aspects of the transformation to e-business. Consequently, an effective and well-planned e-business change management strategy must address the human issues that are considered as a vital business component required in the transition to become a successful e-business (Ginige et al., 2001). In most cases, the organizational willingness and competence to manage their human issues well during an organizational change can be the difference between success and failure.

3.2 Organizational Culture and Management Commitment

Whenever a new way of 'doing things' is adopted, it will have its impact on the organizational structures within the project and also within the organization, thus effecting a culture change. The reporting structures, the communication channels, the chain of responsibilities and authorities and the way in which people relate

to each other are some of the things that will change. Consequently, organizational culture is set to play a crucial role during the transformation to e-business environment (Serour and Henderson-Sellers, 2002).

Transformation to e-business is a long-term investment issue and, like all business investment issues, the chance of success is very slim unless senior management is committed to the project as a critical success factor in any organizational change (Meredith, 1987). An e-business change management strategy will not happen without the commitment and effective and strong leadership of both senior and middle management (Rifkin, 2001). For a successful transition, management must be dynamically involved in each and every phase of the process. In addition, they must explicitly demonstrate their support and allocate sufficient resources to the project. Organizational commitment and support cover a large number of issues vital for a successful transformation including providing people with adequate education and training, providing satisfactory resources including human and demonstrating strong leadership.

4. SUCCESSFUL ADOPTION AND DIFFUSION OF NEW TECHNOLOGIES

Information Technology, in general, is seen by management as an essential means to advance and compete in today's new e-world. Technology is only a tool; what makes the difference in practice is the individual who makes use of the technology and the culture that motivates people to realize and understand the advantages of adopting such a technology (Serour et al., 2002). Technology by itself has no value unless it is coupled with people's acceptance and their willingness and readiness to utilize it in the most effective manner. Therefore, the successful introduction of new technology and/or business approach to organizations requires an effective blend of good human and technological resources and abilities. People with high morale, willingness and readiness to adopt and diffuse an appropriate technology can make an organizational change successful.

There is no doubt that moving to e-business is rapidly becoming well accepted as the best approach for organizations to survive and compete in today's global market (Flurry and Vicknair, 2001). For a successful e-transformation, organizations need to adopt and diffuse more than just the Internet and web technologies. E-business practices build on a set of software applications that make e-business possible and practical such as Customer Relationship Management (CRM), Enterprise Resources Planning (ERP) and Supply Chain Management (SCM). Whether organizations decide to purchase these applications as off-the-shelf or develop them in-house, they ought to implement a formal software development process/method in practice. A method can be utilized to customize and maintain the pre-developed applications or to completely develop new systems to support the new e-business processes (Kangas, 2003; Koh et al., 2004). Also the successful adoption of a new technology requires that IT people fully understand their organization's strategic goals and objectives. Team members should be educated about the new technology and be convinced of its strategic significance (Ushakov, 2000; Serour and Henderson-Sellers, 2002).

One of the most important issues that must be considered when adopting new technologies is that people must trust these technologies and also feel comfortable and confident to use them in practice. These objectives can be achieved by introducing the new technologies in a professional and effective manner, providing people with proper and adequate education and training and allowing them to participate in the process of assessing and acquiring new technologies.

5. SUCCESSFUL REENGINEERING OF BUSINESS PROCESSES

A substantial e-transformation, as achieved by shifting all business processes to electronic ones requires a complete reengineering of business processes as well as handling of crucial new processes that emerge due to e-transformation (Gates, 1999). Organizations that are moving their practices to e-business are undergoing massive restructuring efforts to cope with a changing competitive environment. Fundamental to these efforts is the redesign and change of business processes (Paper et al., 2002).

Moving to e-business and, consequently, adopting Internet and web technologies not only needs a radical reengineering of existing core business processes but also the generation of new ones to support the new business environment. For example, CRM is a vital process for e-business due to the fact that business power is shifting from producers to customers. Therefore, organizations must recognize this power shift and create a

customer-focused strategy (Motiwalla and Khan, 2002). As another example, ERP is vital for linking together all core activities of an extended enterprise including manufacturing, stock control and purchasing. In addition, it offers the potential to grow into an important underpinning of the real infrastructure for any organization thinking of building an e-business platform for the future (Jackson and Harris, 2003).

6. CASE STUDY - BACKGROUND

The organization under study is a well-established, multi-national legal publishing company. It is a leading publisher of legal and tax information to the professional services industries. In the past, the organization's focus has been on the production and distribution of printed material and compact discs; about three years ago, a decision was taken to transform the organization into a provider of on-line information in its domain, requiring a transformation to e-business. This e-transformation has meant that the strategies of the organization's different business processes are aligned; the organization as a whole is dependent on its capability of delivering effective products for ultimate customer services. The three major organizational aspects of the entire e-transformation process were identified by senior management as follow:

- Effective change management strategies.
- A successful adoption and diffusion of a formal Object-Oriented (OO) software development process along with the required elements of Internet and web services technologies.
- A successful reengineering of existing business processes to support e-business.

The e-transformation project was driven by a strong business case to enable the organization to compete effectively in their market place. A business case was approved by senior management to place approximately 60 databases online.

6.1 Case Study and Action Research

The Senior IT manager approached the Centre for Object Technology Application and Research (COTAR) at the university to assist them in planning and managing their transformation process to e-business. Action Research (AR) was chosen by the COTAR team as its research methodology since AR offers the ability of the researcher(s) to contribute both to the practical concerns of people in their immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework (Rapoport, 1970; Lewin, 1974; Susman and Evered, 1978; Hult and Lennung, 1980; Argyris *et al.*, 1985; Reason, 1993; Lau, 1999). The action research method focuses on the collaboration between researchers who are aiming to test and prove their theory and practitioners who are aiming to solve their immediate problem(s) (Avison *et al.*, 1999). In other words, AR has the dual aims of providing a mechanism for practical problem solving (Action) and for generating and testing theory (Research). Elden and Chisholm (1993) argue that the dual interest of AR provides a win-win scenario for both researcher and participants and plays an effective role in solving practical problems by increasing the understanding of a given social situation through the direct involvement of the researcher in an organisational change that can also positively affect future decisions and actions based on better understanding of the problem(s) in hand (Hult and Lennung, 1980; Avison *et al.*, 1999). As a result, action research, as an effective qualitative research method, has been widely adopted and utilized for studies in different disciplines including Information Technology (Klein and Myers, 1999; Lee, 1999). Moreover, AR is regarded by many as an ideal post-positivist social scientific research method for Information System research (Baskerville and Wood-Harper, 2000).

6.2 Case Study and Change Management

In the organization under study and during the introduction of a plan for change management, most of the middle management group exhibited a strong resistance to the proposed change due to the fact that they were fully committed to other projects and could not spare any time to participate in the change. One of the strong signs of resistance to the change, as noted by the researchers, was the last minute apology for not attending the change management meetings. It was clear that these individuals were not convinced with the reason(s) for undertaking change, due to poor understanding on their part.

During the introduction of a formal OO process to the IT department, some members of the development teams showed resistance to changing the ways in which they followed an ad-hoc software development process. The project leader for the on-line team opposed the change, arguing that following a process is purely an academic concept not suitable for practice. Furthermore, he claimed that following a process would definitely slow their production down. Again, it was quite clear that the developer's resistance to adopt a new OO process was an obvious result of their lack of understanding of the rationale behind the proposed change. IT personnel were not involved in the initial stage of the transition planning and were asked to change their work culture without a full explanation as to why this was necessary.

As a result of analyzing the above incidents and many others, it was apparent that senior management invested a great deal of time in selling the solution to its people with minimal effort to sell the problem itself. It was also observable that people were not offered the chance to play a part in the planning for the change that negatively related to their behaviour regarding their unwillingness to participate in it.

After nearly three months, senior management decided to revise the change management plan to address the problems related to resistance that had been observed as occurring. As a result, senior management appointed a full time team headed by a senior manager with appropriate and diverse skills to drive the change management process. The now-empowered change management team made a few decisions to support and speed up the change process. Firstly, they commissioned an outside professional firm to conduct a formal assessment of the current organizational and human culture. Understanding the current state of an organization is always an obligatory starting point towards a successful change (LaMarsh, 1995). Secondly, they conducted a number of special sessions to formally introduce the proposed changes. During these sessions, everyone was encouraged to participate not only to plan the change but also in making decisions, giving them ownership of the process. Friday (1994) claims that people are not naturally resistant to change; "we seldom get resistance when we get the people who do the work to come up with solutions that will achieve enormous improvements in performance". Thirdly, they decided to change the role and responsibilities of middle management during the transformation to e-business. This had shifted from monitoring and controlling to collaborative, support functions, helping teams solve problems and creating environment for personnel to work more flexibly.

While it is recognized that culture change is a lengthy process, the change management team emphasized the fact that they cannot ignore the importance of the pace of cultural change. It must be well-managed to be fast enough for business benefit but also slow enough to stay under control. In addition and as a very wise business decision, the change management team established a new web site as part of their Intranet as an open communication channel between management and everybody within the organization. This new communication channel was used very effectively by almost everyone for exchanging ideas, brainstorming concepts regarding changes, reporting problems to management and, most importantly, it was used by management to keep people updated on the progress of the transition process.

All these new enhancements to the organizations change management strategy were very effective techniques to eliminate people's resistance to change and make them feel confident comfortable and motivated to participate. In addition, they created an environment that provides each staff member with clear understanding, expectations, responsibilities and resources to accomplish their goals and foster a climate that allows the expression of all points of view.

6.3 Case Study and Technology Adoption

The IT department within the case study organization has two offices in Sydney and Canberra with a fairly small development team in each location. Each team is made up of a mixture of experienced and inexperienced permanent staff and a number of contractors. The IT department was assessed by a professional firm at level 1 of the SPICE scale (ISO/IEC, 1998). Prior to this study, all software development was done in a fairly ad hoc way depending on the experience of the developers, thus causing major problems especially with contractors. These problems manifested themselves in a number of different ways: mismatches in communications when discussing different aspects of the system, time wasted due to ad hoc/informal on-the-job training and inconsistencies in the final design.

With the organizational move to e-business, the IT department was commissioned to develop a new set of web-based software applications urgently needed for the organization to offer their products on-line – a direct response to their competitors move to e-business. This imperative for product enhancement was to be

realized through the adoption and diffusion of Object Technology (OT). Senior management, therefore, decided that an OO software process along with a recognized modeling language and CASE tool must be officially introduced to develop software applications for e-business. In addition, they appointed a part time team (IT champion team) with appropriate and diverse skills to drive the IT transition process.

The first attempt was initiated and enforced by one member of senior management team to introduce the Rational Unified Process (RUP) (Kruchten, 1999), with which he had some previous experience. However, this attempt was strongly resisted by most of the IT personnel for many reasons. Some claimed that RUP was too large to learn and comprehend without proper training over a long period of time. Others complained that this process was much too "heavyweight" for their type of software development. From a research point of view, this was an obvious result due to several factors that negatively related to the adoption process:

- The lack of a formal assessment of the contemporary software processes in order to select the most appropriate one for the organization's needs.
- The lack of people's participation in the whole process of selecting technology elements that had a negative impact on their feeling of ownership and sharing values with their organization.
- The lack of resources including people and time.
- The lack of top management commitments and support.
- The poor introduction of the new software engineering process that was to be adopted.
- The lack of adequate professional education and training.

Not surprisingly, these factors contributed significantly towards people's negative attitude to the changes and hence led to the termination of the first attempt. Soon after that, champion team with the full authority of senior management decided to launch a new project with significantly increased support:

- Appoint the organization's IT director to lead the champion team for the transition process.
- Commission an outside consulting firm in conjunction with IT personnel to conduct a formal assessment for various technology products for recommendation.
- Allocate enough resources to run adequate and undertake professional education and training.
- Allocate sufficient and dedicated funds and to acquire the technology products when needed.

An OO process, OPEN (Graham *et al.*, 1997), was selected for adoption along with the UML notation for software modeling. All planned education and training sessions were fully funded and a CASE tool plus training was commissioned. On completion, an official launch took place in both Sydney and Canberra in April, 2002 to announce the success of the OO transition. The IT transition process to an object-oriented software development environment to support the new organization's e-business processes was declared a complete success by both senior management and the development teams.

6.4 Case Study and Business Process Reengineering

During the transformation process at the organization under study, the existing business and technology processes relating to their customer support were assessed for major changes to support their new e-business environment. Examples of these processes include customer information maintenance, customer status review and customer support facilities. In addition, a number of new supportive processes were identified and a decision was made to implement them. These new processes include on-line customer communication, customer notification and customer comments and feedback.

Following the organizational strategic plan to change their status from a service-focused to a customer-focused organization, management first recognized the Customer Relationship Management (CRM) core processes likely to be impacted by the e-transformation. They then identified what new business processes would be required. A new secure website was carefully designed and implemented with simple navigation and communication tools. Customers were offered a periodical newsletter to keep them up to date and in continuous contact with the organization. A feedback channel was established for customers to send their comments and concerns straight to the appropriate personnel within the organization. As a result, customers were able to login to a secure web site to view and maintain their own information. Senior management declared the early signs of success by saying "our customers become part of our organization; this is a great achievement of keeping them in continuous active communication with us".

Supply Chain Management (SCM) was the second core process to be engineered due to its significance impact on the e-business trade. As a result of the successful reengineering of the existing SCM, existing customers were offered a number of new efficient facilities to conduct B2C. They are able to browse through

the organization's product catalogues with adequate brief and/or detailed information. With new secured credit cards facilities, customers can place their orders online and make immediate payments. For people who still in a doubt of the Internet security, a special form was designed and uploaded to the web site that can be downloaded by customers to fill in their payment details and then return for processing by fax or ordinary mail services. In addition, customers may revisit the organization's web site to follow up on their orders, check current order status and change any particular details prior to shipment.

Using the capabilities of the Internet and web services, the organization was able to establish a new selling chain through customer request and acquisition. With this, customers may request local and/or international products not in the product catalogues. This new service led to the organization's customer network growing by 18% by the end of the first year. Also, the procurement process has gone through a major update and been reengineered from its traditional nature to an e-procurement process. A new organizational Intranet has been implemented with a secure portal access to all suppliers. These private and government suppliers are able to upload their products directly to the organization's repository using new secure and safe technologies. They are then transformed to an XML format that can be sent to the appropriate reviewers and editors. Reviewers check the received documents for any transmitting errors and editors add value with the title, authors, a brief description and source of supply before they become available for sale. Without doubt, the new e-procurement business process has speeded up the entire process of acquiring products from suppliers all over the world. It has also significantly decreased the time for reviewing and adding value to the raw products to distinguish them from their competitors. The new e-procurement process not only decreased the cost of acquiring and processing their raw products but also, very effectively, enhanced their ability to meet their customer demands.

7. CONCLUSION

More organizations are now realizing that transforming their traditional business processes to e-business is not an option any more; rather, it is mandatory in order to survive and compete in today's global e-market. While, the transformation process to e-business is inevitable, it is considered to be risky and unpredictable. Therefore, substantial attention and precise planning must be well thought-out in advance to ensure a fruitful result. This paper has highlighted the importance of moving organizations to e-business and emphasized the imperative role of the organizational aspects of transformation to e-business. Based on an industrial case study, the three major aspects discussed in this paper were: change management; technology adoption and business process reengineering. We find that by considering these organizational aspects in great detail, the chances of successful transformation to e-business are significantly enhanced.

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E-HOME IN E-SOCIETY
SOME EFFECTS OF THE COMPUTER ON FAMILY LIFE
AND LEISURE TIME
A SYDNEY PERSPECTIVE

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ABSTRACT

As did electricity a century ago, the computer brought about a new power not known before. Without it, the warp and weft of life in our society can hardly sustain. Power, if unleashed, however, easily gives way to overuse and misuse leading to unexpected, undesirable consequences. One of them is a drastic change in home life. Continual and widespread use of the computer at home leaves the family members with little time to maintain a supportive union. Home is becoming a mere space to accommodate isolated individuals submerged in "cyberspace". This paper is an attempt to shed some light on the dark side of what we may call "ehome".[i]

KEYWORDS

ehome, leisure, family, household

1. THE COMPUTER ARRIVED HOME

Having served the factory, office, school and laboratory, perhaps to a saturation level, the computer is now presenting itself as a personal assistant and a revolutionary household appliance. The home is now an enormous lucrative market for computer-based technologies (Mackay, 1995). When appliances such as the radio, telephone, refrigerator, gas stove, television, microwave oven and the like first came out in the market they seemed to be luxuries. Gradually, however, they were adopted by households as indispensable for running everyday home life. The computer was of no exception. Consumerism seems to turns luxuries into necessities. This is what makes capitalism work after all.

If the computer was an item of luxury in the 1980s, it has already established itself as an important component of most contemporary homes; and it is quite affordable. Like electricity, water and gas, information seems a necessary commodity for running the everyday home life. As one may open the tap for water and press a switch for light, one can also switch on the computer and obtain information and numerous online services not available at home before. Shopping, banking, telecommuting, correspondence, gambling and entertainment are a few examples. If the Industrial Revolution made people leave home and go to the factory or the office, the 'Information Revolution' has made them return home (Forester, T., 1990).

One of the early promises of computer advocates was that it would provide the user with more leisure time. As we will see in this paper, households in our Sydney survey believe that by using the computer they more or less save time. When we take a close look into how this saved time is spent, we notice that, if on anything else, it is not spent on family life or outdoor leisure activities. We see less face-to-face

communications and fewer personal interactions between the family members. Although still under the same roof, households are becoming more isolated from each other.

2. HOUSEHOLDS ADOPTED THE COMPUTER

According to Australian Bureau of Statistics (ABS), the household use of the computer and access to the Internet has been dramatically increasing. In 1994 only 23% of Australian households used a computer at home (ABS, 1994). In 2002, it jumped to 66% while 58% of the households had access to the Internet as well. These figures are averages over Australian regional and metropolitan areas.[ii]

Our Sydney survey in September 2003 shows that in 80% of Sydney's homes there was at least one computer and 70% of the households had access to the Internet. The most common place for using the computer was the home where 94% of our participants use their computers three hours everyday on average. The computer can now be found everywhere in the home including the bedroom. The following tables show some interesting figures.

Table 1. Places of computer use

Place Where a Computer Is Used	Percentage	Avg. Hours Per Day
Home	94%	3
Office	49%	5
Schools, Universities, Colleges and Libraries	48%	3
Friends and Relatives Homes	27%	1
Internet Shops	4%	less than 1

Table 2. Number of computers at home

Number of Computers at Home	Percentage
0	20%
1	50%
2	15%
3	10%
4 or more	5%

Table 3. Where the computer is used at home

Where the Computer Is Used at Home	Percentage
Study Room	29%
Laptops (Mobile)	28%
Bed Room	27%
Lounge Room	12%
Sport Room	2%
Dining Room	1.5%
Kitchen and Other Places	0.2%

3. SOME USE IT MORE, SOME USE IT LESS

Gender, level of education, age and occupation still make a significant difference in using the computer. Females use the computer significantly less than males (37% vs 63%). Those less than 30 years of age are more frequent users of the computer. People with college and university degrees have a higher tendency towards using this technology. Students, professionals and business type people use the computer more than those of trade and manual occupations.

Income, however, makes no considerable difference in using the computer. This is of no surprise. If the early mainframe cost millions, occupied a whole floor and needed a team of experts for its operation, a computer today is as small as a notebook and more affordable than many home appliances. People of more than 50 years of age had no exposure to the computer when attended school. This may be a reason why they are less interested to use the computer regularly. It is noticeable that those who use the computer almost constantly everyday at work have less desire to use it at home. Computer professionals and bank tellers are least frequent user of the computer at home.

The fact that females use the computer significantly less than males still remains a mystery. Is it because the computer was originally designed and made mostly by men to be used generally by men? Is it because women demand different types of products, a different touch and a different look as in case of perfume and clothing? Or, is their refusal towards mechanical, emotionless and deterministic machines in feminine nature? We leave answers to these questions to further studies.

4. AN UNORTHODOX TECHNOLOGY AT HOME

For thousands of years the family has played a fundamental building block in all human communities. Home has been a refuge for its members and shaped their principal values. When it comes to radical change, family and society have crucial, mutual influences on each other. How will these changes reshape the human society in the 21st century?

Most of the technological gadgetry brought home by the Industrial Revolution were appliances to automate existing manual tasks and improve household's life. The household saved time and enjoyed the comfort and convenience provided. This saved time, to a large extent, was spent on family leisure activities, which in turn strengthened family relationships (Gilding, 2001). They did not cause any radical change in the way of life at home.

The conventional home appliances such as washing machine and refrigerator could be used by anyone at home with little conflict of interest. Then came radio, telephone and television. These new arrivals could not be able to satisfy every member of the household simultaneously. Conflict of interest started to appear within home life. Individual members of the household wished to watch their own program, listen to their own music, etc. This was the first wave of unexpected changes in family life.

And then the computer, the "little giant" as it was called by one our participants, came home. This is even more unorthodox than any previous home technology. It brought home an enormous innovative power. And we are now facing some of its radical impact on the way home life used to be. Since 1970, the marriage is declined. Young people delayed marriage and having children. They have increasingly entered into de facto relationships. The divorce rate escalated. Sole parent households proliferated. So did other households arrangements, such as stepfamilies and group households. (Gilding, 2001)

5. THE ENIGMA OF TIME SAVING

The message often proclaimed by technology advocates is that technology makes life easier by letting machines do all the hard work while people enjoy a leisurely life. Does the computer really provide householders with more leisure time? To find an answer, we first asked the participants whether they believed by using the computer they saved or lost time. From those who saved time we asked what they did with their saved time. Let us see the results:

Table 4. Saving or losing time by households

Save/lose time by using the computer	Percentage	Hours Per week
Save time	78%	7
Lose time	7%	5
Do not save time	7%	-
Don't know	8%	-

Table 5. How the saved time was used by households

How the saved time was used	Percentage
Computer leisure activities	42%
Reading	12%
Sleeping	11%
Relaxing	10%
House work	8%
Personal affairs	7%
Spend with family	*6%*
Outdoor activities	4%

We cannot deny that by using the computer households believe they save time. But what they do with this time is rather noticeable. First of all, a big chunk of it is used again on the computer. Even if the home computer was used for leisure it was mostly used by *individuals* and often in *isolation*.

A mother of three children complained that her "two teenage sons lock themselves in their rooms right after school, fiddling around with their computers, and indifferent to what's going on in the home. When their father comes home, he does the same. I have to shout a few times to bring them together at the dinner table. Every one gulps his dish down and goes back to his beloved machine. We hardly talk to each other. … One day I'm gonna smash these little monsters."

Surprisingly, very few households (only 6%) show willingness to spend their spare time with their families. Even after the arrival of TV and radio, family members still could get together to watch a favourite program, though with less verbal communications. But the 'personal computer' even allows less "personal communication' and fewer family gatherings.

6. OUTDOOR LEISURE ACTIVITIES REDUCED

Australians have been famous for their passion for outdoor leisure activities. Thanks to its beautiful beaches and bushes. But it appears that this fame may fade out. In the 1980's people in Sydney on average used to spend around 15 hours per week on their outdoor leisure activities (Ranjbar, 1999). Our Sydney survey shows a significant drop to around 9 hours per week in 2003. More careful analysis on frequent computer users' time management reveals that they do significantly less physical exercise indoor or outdoor.

Most of the frequent computer users had less tendency towards going out of the home for any purpose. Among those who claimed that they saved time by using the computer at home, only 4%, the least in the list, spent their saved time on outdoor activities. Frequent computer users also could find little time for social intermingling. They spend more of their home time individually in the front of a computer for all the reasons they have. The youngsters argue they enjoy spending time on their computers more than on the family matters. They believe that they are also left with little time to go out for leisure. Many of our participating parents were worry about loneliness and isolation of their children who are obsessively attached to their computers; the new 'computer addiction'.

7.   A PHOBIA-PHILIA GAP WITHIN THE FAMILY

There is growing concern among social scientists about 'hate and love of technology'. During the last couple of decades, there have been technophobes who committed murder and caused serious destruction supposedly "in opposition to the evil technological invasion". (Rosenberg, 1997)

When the technophobic and technophilic gap widens within the same family, one would wonder how fragile the cohesion of that family could become. An example was a family in which the husband was obsessively "in love with" and overproud of his state-of-the-art computer set up at his home office. His two teenager sons, looking up to him, had their own latest computer systems. His wife, on the other hand, not only had no desire to touch a computer but also hated it.

We asked the participants whether they feel 'love' or 'hatred' or have 'no feeling' towards a few home technologies such as the washing machine, dishwasher, microwave oven, video recorder and the computer. No one hated the washing machine, dishwasher or microwave oven. Almost half of the respondents cited difficulties in programming and operating the video machine but no one stated hatred against it. The only device that 15% of the participants openly referred to as an object of hatred at home was the computer. Most of them were parents who also indicated a sense of fear for the computer. They believed it is a "stupid", "dangerous" "monster" separating their children from them.

8.   CONCLUSION

It is not always possible to foresee all the implications of a new technology until it is adopted by the mass of population and used for a relatively long time. When the automobile was invented, few envisaged the dangerous consequences it might bring about. It was even welcomed, not only as a faster and more convenient mode of transport, but also as an anti-pollution invention! "Roads and streets would be totally clean of dung if people use cars," was a general anticipation. But they could not foresee the ever-increasing air pollution and road accidents. Are we going to see similar analogy for the computer in long run?

As standards and safety measures are undertaken in using water, gas and electricity in the home, similar procedures may be necessary for using the computer. Our study shows that the computer when overused and misused is not all safe and harmless to family life. We hear of adolescents making bombs using instructions from the Internet. Gambling, child pornography, computer addiction and many other online commodities are, in fact, harmful to home life. In the existing home, the household is left with less time to enjoy family life. They can hardly find extra time for physical exercise, socialising and leisure. We should carefully consider these effects before we move into our 'electronic cottages' and 'smart houses'.

If "I think, therefore I am" proves right, we exist and live in a tangible, real society in space and time as conventionally perceived. If we also perceive a new 'reality' in a "virtual world" in a "cyberspace" in which we also like to "live", then we are dual citizens of two totally different worlds. The question facing us is: Are we fit for such a dual life? It is quoted by Aristotle that "we are what we repeatedly do." By nature, we are neither consistently logical nor deterministic. Yet if we repeatedly use a deterministic, mechanical and logical machine, which is unimaginably fast, what will we become?

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[i]) The numerical data for this study are driven from a questionnaire-based survey of 200 anonymous, random households in Sydney metropolitan area in September 2003. This survey was complemented and cross-examined by 50 personal interviews later on.

[ii]) Recent OECD figures for the PC penetration in households put Australia among top ten countries. Apart from the US, Canada, New Zealand and Japan, the rest are European countries. It is, therefore, safe to assume similar results in computer usage among European households.

ADDING CULTURAL VARIABLES TO A WEB PRIVACY ONTOLOGY

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ABSTRACT

Predicting that Web services for privacy will be highly informational in the future, we develop a Web ontology resource to support the organization and useful retrieval of cross-cultural privacy information. We categorize the cultural dimensions that affect privacy internationally, and note the gap between policy and implementation that system designers should consider. Extending a high-level model of a Web privacy ontology, we store these cultural dimensions in an illustrated ontological fragment. The result is a useful component of an online privacy architecture for the future e-society. We implement the privacy ontology using XML and RDF-based ontology tools.

KEYWORDS

Internet applications, Privacy ontology; Semantic web, culture

1. INTRODUCTION

Although none of the venture-backed business models employing technical solutions for functionally private channels for consumers survived the dotcom fallout in 2001 (Hsu, 2003), the future of commercially offered privacy services is still bright. Post mortems reveal fundamental problems with e-privacy business models. From the user perspective, it may be difficult for some to trust the third party provider itself or more specifically the human employees in the TTP. Those e-privacy businesses that used the advertising business model soon found that they could not compete with players such as Yahoo, and other large portals, which could cut the cost of advertising on these sites to unsustainable levels for smaller competitors. Timing and understanding the users in target markets are clearly important factors in introducing these business models to a marketplace.

We speculate that the role of third party providers specializing in privacy may be more informational than functional in the future. In many countries such as the US, Canada, and the European Union, privacy is functionally maintained through secure technical channels usually provided by the user's organization or by the organization that the user is transacting with, and it is articulated through organizations' policies for implementing fair information principles, in accordance with privacy acts or laws. We predict that future

success of third party business models for privacy will be in the provision of information-based privacy Web services targeted for international businesses, global users, and to society in general.

More sophisticated services than are currently available are required to serve the noble goals of many web sites set up to make knowledge available to all. As a sector example, sites such as www.canlli.org, www.austlii.org, and www.law.cornell.edu all share a similar mandate to make legal information available and freely accessible to ordinary citizens. However, a current search on privacy law on these sites is not useful or easily decipherable to most of us. Examples of potential privacy Web services include: easily seeking out useful knowledge about other countries' privacy laws, integrating privacy knowledge from various stakeholders, assessing a country's privacy culture, supporting the discovery of privacy Web services, automating the visualization of privacy information and knowledge according to a range of user profiles, and managing collaborative stakeholder updates to distributed web ontologies containing privacy domain knowledge.

Anticipating both humans and machine agents' use of privacy Web services offered in global privacy architectures, we expect such services will facilitate global awareness and comprehension of privacy regulations in different countries and cultures. Facilitation may be as simple as providing a "hinting" navigation structure for discovering knowledge around a country's privacy principles and identifying any restrictions for both humans and software agents. Agents are not yet as sophisticated as humans are in contextually searching and integrating information distributed over different sources. Their promise lays in our creating new workable methods to provide the ability for agents to infer both in context and in different languages. Their utility is in the vast amounts of material that they can sieve through in inhumanly short time periods. We propose to enhance user and agent context by adding cultural understanding to agents' architectural ontology resources on the semantic Web.

2. CULTURAL VARIABLES AFFECTING PRIVACY

Bennett (1992) proposes five models that describe the privacy governance models in use by most countries' governments, according to who bears primary responsibility for protecting privacy interests: voluntary control (e.g. US), subject control (e.g US), data commissioner model (e.g. Canada), registration (e.g.UK), and licensing (e.g Norway). The bearer(s) of the primary responsibility are either or combinations of data gatherer, data subject, and government. In voluntary control and subject control, the organizations and citizens self-regulate on privacy issues. The data commissioner model uses a privacy ombudsman to help protect citizens' privacy. While the registration and licensing models mean the data gatherers must first register with the government the data stores or databases which contains private data. In registration, the government can deregister a store as a penalty if citizens complain about a privacy infraction. In the licensing model, government employees are tasked to do inspections for compliance.

Framing privacy goals as humanistic, instrumental, and political, Bennett further elucidates why privacy is important to us. From a humanistic viewpoint, privacy is about protecting the dignity, integrity, individuality, or private personality of a citizen. From an instrumental viewpoint, privacy facilitates fairness, integrity, and effectiveness of the decision making process. Politically, privacy is required for voting, secret ballots, freedom of association and opinion, and is a shield from government interference. Culturally, users select either specific or diffuse relationships, and high contact (Egypt, India) or low contact (NA, UK) proxemics to provide privacy boundaries (Trompenaars, 1998). Specific relationships separate work and family life. Such compartmentalization is common in the UK, Britain, and Canada. Diffuse relationships are more common in countries in Southern Europe, such as Spain, and many in South America. Humanistic privacy goals are expected to be more important in a feminine society such as Sweden or Norway where quality of life is an important concern. It is not surprising then that Norway has chosen the strictest government privacy model, the licensing model, to implement. In contrast, governments of masculine and litigious societies, such as the US, select the privacy model with the least regulatory protection, leaving humanistic privacy problems to the courts to resolve. Instrumental privacy goals such as fair decision-making in any context are important to Universalist cultures such as the US. Political privacy claims are highly prized in democracies; some individuals in collectivist cultures, as in China and Japan, value privacy when reflecting views that are different from the political views of a clan or society.

Cultural variables, such as uncertainty avoidance, power distance, masculinity, and individualism (Hofstede, 1997), are expected to affect implementation of privacy regulations in the private sector and indeed on the part of the user. Capturing the important factor of control across cultures and individuals is the Electronic Privacy Information Center definition of privacy protection: "Privacy protection is widely understood as the right of individuals to *control (our emphasis)* the collection, use and dissemination of their personal information that is held by others." Control is understood at an individual level within and across cultures through the internal and external locus of control constructs (Rotter, 1966). Cultural variables will influence the use of, as well as the type of, mechanisms that users will employ to protect their privacy. For example in low power distance countries such as the US and Canada, users may be more willing to investigate applying P3P controls than would high power distance countries such as Thailand and Singapore. The levels of concern the users have around their privacy often reflect the willingness to investigate control mechanisms.

Table 1. Cultural Variables that affect Privacy and their indices for 16 countries

(n/a – not available)

	Power Distance	Individualism	Masculinity	Uncertainty Avoidance	Univers-alist/(U) or Particulist (P)	Specific (S) or Diffuse (D)	Regulatory Model
	0-100	0-100	0-100	0-100	0-100	0-100	1-4
	Small	Collectivist	Feminine	Weak	Context of The Work	Context of Employee performs a	Self-Regulation
	to	to	to	to			to
	Large	Individualist	Masculine	Strong	Contract	Home-task	Licensing
Country	PDI	IDV	MAS	UAI	P/U	D/S	Model
Sweden	31	71	5	29	U - 67	S-91	4
Norway	31	69	8	50	U – n/a	S-80	4
Thailand	64	20	34	64	P – 63	D-69	2
Spain	57	51	42	86	P-61	D-71	3
France	68	71	43	86	P - 56	S-88	3
Israel	13	54	47	81	n/a	S-75	3
Singapore	74	20	48	8	P-48	D-58	1
China	80	20	50	60	P-57	D-32	1
Canada	39	80	52	48	U-66	S-87	2
Argentina	49	46	56	86	P-39	D-52	3
Greece	60	35	57	112	P-56	D-67	3
United States	40	91	62	46	U-57	S-82	1
Germany	35	67	66	65	U-61	S-83	3
United Kingdom	35	89	66	35	U- 60	S-88	3
Mexico	81	30	69	82	P-58	D-70	1
Japan	54	46	95	92	P-64	D-71	1

Hofstede's (1997) cultural theory postulates that "cultures are relatively enduring" and that the values and beliefs of individuals, which arise from specific cultural traits, will greatly influence their behaviors. The body of research utilizing Hofstede's theory of cultural variables has grown extensively over the last two decades and still demonstrates considerable stability over a wide range of applications. Table 1 summarizes the major cultural variables across a representative selection of countries. Using the Privacy Model Framework developed by Bennett (1992) as extended in (Milberg et al, 2000), the table also includes a coding of the latest national privacy regulations where 1 = hybridization of voluntary and subject control (self-regulation), 2 is the data commissioner model etc. This table is indicative of the relationships theorized to exist between cultural variables and their expression as regulatory approaches at the national level.

As an example, the table shows that the Norwegian culture tends to distinguish less between society segments (PDI = 31) in comparison to other nations. Its cultural orientation tends to individualism (IDV = 69), and the culture has a medium level of uncertainty avoidance (UAI = 50). Norway also represents one of the most feminine of the represented nations (MAS = 8), and has a privacy model that is one of the most regulated type (Licensing = 4). Although Greece is moderately masculine, it has the strongest uncertainty avoidance and the strength of its privacy governance model reflects the latter factor. Similar to Greece, is Argentina, in terms of masculinity and high uncertainty avoidance.

While the choice of regulatory approach may be influenced by economic and political variables, empirical evidence suggests that an overall relationship between cultural traits and privacy concerns exists, and that particular cultural variables have greater or lesser degrees of expression within that relationship. Countries with higher levels of concern with rulemaking (Uncertainty Avoidance) may tend to express this through increased government regulation. Countries who emphasis feminine characteristics (Masculinity-Femininity), such as concern for others in society, seem to also seek greater levels of privacy protection for the country. Countries with high levels of specificity in work-home separation also seem to seek more from the government actor in terms of privacy regulation. Anomalous US has recently seen its Federal Trade Commission (FTC) introduce a much-subscribed-to list to protect citizens against telemarketers intruding on their private time; the FTC further recommends examination of the applicability of data commissioner model.

3. MODEL OF THE PRIVACY DOMAIN FOR A WEB ONTOLOGY

Privacy Web services will require a supporting infrastructure containing a domain ontology and knowledge base. We suggest that the onion layer model is representative of the privacy domain whereby each ring represents a privacy layer provided by a tier of governance or an important stakeholder. This model is an important reference point for the development of informational privacy Web services. Table 2 shows a mixture of formal and legal laws and acts, informal and cultural guidelines and standards for the general masses, and specific legislation and guidelines for interest groups. The table intends to capture the different privacy protection mechanisms at various stakeholder layers.

Table 2. Privacy Layers

Mechanism	International (e.g. UN, OECD, WTO)	National/ Federal	Provincial State	Municipal Local	Sectoral (e.g. Health, Finance)	Association (e.g. Business Chambers	Organization	User
Guidelines	X	X	X	X	X	X	X	X
Acts/Laws	X	X	X	X				
Standards	X	X	X	X	X	X	X	X
Policy	X	X	X	X	X	X	X	X
Privacy Champion		X	X	X	X	X	X	
Technology e.g. P3P	X	X	X	X	X	X	X	X
Social contracts						X	X	X

A mixture of Bennett's government privacy models is applicable at different levels of government, and the strength of the privacy protection can differ across levels of government. Reflective of the mixture of models is that some provinces have provincial privacy commissioners, and some do not, instead relying on the federal data commissioner. The US expresses a mixture of voluntary control for corporations, and subject control where citizens can readily take privacy infractions to the courts. Since 1993, the province of Quebec, Canada, had stronger privacy legislation for business than that enacted at federal level; indeed the strongest privacy protection in North America from 1993 until 2001 (when the rest of Canada adopted PIPEDA), was implemented by the francophones in Quebec. Kluckhorn and Strodtbeck's (1961) "activity orientation" culture dimension and/or Hofstede's power distance may partially explain the discrepancy between Quebec and the rest of North America. The "activity orientation" dimension explains that a containing/controlling culture such as France emphasizes pragmatism and logic.

4. INSTANTIATION OF A WEB PRIVACY ONTOLOGY FRAGMENT

It is intuitive that a Web privacy ontology can aid in providing integration services across the privacy layers. Advantages of a Web ontology over standard database approaches for semi-structured data in Web applications lays in the richness of the metadata and the suitability of RDF and languages such as DAML/OIL and OWL in organizing the wealth of Web documents and resources for much more efficient searching.

A formal definition of an ontology in the computer science sense is given in Maedche (2003): "..an ontology refers to an engineering artifact, constituted by a specific vocabulary used to describe a certain reality, plus a set of explicit assumptions regarding the intended meaning of the vocabulary". More formally, Maedche describes an ontology structure as a 5-tuple $O := \{C, R, H^C, rel, A^o\}$ consisting of two disjoint sets C and R whose elements are called concepts and relations respectively, a concept hierarchy or taxonomy, a function rel that relates concepts non-taxonomically, and a set of ontology axioms, A^o, representing facts. A lexicon for an ontology structure is defined as a 4-tuple $L := \{L^R, L^c, F, G\}$ consisting of two sets L^R and L^C whose elements are referred to as lexical entries for concepts and relations, respectively. F and G are two relations that are references for concepts and relations respectively.

In Figure 1, we illustrate a small fragment of our privacy ontology. Assume $C = \{c1, c2, c3, c4, c5, c6, c7, c8, c9, c10, c11, c12, c13, cL, cM, cN\}$ and $R = \{r1, r2\}$ and $H^C = ((c5, c4), (c6, c4), (c8,c7), (c9,c8), (c10, c8), (c11, c8), (c12, c10), (c12, c11), (c10, c8), (cN, c8), (cM, c8), (c14, c8), (c13, c8), (c13, cL))$. A partial lexicon for privacy concepts and relations are given as $L^C = \{$"personally identifiable information", "data gatherer", "Privacy act ", "data subject", "privacy principle", "remedy"$\}$ and $L^R = \{$"collects", "notifies"$\}$. Some mappings for F and G are as follows. F (Personally Identifiable Information) = c1, F(data gatherer) = c2, and F(data subject) =c3, F(privacy act) = c4, F(privacy principle) = c5, F(Remedy) = c6, G(collects) = r1, and G(notifies) = r2.

The fragment in Figure 1 is tiny. Other important concepts to privacy regulation include applicability, jurisdiction, commercial activity, consent, statute section and so on. The development of a global, distributed Web privacy ontology requires many international working groups in the various countries. Domain experts are particularly important even as tools such as OntoExtract/Corporum (www.cognit.no) enable semi-automatic identification of concepts and relationships by using law text documents as input.

Privacy ontology stakeholders include governments, users, legal experts, organizations, associations, communities, and societies. Local ontology fragments may be very useful in powering sites such as that of the Privacy Commissioner of Canada, www.privcom.gc.ca, say. This site has hundreds of privacy issues findings since the Office's inception in 1983. Most searches are sequential and time consuming through the finding documents. We anticipate the use of agents' services in accessing fragments of Web privacy ontologies (that organizes, findings for example, according to concepts and relations), refining searches, and generating automatically formatted documents containing useful results.

Figure 1. Subset of a Privacy Web Ontology showing Privacy Culture Variables

5. IMPLEMENTATION

OntoEdit (Fensel et al, 2000) provides an ontology-engineering environment that allows users to create, browse, and modify an ontology using a GUI interface. OntoEdit (www.ontoprise.de/products/ontoedit) supports the W3C standards, and offers a multifunctional export interface to many major ontology representation languages including RDF and DAML+OIL. Using OntoEdit to represent the web privacy ontology described in this paper, currently implies storing the ontology in Sesame, an RDF database that stores semantic information about objects in the form of triplets. To create the privacy ontology we follow software engineering and ontology engineering guidelines, for instance as those presented in Noy and McGuinness (2001). We successively identify and enter into the ontology important classes, defined properties of classes, class hierarchies, and instances. Following this we define relationships between main concepts.

To determine the important concepts, we examine pertinent documents for regulatory and cultural privacy terms that the user might like to have explained. Certainly, *Privacy Law* should be one of the concepts for future support of other countries' laws or even different provincial/state privacy laws. Usually every privacy law defines the circumstances under which the law applies, when the law is coming into force, and what the purpose of the law is. When doing business on the Internet, the user would like to know which privacy law can be applied to the location where the service site is at, or which law applies to the country the consumer resides in, so that the *Jurisdiction* is another term in our ontology. The ontology fragment in Figure 1 is directly implemented as shown in Figure 2. A special *P3P_tags* class, also illustrated in Figure 2, references P3P tags and international fair information and privacy principles as shown in Figure 2. The P3P tags facilitate a common privacy vocabulary among agents and should be included in any privacy ontology. It is also useful to embed the tags in concept and property definitions.

To find whether a certain P3P tag matches a legal privacy concern and to which detailed legal items, user agents can use the following query:

select Q, B, Y, A ,Z

from {Q} ns3:Matchs_principles {Y}, {X} ns3:Match_concern {Y}, {X} ns3:Is {Z}, {X}
ns3:Defined_in_section {A}, {X} ns3:Defined_in_privacy_law {B}
    where Q like "http://newOnto.org/f8643283ab#_opt-in_"
    and B like "http://newOnto.org/f8643283ab#PIPEDA"
    using namespace ns3 = http://newOnto.org/f8643283ab

Figure 2. Web Privacy Ontology implemented using OntoEdit

Because many cultural variables have index values associated with them (e.g. the popular Hofstede's indices), the k-means based clustering algorithm may be used to create culturally similar groups of agents, and implemented in systems such as ACORN (Marsh et al, 2003). Specifically to the privacy domain, we can create groups of agents that represent users sharing similar privacy concerns, or more useful in the commercial world, groups of user and service site agents where respect of privacy concerns match. An extension of this idea would be the computation of privacy match indexes through simple parsing and comparison of P3P-based privacy policy statements and agent-loaded user P3P privacy preferences to use as input to a clustering algorithm for identifying user and service site groups.

6. CONCLUSION

Strengthening the user perception of privacy and trust on the Internet will require user-focused technological, legal, and social approaches, and multiple stakeholder support, including from governments, business, associations, and communities. Internationalising the Web requires understanding different cultures at multiple levels, while recognizing established cultural gaps between policy and implementation. Major international privacy projects are the P3P platform (P3P, (2004), JRCArchitecture (2004)) and PRONTO (JRC, 2004). Adoption studies for P3P are promising (Bayers et al, 2003, Cranor 2003) and applications built on architectural components that use P3P as a foundation are likely to grow. We incorporate P3P concepts and definitions within a Web privacy ontology that has also been extended to include cultural variables for privacy. We expect future Web services for business and society will find this Web privacy ontology resource to be useful as a evolving reference source for privacy knowledge.

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GENERIC XFORMS-BASED USER INTERFACE GENERATION FOR XML SCHEMA

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ABSTRACT

Applications that use XML-formatted documents to store and exchange data are ubiquitous. The structure of these XML documents is usually well defined in XML Schema documents. Rather than first having to create an XML document and afterwards validate it, it would be feasible to generate a user interface based on an XML Schema document using an XSLT style sheet that eventually results in a valid XML document. In this paper we describe how XForms can be used for this purpose. Nevertheless, some interoperatibility conflicts occur during this transformation. They are discussed in detail in this paper and an extension of the XForms standard that will allow us to overcome these interoperatibility conflicts is defined. These extensions make it possible to change the structure of an XForms instance document at runtime and allow us to transform any XML Schema into an XForms web interface. Many applications - both online and offline - would benefit from this proposed extension.

KEYWORDS

XForms, User interface, XML Schema.

1. INTRODUCTION

On October 14th, 2003, the XForms recommendation was published by the World Wide Web Consortium (W3C) (Dubinko, 2003). XForms, based on Extensible Markup Language (XML) (Bray, 2000), is intended to make Web forms reusable on PC's, handhelds, cellular phones and other systems. Web forms are an easy way to let visitors of a website interact with an underlying web applications such as e-banking, hotel reservation, web mail, etc.

Traditional HTML forms are becoming outdated: they don't support XML; common tasks dependent on scripting; they are device dependent, etc. XForms is introduced to meet these shortcomings of HTML forms: XForms is an XML vocabulary; XForms Actions and XForms Events define built-in common tasks; XForms is fully device independent. The fact that XForms uses XML instance documents to submit its form data instead of name-value pairs as used in HTML forms, is an important advantage of XForms' way of form serialization because more and more applications use XML formatted documents to store and exchange data. The structure of these XML documents is usually well defined in XML Schema documents. Rather than developing a specific user interface for every imaginable application which uses XML as underlying data storage format, it would be feasible to construct a generic transformation that will generate such a user interface based on an XML Schema description. This way user interfaces can easily be generated for every XML Schema document.

In our set-up XForms will be used to construct the user interface. This approach does not require any prior knowledge of XML neither of XML Schema. Another advantage of this method is that the resulting application is web based and therefore can be used on every XForms compliant browser. Furthermore any data editing can be done in a decentralized manner while the submitted data can be stored on one single server. In this paper we will describe how XML Schema documents can be transformed into XForms documents using an XSL Transformations style sheet (Clark, 1999). The use of XML Schema is explicitly supported by the XForms model as well as by XForms' built-in data types. This functionality is used to validate the XForms instance against the supplied schema(s).

Other tools that can generate user interfaces based on XML Schema already exist, for example Microsoft InfoPath™ and Xintegra Arquemie™. We noticed that these tools encounter the same difficulties when transforming XML Schema to a user interface. In contrast to our working method, these tools are not able to handle generic XML Schema documents, therefore user interaction is required. In the next section we will outline the two main parts of an XForms document. The third and fourth section will give more detailed information about our approach and the difficulties of this working method. Possible solutions are described in the fifth section where we define some feasible extensions to the XForms functionality that will cover all of the observed shortcomings. In the final section we formulate our conclusions.

2. XFORMS DOCUMENT STRUCTURE

The original idea behind the development of XForms was to create more dynamic web forms. XForms documents should be faster, easier to create and they should contain extra functionality compared to traditional HTML forms. Complex e-business applications would derive benefit from this new technology. It soon became clear that XForms also could be used for creating and editing XML documents.

The XForms specification defines a set of predefined elements and attributes and their semantics in the XForms namespace. XForms is an XML application that requires another XML vocabulary to be embedded in. In this paper XHTML will be used as such a host language. Unlike traditional HTML forms, XForms separates the logic (model) and the visualization of the form. Therefore an XForms document consists of two main parts, one part describing the model of the XForms document and the other part describing the form controls. A simple example of an XForms document is given in Listing 1.

Listing 1. A simple XForms document

```
<html>
  <head>
    <xfm:model id="name_model" schema="name.xsd">
      <xfm:instance><Name/></xfm:instance>
      <xfm:submission method="post" action="http://foo.bar.com" id="submitName"/>
    </xfm:model>
  </head>
  <body>
    <xfm:input ref="/Name" model="name_model">
      <xfm:hint>Enter your name here</xfm:hint>
      <xfm:label>Enter your name:</xfm:label>
    </xfm:input>
    <xfm:submit submission="submitName">
      <xfm:hint>Click to submit</xfm:hint>
      <xfm:label>Submit</xfm:label>
    </xfm:submit>
  </body>
</html>
```

In the XForms model, zero or more XForms instances can be defined. These instances can be declared inline or via externally defined initial instance data. When an XML Schema document (further called: schema) is supplied, these XForms instances should validate against that schema before submission. In Listing 1 the instance of model `name_model` is declared inline; a URI of a schema is provided.

In the model, optional `bind` elements may be declared. These `bind` elements contain model item properties. A model item property describes a characteristic of each node of the XForms instance on which it operates. That node-set is denoted with a model binding expression using the `nodeset` attribute. A model

binding expression is an XPath LocationPath expression that denotes a node or node-set. Furthermore model item properties will be applied on every node in the selected node-set. Those model item properties will enforce those nodes to fulfill several conditions. These conditions can describe the relevance of a node, predicates, the necessity (required or not), write permissions, a calculated value (based on the values of other nodes). Finally, the submission element specifies which part of the XForms instance data should be serialized and how that should be done. In contrast with traditional HTML forms, it is not necessary to submit all data provided by the user. Several submission elements can be provided, in this way different parts of the XForms instance can be submitted in several ways e.g. depending on user input. When embedding in XHTML, the model should be declared within the XHTML HEAD element.

The form controls defined in the XForms recommendation determine the interface towards the user. Using these controls, the user can supply data for the underlying XForms instance. Form controls can also be used to change the data and the structure – to a certain extent – of that XForms instance. Each form control should be bound to an XForms instance node declared in the model. Markup elements are used to declare form controls. Their appearance and behavior is described by attributes. The semantics of those markup elements are well defined, how they will be visualized depends on the XForms processor in use. This separation allows different rendering types for the same markup element on different platforms and devices. When embedding in XHTML, the form controls should be described within the BODY element.

3. MATERIALS AND METHODS

In our set-up an XSL Transformations style sheet is used to generate an XForms document based on a supplied XML Schema document in a generic manner. As stated in the previous section, an XForms document consists of a model and a user interface. Therefore the supplied schema will be traversed twice; once for the generation of the initial XForms instance data and once for the creation of the XForms form controls. In Listing 2, this concept in outlined in the hosting XHTML document. If an XML Schema is supplied with the XForms instance, the XForms processor will always make sure that the XForms instance is valid. Note that in our examples we use different namespace prefixes to denote the vocabulary the elements are part of. In Table 1 all prefixes used in this paper are listed.

Listing 2. General layout of a typical XForms document embedded in an XHTML Document

```
<html xmlns="http://www.w3.org/1999/xhtml"
xmlns:xfm="http://www.w3.org/2002/xforms">
  <head>
    <xfm:model id="my_model">
      <xsl:apply-templates mode="model"/>
    </xfm:model>
  </head>
  <body>
    <xsl:apply-templates mode="form"/>
  </body>
</html>
```

Table 1. Prefixes used in this paper and their vocabulary

prefix	namespace	technology
none	http://www.w3.org/1999/xhtml	XHTML
xfm	http://www.w3.org/2002/xforms	XForms
xsl	http://www.w3.org/1999/XSL/Transform	XSL Transformations
xsi	http://www.w3.org/2001/XMLSchema-instance	XML Schema namespace for instances

3.1 Generation of the Initial XForms Instance

Because the initial XForms instance is not known at the start, it will be generated during the first pass of our XSLT style sheet. The XForms instance will be declared inline and if necessary, filled with default or fixed data provided by the XML Schema document. Special attributes stipulating occurrence constraints, datatypes and general behavior are taken into account.

The root element of the XForms instance will be a globally declared element of the schema. A globally declared element is an element that is declared as direct child of the schema tag. When more than one element in an XML Schema document is globally declared, they can all be root element of the resulting instance. In XML Schema it is not possible to mark such a global element to be the root element of the instance. Here a first difficulty is encountered: many elements may be declared global. The end user must choose which element will be the root element of the XForms instance (see subsection 4.1.2).

According to the XML Schema specifications, elements can be declared inline, by reference or by type. These three types of declaration can also be combined. With inline declared elements all child elements and attributes are declared locally. They are traversed hierarchically in order to construct the XForms instance. When an element is declared by reference, the global element with that name will be matched. The last possibility is to declare an element by type. In that case a `complexType` or `simpleType` with that name must exist as child of the schema root element.

When an element is declared by reference or by type the appropriate templates will have to be applied by specifying the name of the element or type respectively. In case of inline declaration, templates matching the child nodes can be applied without further constraints. Doing so, the whole instance tree can be build up.

XML Schema allows us to specify the cardinality of nodes. When generating the XForms instance we only look at the `minOccurs` attribute because the XForms specification allows us to insert multiple nodes in a homogeneous collection at runtime. A homogeneous collection is a collection consisting of data items having the same type and structure. This functionality will be used when form controls for these elements are created. In the XForms instance we insert `minOccurs` nodes with a minimum of 1, more nodes can be added (to a maximum of `maxOccurs`) using form controls.

In XML Schema one can assign default or fixed values to elements and attributes by using the default or fixed attribute respectively. These attributes are mutually exclusive, and so it is an error for a declaration to contain both fixed and default attributes. The values denoted by these attributes will be filled in immediately in the XForms instance.

In contrast with traditional HTML forms where one can set a default value using the `value` attribute in the `input` form control, the initial data has already been set in the XForms instance and will be automatically displayed in the form control. This is due to the regulation that the value of a form control must be consistent with the XForms instance node it is bound with, at any time. In XML Schema a value for an element or an attribute can be declared as fixed; this means that no other values for that element or attribute are valid. In our implementation the `output` form control rather than the `input` form control is chosen to visualize this, simply because the data of an `output` form control can't be modified by the end user.

3.2 Building up the User Interface

As XForms does not describe how form controls must look like, it is up to the XForms processor in use to decide how they will be visualized. Combined with well designed Cascading Style Sheets, intuitive forms can be generated. In our XSLT style sheet we mainly used the XForms `input` element because this form control allows the user to enter data. When we need to add/remove nodes to/from homogeneous collections we use XForms `repeat` functionality in combination with XForms Actions. XForms Actions is a set of predefined elements based on the XML Events framework (Pemberton, 2003). These actions describe how nodes and values of the XForms instance can be modified, refreshed, reloaded, sent and so on. They also describe some extra interaction possibilities of XForms documents such as dynamic loading of XForms instance data, notification methods using messages, etc. XForms Actions is meant to replace the basic scripting tasks performed by common client side scripting languages such as JavaScript and VBscript. To generate the user interface, an analogue scenario such as that of the model is used.

First the declaration type of the first element is determined (See also 3.1). In case of a referenced element the template will be applied again on that globally declared element. In case of an inline declared element we advance to the type declaration. Finally, in case of a type declaration the appropriate template must be applied on that type declaration.

When a leaf node in our XForms instance is reached, the end user should be provided with an `input` element. This way the user can enter the value for that node. The `ref` attribute of a form control contains a binding expression. A binding expression connects an instance data node to a form control. The form control is then labeled with the name of that element. We used the optional XForms `hint` element of the form control to display the also optional XML Schema `annotation/documentation` value of that node.

Some XML Schema `simpleType` declarations can be transformed in form controls other than the `input` form control. For instance, when the possible values of a `simpleType` are enumerated, this can be transformed into a `select1` form control forcing the user to pick one of the proposed options, comparable with radio buttons in traditional HTML forms. An example is given in Figure 1.

Special care should be taken when a `nillable` attribute is detetected in a schema. When the value of that attribute is `true` no data should be entered for that node in the XForms instance because its value will be ignored anyhow. To allow the user to specify if that node's value is nil, XForms' `select1` element is used in combination with the `switch` element. The choice made in the `select1` element will activate a `case` element in the `switch` node. Figure 1 illustrates this for an element named `Marital_Status`. The top image illustrates the layout when the value of the `nil` attribute is false; the image at the bottom illustrates the opposite.

Figure 1. Visualization of the use of the nil attribute

Some elements can appear more than once in the XForms instance. The values of the attributes `minOccurs` and `maxOccurs` in XML Schema determine what possible cardinalities are valid.

By making use of the `insert` and `delete` elements in combination with XForms Actions it is possible to add items to or remove items from the homogeneous collection. To do this the node-set containing this homogeneous collection will have to be determined. A repeat node is than declared based on that node-set. An `id` for the repeat element has also been specified in order to be able to identify the node-set to which the items will be added or removed.

Attributes can be declared to appear once or not at all. In particular, the use attribute indicates whether the attribute is required, optional, or prohibited. The case where the attribute is required or prohibited is easily implemented, simply by adding or not adding the particular attribute to the element. An optional attribute can not be handled the way the `nillable` attribute (see Figure 1) has been handled. It is not possible to add or remove attributes from an element at runtime. When the value of an element is declared nil, it will simply be ignored. The value of an attribute can not be declared as nil. This means that an attribute with no value that is present in the element nevertheless has a value: an empty value, which is an important semantical difference.

4. DIFFICULTIES OF THIS WORKING METHOD

Using just one XSLT style sheet limits the possibilities of this working method. For example before we start parsing the XML Schema document, we have no knowledge about the final structure of the instance. Choices must be made during the parsing process without interaction of the end user. This limitation results in reduced functionality of this working method.

4.1 Deterministic Nature of the XForms Instance

A single schema typically can validate many instance documents; this is due to the non-deterministic character of XML Schema. Several XML Schema structures imply this behavior, e.g.:

- Occurrence constraints allowing us to have several elements of the same type or element groups having the same parent;
- Use of optional elements and attributes;
- Use of `choice` and `all` for declaration of the content models;
- Use of global elements.

In contrast to this XML Schema flexibility, the instance of an XForms document must be deterministic. This implies that the whole structure of the XForms instance must be known and at runtime no elements or attributes can be added or removed excluding these of *homogeneous collections*.

As we will explain in the following sections, this deterministic nature has a major impact on the functionality and the complexity of automatic generation of XForms documents based on XML Schema documents using a single XSLT style sheet in a generic manner.

4.1.1 Use of Choice

The `choice` group element allows only one of its children to appear in the instance document. Because there is no interaction with the end user at initialization time we can not add any of the child elements to the XForms instance. The user should choose which element should be added. Again, adding or removing elements from the XForms instance at run time is only possible when they are an item in a homogeneous collection. This is clearly not the case for the `choice` element. Therefore we can not use that functionality.

In XForms, `bind` elements can be used to mark nodes as not relevant. Non-relevant nodes will not be serialized. So for example if all possible child elements from a `choice` element group are added, it is possible to *virtually* remove a node from the XForms instance by changing the `relevant` attribute in the corresponding `bind` element. We need to create a new element which will contain both the instance document and the choice made by the end user. An important disadvantage is the increase of the complexity of the XForms instance because for every `choice` element in the schema there must be a new element added to the root element which will contain the choice of the end user. Also extra `bind` elements must be declared in order to be able to change the `relevant` property of the possible elements of the choice.

4.1.2 Globally Declared Elements

Global elements and attributes are declared as children of the `schema` element. These globally declared schema components can be referenced by other elements using the `ref` attribute. A referenced element appears in the instance document in the context of the referencing declaration. Globally declared elements can also appear as root of the instance document. This particular functionality is another difficulty when converting to a user interface. As stated in the section above, using one style sheet to generate an XForms document does not allows us to interact with the end user at the time of the creation of the XForms instance. Therefore it can not be decided which of the globally declared elements will be the final root element of the instance. This means that the end user must be able to choose at runtime.

This problem looks similar to the one described in the previous section, but there is a major difference. In case of a `choice` there is an element that contains the element chosen by the end user, while in case of globally declared elements there isn't because one of the globally declared elements can be the root of the XForms instance itself. We need to create a new root element containing globally declared elements. For every child node of that newly created element a specific `submission` element must be declared. When the form is eventually submitted only the correct child node will be serialized. The problem with globally

declared elements can also be implemented using different XForms instances in the model. This means that all possible structures of the XForms instance to be serialized must be present in the XForms document.

4.1.3 Consequences

If we have a simple schema with four globally declared elements and two of these elements have a choice element group we need to have four XForms instances and just as much `bind` elements. In case all elements are globally declared this will result in $\sum_{i=0}^{n} x_i$ possible instances, where n is the number of globally declared elements and x_i is the number of elements in choice group of element i. This value is an upper boundary for the possible number of XForms instances. Another disadvantage of this described solution is the need of an extra pass over the schema in order to construct `bind` elements for all critical sections. It is clear that this "work around" will work for relatively simple schemas but it is not suitable for large XML Schema documents.

4.1.4 Infinite Nesting

When a child element has the same type as one of its ancestors, it is a recursive structure. If none of the elements in this structure have declared `minOccurs` to be `0` it is even an infinite recursive nested structure which is illegal. The same problem is encountered when an XForms instance of such a schema must automatically be generated in a generic way. Nodes can only be added or removed at runtime when they are in a homogeneous collection. In order to add or remove an item out of such a collection at least one such item must be present at initialization time. This implies that if the value of the `minOccurs` attribute is `0`, it must be ignored otherwise it is not possible to determine the structure of possible child elements. It is impossible to determine whether a given node will result in infinite nesting. When our XSLT style sheet is provided with such a schema we eventually get a *stack overflow* because the XSLT engine will get into an infinite loop while constructing the XForms instance.

4.2 Mixed Content

In general, schemas are characterized as elements containing subelements in which data only appears at the leaf elements. When the value of the optional `mixed` attribute is set to `true`, it is possible to interleave data with subelements for a given element. This also means that data can appear at higher elements than leaf elements. If we want to generate an XForms document that can handle this functionality we will have to add `input` form controls between every two consecutive subelements of that particular element. Although this is perfectly possible it will overload the resulting XForms document and is therefore not implemented.

5. EXTENDING XFORMS' FUNCTIONALITY

As stated in the sections above, the deterministic behavior of the XForms instance does not allow the end user to fully change the structure of that instance. A possible solution might be to scan the XML Schema document first for critical sections such as `choice` elements, optional attributes, global elements, etc. The next step would be to ask the end user for each critical section what to do. This data can than be supplied to the next style sheet using parameters (`xsl:param`). The advantage of this method is that the resulting XForms instance will exactly correspond with the instance in the mind of the user. An important disadvantage is reduced transparency and the fact that the end user must have prior knowledge of XML Schema and the concepts behind XForms.

Content-adaptive form processing applications are applications where one has to answer questions based on previous supplied answers. These applications are widespread both online and offline: assurance claim forms, medical registrations, hotel reservations, statistical surveys that have complex skip patterns involved, etc. If for instance in such a form one says his gender is man, any questions regarding pregnancy are not appropriate. The examples above states clear that there is a need for content-adaptive functionality in today's forms. XForms has limited support for this functionality by changing the `relevant` property of a node-set using `bind` elements in the model. Although this XForms feature will cover a lot of content-adaptive forms, it will however not do for all such applications possible. In this section we will propose extensions for

XForms which will allow all content-adaptive forms to be processed. These extensions will solve all the problems raised in this paper.

5.1.1 Precise Description of the Missing Functionality

In XForms we can not freely modify the structure of the XForms instance. In order to add nodes to or remove nodes from the instance they must be part of a homogeneous collection. This means that a node-set must be referenced within an XForms `repeat` module. Nodes in a homogeneous collection are called items. All items in a homogeneous collection must have the same structure, name and namespace.

Nodes can be virtually removed by setting its `relevant` property to false. Therefore they must be present in the XForms instance. Although this functionality allows us to manipulate the XForms instance at an abstract level, it is still impossible to duplicate `all`, `sequence` or `choice` content groups because they are not part of a homogeneous collection; they are a set or sequence of nodes rather than a node-set.

5.2.2 Proposed Extension

This paper illustrates that there is a need to be able to add, remove and manipulate individual nodes and attributes at runtime. This will allow any XForms developer to dynamically modify the instance of his application at runtime. To achieve this goal, XForms functionality can be extended using following actions:

`addElement:` Has the following attributes:
- *Single-Node Binding Attributes* as described in (Dubinko, 2003).
- `name`: Name of the element to be added.
- `position`: Required XPath expression that evaluates to a 1-based offset into the sequence.

`addAttribute:` Has the following attributes:
- *Single-Node Binding Attributes* as described in (Dubinko, 2003).
- `name`: Name of the attribute to be added.

`removeElement:` Has the following attribute:
- *Single-Node Binding Attributes* as described in (Dubinko, 2003).

`removeAttribute:` Has the following attribute:
- *Single-Node Binding Attributes* as described in (Dubinko, 2003).

The `addAttribute` and `removeAttribute` can be used to solve the problem of optional attributes described in section 3.2. The `addElement` and `removeElement` can be used to duplicate `all`, `sequence` or `choice` content groups. Recursive nested elements don't need to be present in the XForms instance anymore at the initialization of the XForms document, they now can be created or removed when necessary. This will allow us to generate every imaginable form that will validate against the provided XML Schema. This extra functionality is necessary in order to generate forms automatically. The produced forms can then be used *as is*, or used as a starting point for further refinement of the form.

Recently, W3C has published the requirements for XForms 1.1 (Boyer, 2004). In this document the above mentioned missing functionality has also been observed.

6. CONCLUSIONS

XML is an excellent vocabulary for the storage and exchange of data. Nowadays, specialized tools are used to edit these XML documents. Often, the structure of XML documents is well defined in XML Schema documents. As we have described in this paper, it is feasible that user interfaces automatically can be generated based on XML Schema documents. In this paper we use XForms to construct the user interface. The use of XForms has several advantages: it is web based, device independent and has native support for XML Schema documents. We used an XSL Transformations style sheet to generate an XForms document based on a schema in a generic manner. We described how the several difficulties we encountered can be tackled. The limitations on the flexibility of the XForms instance do not allow us to transform all possible schemas. These limitations reside in the deterministic character of the structure of the XForms instance. Furthermore we presented an extension to XForms' functionality that will handle the deterministic character of XForms' instance documents. Many online and offline applications such as online surveys, hotel reservations and order placements would benefit from this new feature.

ACKNOWLEDGMENTS

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TOWARDS COMPLETE MAPPING BETWEEN XML/XQUERY AND UML/OCL

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ABSTRACT

The Unified Modeling Language (UML) is extended to model web applications. Meanwhile, Web technology becomes heavily relies on XML documents. The structure of XML documents, namely the XML Schema or Document Type Definition (DTD) for these documents can be modeled using UML data structures. UML tools are usually concerned with the generation of the structure and behavior of the system that is captured by models in their equivalents in the selected platform. In this paper we introduce a novel approach for the integration between UML and XML families of technologies. We model the structure of XML using UML class diagrams and based on this, we study how queries for XML documents, namely XQuery expressions can be described using UML techniques. We show that modeling of XML documents and its queries represented by XQuery expressions is possible using the querying capabilities of UML Class diagram and the Object Constraint Language (OCL). As a result, we see how these two technologies compare, what the advantages of both technologies are and how they can be combined.

KEYWORDS

XML – XQuery – UML – OCL – Interoperability

1. INTRODUCTION

The eXtensible Markup Language XML [6] is rapidly becoming the standard format to exchange structured data over the web. Since XML documents is viewed as a source of storing and exchanging information in XML format, it is logical to pose queries against that XML documents[1]. XQuery is the current W3C standard language for querying XML documents. At the same time, the Unified Modeling Language UML [20] is the OMG's standard language for object oriented analysis and design. UML defines modelling languages that span a range from functional requirements and activity workflow models to class structure design and component diagrams. These models, and the development process that uses them, improve and simplify communication among an application's many diverse stakeholders. Class diagram is a UML diagram that shows the static structure of the domain abstraction (classes) of the described model. It shows the attributes, operations and the constraints of each class in the model. XML Schemas are static by nature so the most appropriate UML diagram to express them is the class diagram. A UML class diagram is very suitable to be used as a tool for visual representation of the elements, relationships, and constraints of an XML vocabulary. Class diagrams allow complex XML vocabularies to be understood by non-technical business stakeholders. There was a lot of work done in this area to introduce different approaches for graphically and visually representing XML document structure in the form of DTD or XML Schema using UML Class diagram and other different models [13][14]. Although UML sustain many aspects of software engineering, it does not provide explicit facility for writing queries. UML provides a textual Object Constraint Language OCL which can be used to express detailed aspects about the modelled system. OCL [16] was originally designed for expressing constraints on a UML Model. However its ability to navigate through the model types has lead to attempts for using it as a query language [15]. We believe that OCL can play for UML the same role which XQuery plays for XML. There are many similarities between OCL and XQuery which motivates us that both of them can play the same role in its world. We also believe that achieving such

mapping between XQuery and OCL will open a new direction for using UML and OCL for modeling web applications. Based on this, in this paper, we propose a novel approach for integrating XML and UML families of technologies. Figure 1 shows our proposed framework for the integration between UML/OCL and XML/XQuery. Our integration proposal is based on the idea that, each XML document is an instance of XML schema. Each XML schema can be graphically modelled using UML class diagram notations. Queries over the XML document usually represented using XQuery language and our target is to find a complete mapping schema that enable us to represent each query expressed by XQuery language as an OCL expression over the UML class diagram. Achieving this target is out of scope of this paper as in this paper, we only introduce our proposal and show the possibility of this mapping as according to our knowledge, there is no work had been done in this point of research before. We also show that the current capabilities of OCL can cover and satisfy most of the XQuery expressions which motivates us to continue in building our complete mapping scheme. The paper proceeds as follows. In section 2, we briefly give an overview of XQuery and OCL. In section 3, we show the similarities between XQuery and OCL which motivated us for such mapping and integration framework. In section 4 we represent our case study and our idea for the possibility of representing XQuery expressions using OCL. Finally, in section 5, we conclude the paper and outline issues for further research.
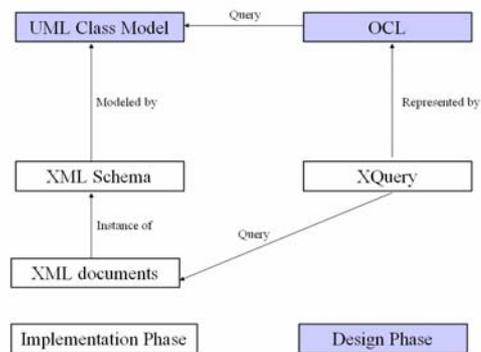
Figure 1. UML/OCL, XML/XQuery mapping framework

2. BACKGROUND: XQUERY AND OCL

2.1 XML QUERY LANGUAGE: XQUERY

Since XML documents is viewed as a source of storing and exchanging information in XML format, so it is logical to pose queries against that XML documents. This is the basic reason why a query language for XML data is extremely important. The World Wide Web Consortium (W3C) provides two textual languages to formulate XML queries and express document transformations, XQuery and XSLT. XQuery is designed to be a language in which queries are concise and easily understood, and to be flexible enough to query a broad spectrum of information sources, including both databases and documents[1] [3]. XQuery is defined in terms of XQuery1.0 and XPath 2.0 data model. The Query data model [9] represents XML data in the form of nodes and values, which serve as the operands and results of the XQuery operators. XQuery is closed under the Query data model, which means that the result of any valid XQuery expression can be represented in this model. In the Query data model, every value is an ordered sequence of zero or more items. An item can be either an atomic value or a node. An atomic value has a type, which is one of the atomic types defined by XML Schema or is derived from one of these types by restriction. A node is one of the seven kinds of node defined by XPath, called document, element, attribute, text, comment, processing instruction, and namespace nodes. Nodes have identity, and an ordering called document order is defined among all the nodes that are in scope. XQuery is a functional language and instead of executing commands as procedural languages do,

every query is an expression to be evaluated, and expressions can be combines quite flexibly with other expressions to create new expressions so the basic building block of XQuery is the expressions [1]. In XQuery, Several types of expressions are possible: *Primary expressions, Path expressions, Sequence expressions, Arithmetic expressions, logical expressions, Comparison expressions, Conditional expressions, Quantified expressions, FLOWR expressions, Element Construction expressions, Validate expressions and Unordered expressions.* We will present all these types of expressions with more details in section 4.

2.2 OBJECT CONSTARINT LANGUAGE (OCL)

The Object Constraint Language (OCL) [16] is a textual specification language, designed especially for the use in the context of diagrammatic specification languages such as UML.OCL was always used to add well-formedness rules on both the model and metamodel levels within UML. OCL is tightly connected to UML diagrams, as it is used as textual addendum within the diagrams, e.g. to define pre- and post-conditions, invariants, transition guards. OCL also uses the elements defined in the UML diagrams, such as classes, methods (side effect free) and attributes. The language is based on types. Each OCL expression evaluates to a type either predefined by the language or defined by the model on which the expression is built. Composing an expression comes out through the concept of navigation. Navigation in OO modeling means to follow links from one object to locate other object(s). Navigation in OCL is one of the following forms [16] [19]:

- **Navigating from an object to a property**

   An example of this is accessing the value of an object's attribute or method like
   ```
   context Person inv:
   Self.age > 25.
   ```
   The size of the result in this type of navigation is always of maximum 1.

- **Navigating from type to type**

   This happens when the expression moves from one object type to another through associations. For example
   ```
   context NaturalPerson inv:
   Self.address->size > 0.
   ```
   In this expression we started at the type represented by the variable self which is NaturaPerson, through the "." a navigation through the association took place and the result of the expression at this moment is a set containing all address object that matches the self object. In this case also the type of result is compound on the following form Collection (destination object type). In our case it will be the following Collection (Address). Since Collection is an abstract type in the OCL metamodel, we have to refine the type by selecting from one of three types Set, Sequence, or Bag. The selection of the correct type depends mainly on the semantics of the association between the source and destination types. By default the type is Set. If the association is labeled with {ordered} then the collection is of type Sequence. If it is possible that navigation will generate duplicate elements then the collection type is Bag.

- **Operations over collections**

   This is a special type of navigation in which a Boolean predicate is examined against collection elements, either for testing that all, some, none of the elements match this predicate. An example on this navigation:
   ```
   context NaturalPerson inv:
   self.Address->select(attrStateOfapartment = #main)-> size =1.
   ```
   In this constraint an operation is made on the set of addresses a person might have to select only those addresses that are the main residence for the person. The purpose of this constraint is to state that a person must have only one main address. It is clear that within one expression the three different types of navigation can occur (which is very common with complex expressions).

Almost all uses of OCL before were as a constraint language. Constraints expression are subset of the OCL expressions that evaluate to the type Boolean. In this paper, we are about to use the querying features of OCL and its ability to represent XQuery expressions.

3.   MOTIVATIONS FOR THE MAPPING BETWEEN OCL AND XQUERY

The purpose of OCL is to specify constraints on UML Model Elements and to limit the possible system states. OCL can be used also to query the models [17],[15]. In [15] OCL was not considered as a complete query language because of lacking expressions that evaluate to tuple types. But with the emergence of OCL 2.0, tuples are now possible to be expressed using OCL. On the other hand the purpose of XQuery is to provide flexible and powerful query facilities to extract data from a collection of real and virtual XML documents. In XQuery everything is an expression that evaluates to a value. We believe that OCL can play for UML models the same role that XQuery plays for XML documents. We justify our belief by showing the following similarities between OCL and XQuery.

- **Path Expressions vs. Navigation**

    Both languages support the notion of moving between types (in OCL) and nodes (in XQuery) [10]. The three different types of OCL navigation expressions we showed in section 2.4 with the set of its predefined operations over collections can cover the different XQuery expressions that we cover in detail in section 4.

- **Type based Expressions**

    XQuery is strongly typed language, meaning that the types of values and expressions must be compatible with the context in which the value or expression is used. Types can be imported from one or more XML Schemas that describe the input documents and the output document. XQuery language can then perform operations based on these types[5]. For example, this expression raises a type error because when isbn attribute is defined as string and then compared with an integer value.

    $$/book[isbn] = 1234$$

    In the same way OCL expression must evaluate to a type that is either predefined in the language or defined in the model to which the expression is attached.

- **Declarative nature of queries**

    Queries of both languages are declarative in nature where we specify *what* we need rather than specifying *how* to reach it.

- **Common constructs**

    Both of the languages are able to represent different control, and logic constructs like if statements, looping, arithmetic operations, and logical comparison, etc.

4.   MAPPING BETWEEN XQUERY AND OCL

We are looking for complete mapping scheme between XQuery and OCL. Achieving this target is out of the scope of this paper. In this paper we only open the minds for the possibility of this mapping. In section 4.1 we represent a case study that describe our suggested scenario of integration between XML, XQuery, UML and OCL. In section 4.2 we give an overview over the different types of expressions supported by XQuery, We represent our idea of the direct mappings and matches exist between some XQuery expressions and OCL. For the expressions which are not possible to be mapped directly, that will be our future work to make some extensions in OCL to make it possible.

4.1 Case Study

In this section, we represent our case study according to the proposed framework of XML/XQuery and UML/OCL integration scenario represented in figure 1. Figure 2 show the XML schema of our example. Figure 3 shows an example of XML document instantiated according to the XML schema represented in figure 2. Figure 4 shows the representation of our sample XML Schema using UML class diagram notations. There are different approaches for representing XML document using UML class diagrams [21][22] [23]. in our case study we have chosen simple one that represent each simple element type contains only text as an attribute for the class and each complex element type contain elements as separate class. We chose the class diagram association relationship to represent the relationship between the elements of our classes. Our idea of

representing XQuery using OCL is independent from this step of representing XML Schema using UML class diagram so any other approach can be used without affecting our idea and our results.

```
<Schema name="OrderSchema">
 <ElementType name="firstName" content="textOnly" dt:type="string"/>
 <ElementType name="lastName" content="textOnly" dt:type="string"/>
 <ElementType name="customerID" content="textOnly" dt:type="string"/>
 <ElementType name="addressID" content="textOnly" dt:type="string"/>
 <ElementType name="city" content="textOnly" dt:type="string"/>
 <ElementType name="state" content="textOnly" dt:type="string"/>
 <ElementType name="orderID" content="textOnly" dt:type="string"/>
 <ElementType name="quantity" content="textOnly" dt:type="float"/>
 <ElementType name="shipDate" content="textOnly" dt:type="date"/>
 <ElementType name="productName" content="textOnly" dt:type="string"/>
 <AttributeType name="price" dt:type="float"/>
 <ElementType name="product" content="mixed">
  <element type="productName" minOccurs="1" maxOccurs="*"/>
  <attribute type="price"/>
 </ElementType>
 <ElementType name="Customer" content="eltOnly">
  <description> This element type represents the customer information </description>
  <element type="firstName" minOccurs="1" maxOccurs="1"/>
  <element type="lastName" minOccurs="1" maxOccurs="1"/>
  <element type="custID" minOccurs="1" maxOccurs="1"/>
 </ElementType>
 <ElementType name="Address" content="eltOnly">
  <description> This element type represents the address information of an order invoice </description>
  <element type="addressID" minOccurs="1" maxOccurs="1"/>
  <element type="street" minOccurs="1" maxOccurs="1"/>
  <element type="city" minOccurs="1" maxOccurs="1"/>
  <element type="state" minOccurs="1" maxOccurs="1"/>
 </ElementType>
 <ElementType name="Shipto" content="eltOnly">
  <element type="Customer" minOccurs="1" maxOccurs="1"/>
  <element type="Address" minOccurs="1" maxOccurs="1"/>
 </ElementType>
 <ElementType name="order" content="eltOnly">
  <description> This element type represents the order information  </description>
  <element type="orderID" minOccurs="1" maxOccurs="1"/>
  <element type="quantity" minOccurs="1" maxOccurs="1"/>
  <element type="product" minOccurs="1" maxOccurs="1"/>
  <element type="shipDate" minOccurs="1" maxOccurs="1"/>
 </ElementType>
 <ElementType name="orderInvoice" content="eltOnly">
  <element type="Shipto" minOccurs="1" maxOccurs="1"/>
  <element type="order" minOccurs="1" maxOccurs="1"/>
  </ElementType>
</Schema>
```

Figure 2. Case study XML Schema example

```
<orderInvoice>
   <Shipto>
      <Customer>
            <firstName>Folkert</firstName>
            <lastName>Wilken</lastName>
            <custID>123C</custID>
      </Customer>
      <Address>
            <addressID>212</addressID>
            <street>206 Soflingert Street</street>
            <city>ULM</city>
            <state>Baden-Wutenberg</state>
      </Address>
   </Shipto>
   <order>
            <orderID>ord123</orderID>
            <quantity>3</quantity>
            <product price="40">PC Monitor</product>
            <shipDate>12.12.2004</shipDate>
   <order>
</orderInvoice>
```

Figure 3. Instantiated XML document
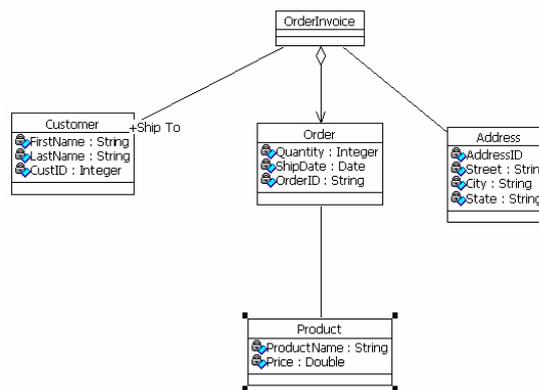
Figure 4**.** Class model representing our sample XML Schema

4.2 Direct Mapped Expressions

- **Path expression**

Path expressions are used to locate nodes in XML data. Consist of a series of one or more steps separated by "\" or "\\". Every step is evaluated to a sequence of nodes. Each operation E1\E2 is evaluated as follows: E1 is evaluated and its node sequence result serves in turn to provide an inner focus for an evaluation for E2.
`Ex1: List the first names of all customers.`
`("Sample.xml")/orderinvoice/shipto/customer/firstName.`
This expression can be represented in OCL using the navigation between object types. If we refer to figure 4 and we try to query the names of customers for whom invoices have been issued; then the start of the navigation will be the "OrderInvoice**"** class. Navigation flows through the association link **"**Shipto" now the expression "OrderInvoice.Shipto" will evaluate to a *collection of objects* (*sequence of nodes in XML document*) of type "Customer". To reach the information we need (list of first names) we need to make one further navigation from the type "Customer" to the attribute "FirstName". At the end of this navigation we have reached the information we need from this query. The equivalent OCL expression is
`OrderInvoice.Shipto.Firstname`

- **Positional Predicates**

Predicates are Boolean conditions that select a subset of the nodes computed by a step expression.
`Ex2: Return the first Customer in the document`
`("Sample.XML")/OrderInvoice/ShitpTo/Customer[1].`
To return a certain element at certain position in a collection of objects we need to use the subsequence operation defined in OCL document [12]**.** The equivalent OCL expression is
`OrderInvoice.Shipto-> asSequence->subsequence(1,1)`

- **FLOWR expression**

XQuery provides a feature called a FLOWR expression that supports iteration and binding of variables to intermediate results. It is similar to the SELECT-FROM-WHERE statements in SQL. The name FLOWR is an acronym, standing for the first letter of the clauses that may occur in FLOWR expression. *for and let clauses*, generate a sequence of bound variables called the tuple stream. *Where clause* serves to filter the tuple stream retaining some tuples and discarding the others. *Order by clause* improves an ordering on the tuple stream. *Return clause* evaluated once for every tuple in the tuple stream.
`Ex3: Return the ID of all orders which have quantity greater than 10`
`For $X in ("Sample.xml")/orderInvoice/order`
`  Where $X/quantity > 10`
`Return  $X/orderID`

To represent a query where some objects are filtered according to a given selection criteria we can use the Select operation from OCL to make this filtration. The navigation starts from "OrderInvoice" using the association to the class "Order OrderInvoice.Order" the expression now evaluates to a set of objects of type "Order" on this set we need to select only orders which have quantity greater than 10. the expression now becomes `OrderInvoice.Order-> Select(quantity > 10)`. This expression also evaluates to set of orders but for which the expression `quantity > 10` holds. To reach the information we need to make one more navigation to the attribute "OrderID". The complete expression will be.

```
OrderInvoice.Order-> Select(quantity >10).OrderID
```

- **Conditional expression**

XQuery's conditional expressions are used in the same way as conditional expressions in other languages. It is a Very well known and common type of expressions. *IF* test expression *Then* then-expression *Else* else-expression.

```
Ex4: Return the ID of all orders which have quantity greater than 10
(rewriting of Ex3 using of conditional expression format instead of where
clause format)
For $X in ("Sample.xml")/orderInvoice/order
    If $X/quantity > 10  then
        Return  $X/orderID
    Else
        ()
```

OCL has a direct representation for the conditional expressions like all other language, The equivalent OCL expression is:

```
if OrderInvoice.Order.quantity > 10 then
     OrderInvoice.Order.OrderID
Else
     NULL
End if
```

- **Arithmetic expression**

XQuery support the arithmetic operators +,-,*, /, div, mod. Each operand of the arithmetic expression should be represented by sequence with length exactly equal to one and then normally apply the expression operators over the sequence values. The result of arithmetic expression is a sequence with exactly one element.

```
Ex5: let X = 3 + 4
```

The equivalent OCL expression is:

```
Let  X = 3 + 4
```

- **Quantified expression**

Quantified expressions support existential and universal quantification. The value of a quantified expression is always true or false. If the quantifier is *some* then the quantified expression is true if at least one evaluation of the expression is true. If the quantifier is *every* then the quantified expression is true if every evaluation of the expression is true.

```
Ex6: this expression returns true if there exist any instance of order
that have quantity greater than 10
Some $X in ("Sample.xml")/orderInvoice/order Satisfy  $X/quantity > 10.
```

This expression can be represented in OCL using "Exists" operation defined for collection types. This expression evaluates to the Boolean type. The OCL expression will be

```
OrderInvoice.Order-> Exists (Quantity > 10)
```

- **Logical expression**

A logical expression is either "and-expression" or an "or-expression". Its value is always one of the Boolean value true or false.

```
Ex7: return all products which have prices in the range between 10 and 20
("Sample.xml")/orderInvoice/order/product[@price > 10 and @price < 20].
```

The equivalent OCL expression will be

```
OrderInvoice.Order.Product-> Select( Price > 10 and Price < 20)
```

- **Sequence expression**

XQuery supports operators to construct and combine sequence of items. Sequences are never nested. Also XQuery provides the *union, intersect* and *except* operators for combining sequences of nodes.

```
Ex8: let s1=(1,2,3)
        let s2= (4,5,6)
        let s3 = (s1,s2)
      for $X in s2
      return $X
```

The equivalent OCL expression is:

```
let  s1 : sequence(Integer)  = (1,2,3)
let s2: sequence(integer) = (4,5,6)
let s3: sequence(integer) = s1->union (s2)
for I = 1 to s3->size()
{
     s3->subsequence(I,I)
}
```

- **Value comparison expression**

Value comparison expressions are intended for comparing single values. Each operand must contain exactly one atomic value. The result of the expression is true if the value of the first operand satisfy the comparison operation (eq – ne – lt – le – gt - ge)to the value of the second operand otherwise the result of the comparison is false.

```
Ex9: ("Sample.xml")/orderInvoice/Shipto/customer/firstName eq "Ahmad"
```

Representation of value comparison expressions can be represented using OCL with a navigation path that ends at an attribute and then the value of this attribute is compared to the value. The OCL expression for this is `OrderInvoice.Shipto.Firstname = "Ahmad"`. The XQuery value comparison necessitate that the expression evaluates to a single node and its value is compared. The previous OCL expression lacks this restrictions as it will evaluate to true only if all the "FirstName" value for all objects are equivalent to the value "Ahmad". In the following we add the condition that the navigation results in only a single object which "FirstName" value is equivalent to "Ahmad".

```
OrderInvoice.Shipto.firstname-> Size = 1 and
OrderInvoice.Shipto.firstname = "Ahmad"
```

- **General comparison expression**

General comparison expressions are existentially quantified comparisons that may be applied to operand sequences of any length. The result of the expression is true if there is a pair of atomic values, one belonging to the first operand and the other belongs to the second operand which are satisfying the comparison operation (= , !=, < , <=, >, >=) otherwise it is false

```
Ex10: ("Sample.xml")/orderInvoice/Shipto/customer/firstName = "Ahmad".
```

The equivalent OCL expression is

```
OrderInvoice.Shipto-> Exists(Firstname = "Ahmad")
```

- **Element construction expression**

XQuery provides constructors that can create XML structures with in a query. Constructors are provided for evry kind of node in XQuery data model.

```
Ex13 :
For $X in ("Sample.xml")/orderInvoice/order
        Where $X/quantity > 10
       Return  <bigQuantity> <OrderID>$X/orderID</OrderID>
          <quantitv>$X/quantity<quantity></bigQuantity>
```

Such expression was not possible in OCL versions prior to Version 2.0. with the addition of tuple types to OCL it is capable of modeling the previous query where the expression evaluates to a tuple or a collection of

tuples that have elements each of which belongs to possibly different type. In the equivalent OCL expression we first need to define the tuple type for this query, then we define the expression which evaluates to this type.

```
Def:
bigQuantity: Set(Tupletype(OrderID: String, Quntity: Integer))=
OrderInvoice.Order->Select( quantity > 10)->Tuple[OrderID = OrderID,
Quantity = Quantity
```

4.3 Unmapped Expressions

- **Node Comparison (is and isnot operators)**

Each operand must be either single node or an empty sequence. A comparison with the *is* operand is true if the two operands have the same identity otherwise it is false. A comparison with the *isnot* operand is true if the two operands have different identities otherwise it is false.

```
Ex14: ("Sample.xml")/orderInvoice/Shipto/customer/firstName isnot
("Sample.xml")/orderInvoice/Shipto/customer/firstName
```

In OCL, there is no direct mapping for this expression because this type of XQuery expressions has the access to the Node Identity not its value which is not explicitly represented in the class model and its instances.

- **Order comparison (<< and >> operators)**

Each operand must be either single node or an empty sequence. A comparison with the $<<$ operand is true if the first operand node is earlier than the second operand node in document tree otherwise it returns false. A comparison with the $>>$ operand is true if the first operand node is later than the second operand node in document tree otherwise it returns false.

```
Ex15: ("Sample.xml")/orderInvoice/Shipto/customer/firstName <<
("Sample.xml")/orderInvoice/Shipto/customer/firstName
```

There is no direct mapping for this expression because it is not currently possible to represent the precedence between objects like it is possible to represent the precedence between nodes in XML tree.

5. CONCLUSION

In this paper, we have shown and discussed the possibility of representing XQuery expressions using OCL. Our proposal in this paper can be regarded as the first step of our work towards a complete framework of integration between XML and UML both worlds. It is therefore our plan in the future work to design a complete framework of integration between XML/XQuery on one hand and UML/OCL on the other. In this work UML and OCL will play the role of modelling the data structure and the queries in the design. The modelled data structure and queries will be mapped to an XML schema and XQuery expressions in the XML implementation layer. We believe that as a side effect of this work the XML layer can be replaced with any other implementation layer (Relational Database and SQL – Object Oriented Database and OQL -…). In our work we chose to use the XML as an implementation target layer because the current widespread of usage of XML and to introduce new line for using UML in the web environment. The use of OCL has been addressed e.g. in the work of [17] [15]. The major drawback there was the inability of OCL to represent queries that return tuples and outcome of join operations but With OCL 2.0, tuple types are definable and so such problem is solved. In section 4.4 we have shown that some expressions are not possible to map without extra information. This stems from the difference in the architectural model between OCL and XQuery. We expect our work to continue and evolve in the future. The authors are currently planning to build a prototype tool that represent their proposed framework of integration and which can implement their future complete mapping scheme. Also another point for future work will be to build extra metamodels for the XQuery and the XML documents to let UML and OCL understand the tree structure which makes mapping of the currently unmapped expressions possible.

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STEPS REQUIRED DEVELOPING MOBILE LEARNING SERVICES

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ABSTRACT

In this paper the required steps to utilize the mobile devices effectively in the education process are revealed. Currently mobile devices such as mobile phones and PDA's have several limitations compare with other interactive media in education e.g. user interface, process speed and screen size. Therefore mobile devices are considered as an enhanced tool for students and teachers in their education process. The effective integration of the mobile devices to other traditional medium enables users to have access to some content regardless of place and time. Time and space are two important factors both for students and staff. The processes of creating the framework for utilizing the mobile devices are divided to four main categories, user studies, concept development, implementation of the mobile learning system and evaluation. This paper focus the user study process and data analysis, which is the essential part of mobile learning system and reveals the methods used to identify the users need and requirements.

KEYWORDS

Mobile learning, user study methods and concept development

1. INTRODUCTION

Handhold devices such as mobile phones, PDA and laptops are common devices among students and staff in education institutes. Utilizing these devices in an education process as enhanced tools is the theme of the mobile learning framework. The handhold devices capability has improved in recent years, new phones are capable of exchange voices, text, pictures and motion pictures. In addition, wireless network operators provide high-speed connection with reasonable cost to their subscribers and educational institute. These features and facilities enable students and staff to utilize the mobile devices in their education process as an enhanced tool to the existing medium.

Unlike PC, mobile devices have some restriction for displaying content e.g. screen size and resolution. When designing user interface for mobile devices, especially for heterogeneous environments, we have to consider the special user requirements, as well as, the capabilities of the devices (Calvary et al. 2001) and (Roth et al. 2000). As (McClard et. Al. 2000) have stated, the portable devices are not a replacement for the PC.

The aim of the research was to create a framework of the mobile learning system. The research was initiated by conducting a staff and students studies at the Information Processing Science Laboratory (IPS) and the Telecommunications Software and Multimedia Laboratory (TML) at Helsinki University of Technology. By conducting various user study methods the utilized tools at the mentioned laboratories are

classified based on education components (Brusilovsky et al 2001) and the services are compared with mobile devices' capabilities from various perspectives. The distributions of services to different devices are the bases of the framework, which was evaluated with users through a mobile learning system prototype.

2. RELATED WORK

One of the most obvious unique characteristics of mobile devices is the lack of constraints related to time and space (Balasubramanian et al. 2002). Mobile computing is fundamentally different than desktop computing. Mobile devices have mainly lower computation power, smaller memory and smaller screen size with low display resolution. Mobile applications and applications in mobile devices are fundamentally different (Johnson, 1998). There are extensive psychological, social, organizational and environmental phenomena to be studies when we start to investigate the "worlds" in which mobile computing might take place (Johnson 1998). A major problem in exploring user requirements for mobile communication and personal organization devices is the versatility of usage patterns and usage contexts in which the usage takes place (Väänänen et al 1998). There has been extensive research on mobile content design; however the result cannot be applied to all devices since all devices have different characteristics, graphics presentation and context. Still to have similar content adjusted to fit the various sizes, while still keeping the user interface usable requires substantial effort (Martikainen, 2002). There are three parameters that contribute to the amount of display size required by user-interface design: size of the individual interactors layout of interactors within a window, and the allocation of interactors among several windows (Vanderdonckt 2001). Two main factors affect reading in page-oriented presentation: the static format on the text (layout), and how text is advanced (scrolling). Layout mainly affects how the attention of the reader moves from one line to the text, whereas scrolling affects how attention is shifted when the text is advanced on the screen (Melchior, 2001).

3. USER STUDIES METHODS

In order to understand the users need and reveal the utilized tool in their education purposes, several user studies methods e.g. semi-structured interview, diary, observations and review of previous research were conducted. The gathered data also assisted to identify the real need of the user for mobile devices in their education process. The process of the conducted study is presented on the following figure.

Figure 1 Requirement specification process
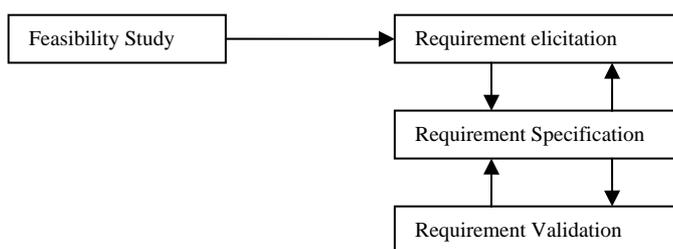
3.1 Semi-Structure Interviews

One key element in conducting useful research is gathering reliable information. In order to do that the questions and the users must be carefully studied in advance. In this study the users are selected from experienced and inexperienced staff. Through appropriate questions we try to share the user's experiences and knowledge about the utilized tools, teaching experiences and course coordination. The interview is conducted with faculty members and students of IPS and TML faculties at Helsinki University of Technology (HUT). The main focus of the interview is to get the teaching process and also utilized tools.

These two departments considered as a typical faculties at the HUT which offer almost variety of courses and seminars. The following tables summarized the user's information.

Table 1. Interviewees summarized table

	IPS	TML	Total
Faculties member	3	3	6
Students	3	2	5
Total	6	5	11

3.2 Diary

To understand needs and requirements of among students and staff that have part time job we conducted a diary in the period of 3 weeks. The students are from TML and IPS faculties. The focus of the questions in diary were related to students' daily activities regarding their job, traveling, daily activities, tools and devices they carry in daily bases. The questions were short enough in order to encourage students to answer. Before distributing the diary through test users the questions are evaluated and then distributed to others. The diary provided us information such as students' movements, students' activities regarding assignments, mobility devices they carry in daily bases.

3.3 Observation

Beside above mentioned steps, several lectures and exercise sessions were under observation for revealing actual utilized tools in various occasions. During these sessions we take a note of our observation sessions to reveal how users usually present the new lecture, what kind of devices they use, how staff utilizes new technology in classroom and what kind of difficulties they encounter during the lecture sessions.

4. DATA EVALUATION METHOD

The gathered information from the users is raw material and needs to be analysed in order to look closely at the users' work and gain new insight into how the user gets along with the existing tools.
The data gathered during users studies were summarized and categorized based on [ISO 9241-11 standard]. The summarized and categorized were about the description of users (Background, skills, etc.) the description of tasks, the utilized equipment and devices both in the school and outside and different environments (working, social). Semi–structure interview and diary were used to define the description of the users, tasks and different environments and observations help to get to the equipments and devices utilized by users. Sample of the classification are as follow:

4.1 Working Environment

A list of the environments in which users usually visit at the university were lecture hall, exercise sessions, office hours, meeting rooms, libraries, and restaurant. Almost all the users were moving in these areas while they were in university. Because the lecture halls are situated in different locations usually teachers are in move in the university. Users are all living in different metropolitan areas. They mainly used public transportation to the universities.

4.2 Social Environment

The users' movement in social environments and their frequency were varied very much because the university and their resident were situated in different parts of the Helsinki metrological areas. The social environments' information mainly pops up from the diary distributed to users. Sample of the gathered data

are as follows, 90% of the users uses public transportation, 10 % uses own car and the most areas which their used to visit are shopping centres, sports centres and library beside university. Almost all the users have a computer at home and they spend their spare time with the computer. All users had a mobile phone (99%) and some also carry a PDA device (80%) while they are on the mentioned social and working environments. They usually read a book, magazine or a newspaper while they travel to and from their working place. They consider e-mail as the most appropriate tool for their communication etc.

4.3 Workflows, Tasks, and Procedures

The samples of tasks which usually carry out by teachers are, organising the course or seminars, coordinating course staff, keeping the lecture sessions, course management etc.

Through the semi structured interview with the lecturer, assistants and students the tasks carried out by each group were gathered. The following table presents the user / task matrix classifications. The following initials were used in the classifications

Table 2. Sample of User / task matrix

F = Frequently, S = Sometimes and N = Never

TASKS	Lecturer	Assistant	Students
Activities related to organizing the course	F	F	S
Activities related to lecture notes preparation	F	S	N
Activities related to lecture presentation	F	N	N
…	…	…	…
Activities regarding the answering of assignments	N	S	F

In Table 2 some tasks are performed by two groups at the simultaneously in order to reach the predefined task. A typical chronological task sequence for the teacher (Hackos, 1998) is presented in Figure 2:

o   Define the topics which must be covered on the lecture

o   Prepare the slides for the next session

o   Add the slides in the web site and in his laptop

o   Publish the next home assignment in the course web site.

o   Start the laptop or desktop computer

o   Start or download the power point slides

o   …

Figure 2 an example of chronological tasks sequences for teachers

Then based on the gathered data from all users, four different scenarios were written. These scenario reflected four groups of people who were involved in education process, scenario one reflect teachers life, scenario two students, scenario three assistants and scenario four students who were involved in teaching activities. These scenarios were again confirmed by four users who were participated to the initial study. The aims of the scenarios were to classify the vast amount of data gathered and also to confirm with user whether we understood their requirement and need.

 Finally the actions and their frequencies appeared in the user study were classified in a table. Sample of the classifications are in the following tables.

Table4 List of Actions and their Frequent Occurrence sample

S_1 referees to Scenario 1, S_2 referees to Scenario 2, S_3 referees to Scenario 3, and S_4 referees to Scenario 4

No	Actions.	Frequency	Number of Frequencies
1	To send messages/mails/comments	$S_1/5,s_2/3,s_3/5,s_4/4$	17
2	To receive messages/mails/comments	$S_1/5,s_2/3,s_3/5,s_4/4$	17
3	To return the feedback	$S_1/6,s_2/3,s_3/5,s_4/3$	17
4	To react on the due deadline	$S_1/6,s_2/3,s_3/5,s_4/3$	17
...	...	...	...
44	To forward automatic answer	$s_1/1,s_2/0,s_3/0,s_4/0$	1

Figure 3.presents the process of the initiating user studies and data analysis for creating the concept for the m-learning framework.
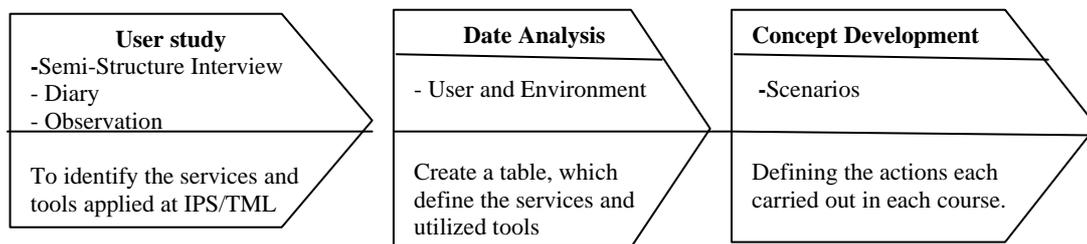
Figure 3. The process and methods applied in at different stage of the study

The important part of this study is to select appropriate methods for classifying the services with respect to the mobile devices. The classification was done through the following steps:

First define some criteria for mobile devices and then based on some requirements such as mobility, accessibility and pedagogy determine what services were most appropriate to which services. The latest method was similar to design rational method (Mäntylä, et al. 1996) where in the design rational method focus to the development of the proto type along with documenting the specifications of the product. By extrapolated the result from the data analysis, each action starting from the highest frequencies was evaluated with the different mobile devices (mobile phones, PDA and laptop) and graded e.g. (Table 4).

Table 3. Comparisons of the text based message with different devices

0 refers as not suitable, 1 refers as most suitable

Text based messages	Mobile Phones	PDA	Laptop
Writing the message	0	1	1
Sending	1	0	0
Receiving	1	0	0
Forwarding	1	0	0
Manipulations /comments	-	1	1
Results	3	2	2

Based on this method the distribution of services to each device was graded and then evaluated. Finally, all actions based on their nature and devices characteristics were classified (Table 4). These processes were carried out for the entire actions in the classification table until all actions and their appropriate device/s were defined.

Table 4. The distribution of the action and related components to different devices
GI refers to mobile devices with small screen size with basics of mobile functionally (e.g. Nokia 6210)
GII refers to mobile devices with higher screen size with more sophistic functionality (e.g. Nokia 9210, PDA devices)
GIII refers to mobile devices with high computation power (e.g. laptop)

Message/Mail/Comments	Voice	Picture	Motion picture	Text
Sending Messages	GI	GI, II, III	GII, III	GI, II, III
Receiving Messages	GI, II, III	GI, II, III	GII, III	GI, II, III
…	…	…	…	…
Receiving Comments	GI, II, III	GI, II, III	GII, III	GI, II, III

4.4 Prototype of the System Based on User Studies

Based on the distribution of actions and their classification three scenarios were written and one was selected as a most convenient one for developing proto type due to the existing resources for developing actual working prototype. The scenario were reflected three situations, future wireless and mobile technology, current wireless and mobile technology and the existing resources and technology for the group to develop the prototype. The functional and non functional specifications of the system were presented in the prototype. Figure 4 present the use case model of the existing technology Scenario.
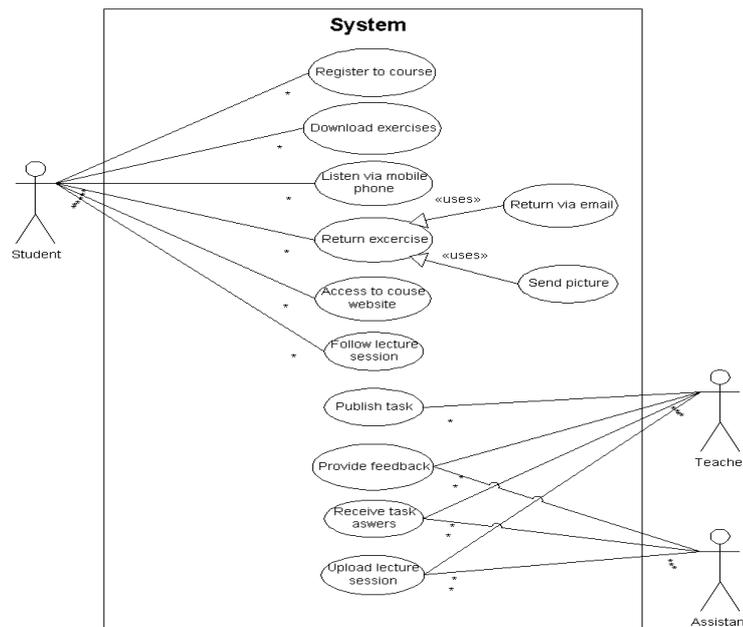
Figure 5. use case model of the prototype

The prototype was developed and evaluated at Häme Polytechnic / Forssa unit by using PHP, MYSQL and WML and HTML. Figure 5 presents the interaction between users and the m-learning system.
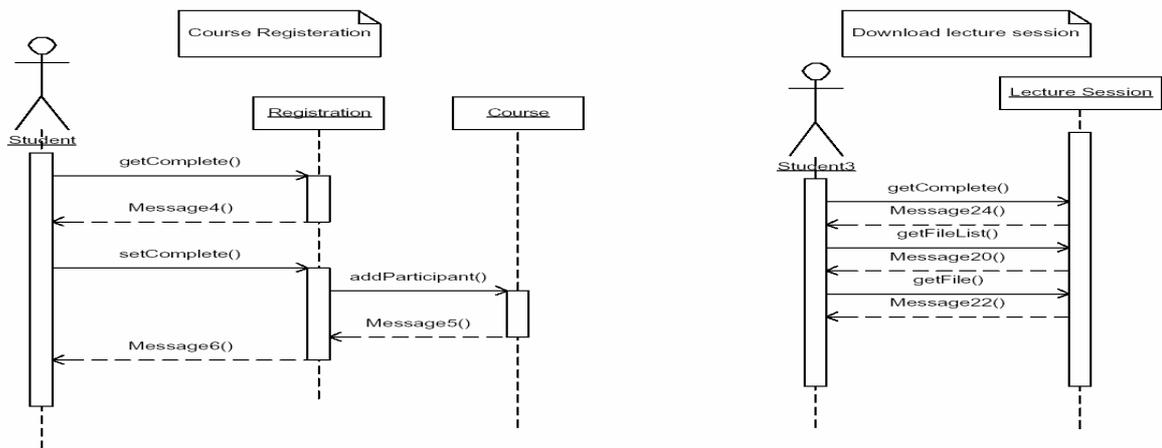
Figure 5. The sequence diagram of the interaction between the user and the m-learning system

5. CONCLUSION

Having direct access with the course organizer helps to achieve the elicitation task more easily and drive reliable results. Even though the initial user's models of the mobile learning were not as straight as it should be, the user's model of the mobile learning was to carry out the education responsibilities over the SMS.

Designing m-learning application requires extensive consideration due to the nature of these devices. These considerations are as follows:

- Reliable and accurate user studies methods.
  - o Select various data collection methods in order the gathered data to be vast and general
  - o The gathered data should represent the users environment in different context
  - o The gathered data must be collected from the right target group

Interviews and observation provides appropriate information about the context of use as defined in ISO 9241-11.

- Data analysis methods

Mobile users are often in the move and they use the applications in different context. It is essential that define the user's environment and their activities.

- o The mobile user's activities inside his/her work environments are usually so tied with outside activities. Due to this fact it is essential that the gathered data to be analysis and classify in different context and environments.
- o It is essential that the data analysis method the main focus is to identify the services without having specific devices in mind.
- o Define the aims of each service and the tasks which the service will accomplish
- o Define what kinds of data should be exchanged

- Device type and device characteristics
  - o Due to the variety of the mobile device it is essential that the mobile device to be classify and grouped based on their common characteristics.
  - o Based on the device features and the service characteristics the services are distributed to the appropriate device.

The prototype testing was carried out also in four different phases, test scenarios, pre-interview, test tasks and observation and post-interview. The results shows that the users are very satisfied with the provided services and willing to utilized in their education process.

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Short Papers

E-GOVERNANCE IN INDIA

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ABSTRACT

This paper analyses the progress made by the Indian government in improving its interface with citizens using IT tools such as the Internet. During the last few years there has been major initiatives among different Governments towards ushering in Information Technology and its tools in the functioning of Indian Government. The emphasis has been on providing better services to citizens and in improving the internal productivity. It has been widely accepted that IT implementation in Government is the most difficult process and hence requires careful planning and formulation of strategies for effective implementation. Therefore, the objective of the paper is fourfolds. Firstly, it looks at what is E-governance . Secondly ,it closely observes the response of the Indian government in introducing E-governance in some of its states.Thirdly, the paper uses few case studies to see the current state of E-governance in India. Finally, the paper concludes with the hope that very soon the whole of the country shall be buzzing with the success of E-governance in India and the gap between the government and its citizens shall be considerably reduced.

KEYWORDS

E-governance, India, eSeva ,Chandigarh.

1. INTRODUCTION

In simple terms Electronic Governance can be defined as giving Citizens the choice of when and where they access government information and services. Putting the Citizen at the centre of government means taking a delivery channel view. This would mean using more and more of Electronics & Information Technology in many of the government functions. I would like to call E-governance as SMART governance where SMART means **S**imple, **M**oral, **A**ccountable, **R**esponsive and **T**ransparent government There is tremendous importance for rules and procedures in the government. Unless the records are kept properly, accessing information and tracing the precedents becomes time consuming and this is one of the reasons for the delays in government administration. Secondly, rules and procedures lead to enormous red tape and delay and this in turn leads to corruption. Today, we find that the present paper based system is very time consuming and inefficient. The rules, procedures can be made transparent to the citizens, information can be made freely available to the citizen, precedents an be traced faster and in short, the pace of effectiveness of governance can be improved by using Information Technology. A 'joined up' government-community-citizen infrastructure has its own significance. A strong and effective information chain, comprising a choice of practical, accessible and   manageable channels of communication has a dual benefit. Citizens enjoy a fast and convenient 'service', whilst government not only becomes more integrated into the community itself, but can focus its resources where they are needed most. Moreover, a culture of self-service enables citizens to 'help themselves' wherever possible, saving time and money for all concerned.

2. THE CURRENT STATE OF E-GOVERNANCE IN INDIA

Concept of e-governance has gained momentum in last 5 years in India. But today India is one of front-runners to achieve fully integrated e-governance by 2010. In 1998, Indian government formed IT task force for initiating organized and serious efforts towards e-governance. Lot of e-governance initiative were taken

around the country with varying degree like 'e-seva' initiative by the state of Andhra Pradesh government to provide governmental services to citizen of state.According to The Economic Survey 2002-03, "there is considerable scope for improving the delivery of social services, such as health care, by promoting community and private sector participation. What is required is a change in the paradigm of the public sector 'providing' public goods and services, without necessarily 'producing' them itself." Innovative as this approach may be, it remains to be seen if it could improve the quality of governance. Unless widespread problems like corruption are tackled there is every possibility that the same problems that plagued the delivery of services by the public sector could impair the functioning of public-private partnerships.Several new laws also have in-built provisions to increase the scope of citizen participation in governance. The Electricity Act of 2003 provides for consultations to be held with citizens groups on regulatory reform including tariff fixation. Similarly the Consumer Protection Act of 1986 provides for the active participation of consumer groups in enforcing the provisions of the Act. The end objective of these provisions remains the improvement of transparency and accountability in decision-making.In recent years a number of civil society initiatives have used a variety of tools to try and improve the quality of governance[6]. Some of these initiatives include:

- Voter Awareness Campaigns: Catalyst Trust, Chennai, Lok Satta, Hyderabad, PAC, Bangalore
- Capacity Building for Advocacy, National Centre for Advocacy Studies (NCAS), Pune
- Public Interest Litigation: Common Cause, Delhi, PUCL
- Jan Sunwais: Mazdoor Kisaan Shakti Sangathan (MKSS), Rajasthan; Parivartan, Delhi
- Campaign for Effective Citizens Charters: Praja, Mumbai, Lok Satta, Hyderabad
- Public-Private Partnerships: BATF, Bangalore
- Budget Analysis and Advocacy: Disha, Ahmedabad, Proof, Bangalore
- Community-media partnerships: Express Citizens Forum, Pune

3. CASE STUDIES OF E-GOVERNANCE IN INDIA

As a result of both government and non-government efforts to improve the quality of governance, there is a slow but definite change for the better. The pace of change will depend a lot on the pressure that people are able to bring on the system to change[2]. After all, as the old saying goes, people get the government they deserve.However , it would be highly appropriate to site a few cases where E-governance has been extremely beneficial in bringing about a change in the working of government.

Case 1: The Gujarat Road Transport Department's 'computerised check-post project' has eliminated corruption at 10 octroi posts on the state's borders, and increased the revenue from Rs. 60 crore in 1998-99 to Rs. 250 crore in 1999-2000. The moment a truck enters the state its weight is recorded and the vehicle is videographed, and the data is instantly accessible in Ahmedabad. This allows little room for local officials to take bribe. Compared to the additional revenue earned, the heavy capital investment of Rs. 18 crore is nothing.

Case 2: The Water Resources Organisation of the Public Works Department of the Tamil Nadu Government is in the preliminary stage of implementing Management Information System (MIS) for its irrigation basins. If implemented in toto, it would allow farmers in remote villages to key in water requirements and crop status on computers that would enable the officials sitting in towns to decide the quantum of supply based on the situations at various spots at times of water scarcity. MIS can check political pressures and bribe-taking by officials, and thus eliminate the inequity in water distribution. But more often than not in such projects, computer use gets confined to government officials and e-governance fails to serve the purpose.

Case 3: eSeva - an online community bill payment system, is Andhra Pradesh Government initiative to deliver government information and services online to the state's citizens. The service will provide real-time utility bill payments for water, electricity, telephone, municipal taxes, birth and death certificates, passport applications, permits and licenses, transport department services and other G2C (government-to-citizen) services (http://www.esevaonline.com)eSeva is a brain child of chief minister Mr. Chandra Babu Naidu and kicked off in 1999 at Hyderabad. In August 2001 19 centres were started in the cities of Hyderabad and Secunderabad. At present there are 35 eSeva centres (with 280 service counters) The whole concept is based

on real-time utility payment system, which is very common in western world. eSeva has tied-up with ICICI bank, HDFC bank, Global Trust bank and UTI bank for online payments. The main data centre for eSeva is at Khairatabad, which is used to store all information, facilitate transaction and update local department servers. The citizen service centre and governmental departments are linked to main WAN through a LAN. eSeva is based on three-tier network architecture. Transactions are conducted on a real-time basis. Departmental servers are connected to the data centre, which in turn is connected to the eSeva centres. Leased lines, with back-up ISDN lines, connect the departmental servers to the eSeva data centre. Transactions done at the eSeva[10] centres are recorded directly on the server of the department
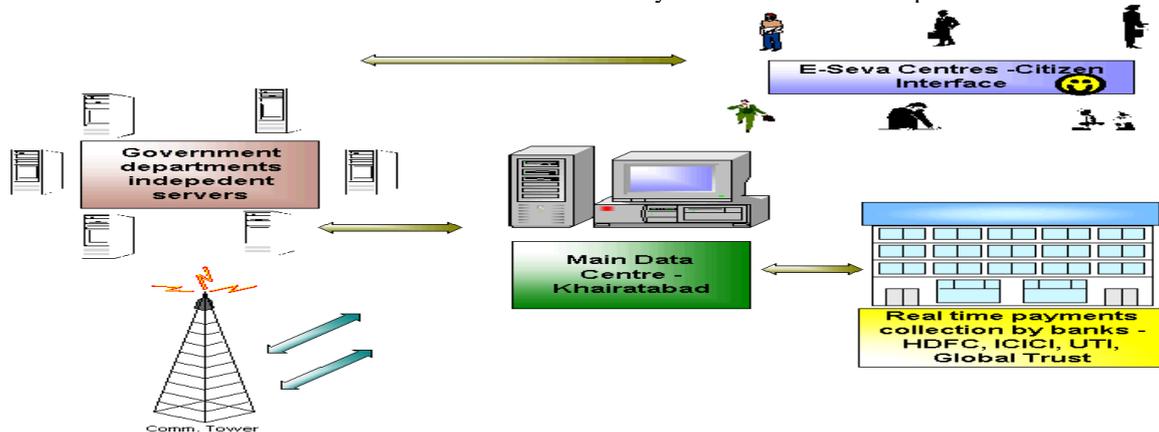
Figure 1

Case 4: Efforts of a micropolitan city for effective E-governance

Chandigarh, the youngest city of India, planned by the famous French architect, Le Corbusier, is situated in the North-West part of the Country. The City serves as Capital of two States, Punjab and Haryana and is under the direct administration of the Government of India as a Union Territory. For its world class planning and architecture, quality life style and pollution free environment, Chandigarh is also known as the **"City Beautiful".** Being the Capital city of Punjab and Haryana and also enjoying the status of Union Territory, Chandigarh is the hub of Government, Public and Private sectors. All major private sector service providers have a branch or regional office at Chandigarh. In the current trends of computing paradigm, Chandigarh is witnessing growing IT culture and awareness. The need of promoting IT and IT related services is increasing day by day. The Educational and Research Institutes like the Panjab University, PGIMER, NIPER, Engineering and Medical colleges and scientific organizations like CSIO need fast and reliable mode of communication for their day to day operations.e-Governance is the most significant aspect of the I.T. Policy of Chandigarh Administration. The vision of the Administration is to create a knowledge based society, wherein every citizen of Chandigarh shall be able to excess the benefits of IT by the year 2005. IT is to be used as a medium for effective interaction between the Administration and the public so that exchange of information and access to government departments is speedy and easy, leading to a better quality of life. As per the IT Policy, all departments of the Administration are to be computerized, with the Public dealing departments to be taken up first. Accordingly, significant work has been done in the Departments of Excise and Taxation, Licensing and Registering Authority, Transport, Registration of Births and Deaths, and Police. Other Departments like Estate Office, Health, Education, and Food & Supplies are currently being taken up for computerization. Relevant applications in all these Departments are being identified and prioritized. The budget for all these projects is to be drawn from the funds available with the Departments themselves. As per Government of India guidelines, 1 to 3 per cent of each Department's Budget is to be allocated for e-governance. The aim is to enable relevant information to be placed on a **citizen's portal** which could be accessed either through the internet or through a chain of Information Centres by the public, so that they are not required to visit Government offices frequently. An **Optic Fiber Network** has also been set up in the city by private companies at their own cost. Part of this Network is being utilized to connect Government Offices and Information Centres.The city has been ranked among the 'aspiring leaders' in terms of e-readiness by a survey on 'e-readiness assessment of states in India' conducted by the National Council of Applied Economic Research (NCAER) for Department of Information Technology (DIT), Government of India.Chandigarh has been placed ahead of the adjoining states of Punjab, Haryana and also Himachal

Pradesh. The survey, submitted by the NCAER to the Government of India, has slotted the states and union territories in five categories: leaders, aspiring leaders, expectants, average achievers, under achievers and laggards.Andhra Pradesh, Karnataka, Maharashtra and Tamil Nadu are the four Indian states that have emerged as leaders in terms of e-readiness whereas Chandigarh, Delhi, Goa and Gujarat are 'aspiring leaders' and have been ranked at level two. Punjab and Haryana fall under level four under the 'average achievers' group. Himachal Pradesh is under the last category that is ' under achievers'.The states and the union territories have been rated on seven parameters: network access, network learning, network society, e-governance and network economy. Chandigarh, Maharashtra, Delhi, Karnataka and Tamil Nadu are on the top in terms of network learning. Network learning is monitored in term of percentage of colleges and schools with Internet access, computer labs, universities offering infotech courses, number of websites of schools and colleges, etc.Chandigarh and Karnataka are also ahead of others in maintaining the network society, which is measured on number of online companies, local language websites and interfaces, number of government websites and number of households accessing Internet and percentage of households with computers and phones.

The best network policy is in place in Chandigarh besides Maharashtra, Tamil Nadu, Karnataka, Goa and Gujarat, the survey says. According to it the network policy is evaluated on the government's efforts to address issues related to telecom, e-commerce taxation, intellectual property and presence of an IT policy and cyber laws. Following recommendations have been suggested by Nasscom for effective implmentation of E-governance[5].

Phase I: By the end of 2003	Phase II: By the end of 2004	Phase III: By the end of 2005
IT training should be mandatory for all Class I govt. personnel Tendering and bid evaluation procedures should be rewritten Fully operational NISG NIC role should be clearly defined Clear tenures for IT champions in Central and State levels	Build state wide area networks Ratio of PC: personnel to be 1:4 in all departments Identify core national projects that need to be automated Rollout national citizen ID cards Computerization of land records in all states State funding from Centre to be linked to e-gov spending	Citizen services offered online in all states 50 percent of all government procurement should be online Focus on developing applications for primary health, disaster mgt and education Accelerate Public Private Partnership when core infrastructure and procedures in place Secure multilateral funding to accelerate e-gov spending

4. CONCLUSION

In the ultimate analysis, I find that the electronic governance wave has started in India. With the technologies to implement electronic governance already available/understood by us, managerial issues are of key importance. Change in the mindset of the people particularly at the top levels in the bureaucracy and policy making is important because it is they who provide the leadership. This change in the mindset can be brought about by focused organization development interventions and training programs.The Indian Government, like many other governments world wide, has recognised that the transformation from tradition-al government to electronic government is one of the most important public policy. It has also recognised that e-government is not simply about im-plementing a new IT system. It is about changing business models and processes to do things differently and better. Information technology offers the solutions[9], but e-government is about changing the way the agency operates. E-governance is beyond the scope of e-government. While e-government is defined as a mere delivery of government services and information to the public using electronic means, e-governance allows direct participation of constituents in government activities. Just to summarise the e-governance as the following; E-governance is not just about government web site and e-mail. It is not just about service delivery over the Internet. It is not just about digital access to government information or electronic payments. It will change how citizens relate to governments as much as it changes how citizens relate to each other. It will bring forth new concepts of citizenship, both in terms of needs and responsibilities. E-governance will allow ordinary people to constantly interface with the government in both local and central level on various matters. But before that one needs to identify the challenges of exploiting the benefits and managing the risks which e-government presents. Being 'e-ready' and managing the

transition to e-government will not happen by chance. It is difficult and requires a careful and concerted effort. Use of internet and related technologies improves public sector performance. It addres-ses issues at the agency level, in a self-help guide format. Agencies also need to be aware of the raft of policies, memoranda and guidelines published by central government agencies to assist agencies in managing e-government implementation.

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RENEWING DEMOCRACY WITH "E-COMMUNITY COUNCILS"

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ABSTRACT

This paper examines action to address the growing political apathy facing many European countries through the possibility of renewing democracy at the local level using e-democracy. We describe the reasons why we need to develop e-democracy tools to support local decision-making and report on work in progress on a project to support wider democratic participation using ICT to support community councils. This project is developing a "community e-democracy model" supported by "community e-democracy tools" that will help to achieve the kind of dialogue and engagement between Community Councils and local communities that will support democratic decision making processes. The research work we are undertaking has the potential to provide a framework for e-democracy at local community, and in so doing contribute knowledge to a broad range of strategy and planning policies.

KEYWORDS

e-democracy community-councils e-participation e-consultation e-voting

1. INTRODUCTION

This paper focuses on the need to develop e-democracy tools and techniques to create new opportunities for democratic participation at the community level. E-democracy is concerned with the use of information and communication technologies (ICT) to engage citizens, support the democratic decision-making processes and strengthen representative democracy (Macintosh, 2004). The principal ICT mechanism is the internet accessed through an increasing variety of channels, including PCs, both in the home and in pubic locations, mobile phones, and interactive digital TV. The democratic decision making processes can be usefully divided into two main categories: one addressing the electoral process, including legally-binding e-voting, and the other addressing citizen e-participation in democratic decision-making. Several commentators have discussed the use of technology to support the democratic process. Coleman and Gøtze (2001) have outlined four possible scenarios for technology supporting democracy. Becker and Slaton (2000) have explored the current state and future of e-democracy initiatives that are designed specifically to move towards direct democracy, while Tsagarousianou *et al.* (1998), have provided descriptions of a number of projects involved with e-democracy and civic networking. Our work takes as its primary focus e-participation. The notion of e-participation and responsible citizenship brings attention to bear on access to information, the nature of participation in public debate and opportunities for communities to provide input to political decision-making and policy formulation (OECD, 2004). The overarching objective of our work is to investigate renewing local democracy by enabling people and communities throughout Scotland to have greater influence over factors affecting their lives. We address this objective by investigating how ICTs can enable the renewal of democracy at the local level.

It is important to appreciate that our work faces two significant barriers –political apathy and the digital divide. We first set the context for our work by describing the democratic deficit that we are addressing in Scotland. We then consider the digital exclusion barriers that are being addressed through other national initiatives. We next provide an outline of our work and provide conclusions.

2. CONTEXT

Our work specifically addresses the important aspect of democracy at the local community level through e-democracy. We argue that geographical communities need e-business, e-government transaction services and e-democracy. A large number of existing initiatives in Scotland focus on access to e-business opportunities and access to e-government public services, very few projects have as their primary focus renewing local democracy through e-democracy.

It is clear from the increasingly low turnout at elections that traditional democratic processes do not effectively engage people. In the May 2003 elections to the Scottish Parliament the average turnout was 49.4% as compared to 59% in 1999 (www.scottish.parliament.uk/research/briefings-03/sb03-25.pdf). Less than half the electorate did not vote for their elected representative. In one constituency of Glasgow only 35.41% voted. The situation in local government is even worse. The City of Edinburgh Council May 2003 election results demonstrate this. All wards showed a fall in turnout with an average drop in turnout of 9.71%. with the lowest turnout being just 36.7%. There is a clear need to renew democracy at the local level by considering new engagement tools and techniques.

The issue of the digital divide (Norris 2001) and its implications for e-democracy needs consideration. For several years, a major concern in many countries has been the consequence of unequal access, lack of proper infrastructure and low adoption of technology. This has created a digital divide, excluding many, particularly those in already socially disadvantaged groups, from the perceived benefits of the Information Society. The digital divide is not just about lack of access to technology due to financial factors but also about lack of use due to low levels of awareness, interest, understanding and acceptance of new ways of working. To address this digital divide, much emphasis has been placed on expanding the communication infrastructure, in particular extending the availability of broadband services. However, problems attached to the Digital Divide are not only related to a lack of telecommunications infrastructure, but to poverty, lack of awareness, and low skill levels (Wilhelm, 2000). Recognising this, a number of projects have been initiated in Scotland concerned with access to ICT, skills to use ICT and content to motivate use of ICTs (Malina and Macintosh, 2003). This project is not intending to replicate this work but rather learn from it. Just over five million people live in Scotland, averaging 66 people per sq km. The geographical area covered by the e-community councils can be related to Stirling Local Authority, considering this PA, the results from the 2001/2002 Scottish Household Survey (www.scotland.gov.uk/library5/finance/spv7-28.asp#610) indicate that on average 43% of households in this area have access to the internet, this can be compared to an average of 35% for the whole of Scotland in that same reporting period.

International, national and local governments and agencies make decisions which fundamentally affect the lives of citizens. Organisational complexity and an increasing pace of change are making it increasingly difficult for individuals and community groups to even know about, far less engage in, decision making processes. Communities require easy to use ways of accessing and sharing information and ideas, responding to consultations and participating in policy formulation. The rapidly expanding public access to the internet offers an opportunity to individuals and community groups to discuss issues together and lobby government for policy changes.

3. THE E-COMMUNITY COUNCIL

Community councils are the local tier of the statutory framework of democracy in Scotland. They are small, local groups and there are 150 Community Councils across Scotland. They typically each have 12 elected members who represent a small population spread across both small and large geographical areas, depending on the urban or rural nature of their location. Community Councils are by law, made up of members of their own community. As such they have direct access to and from their constituents at a more detailed daily level

than most politicians or local authority councillors. They live in the community they serve, know personally many of the issues and can readily judge the impact of new or changed policies and suggestions from government. Currently they represent their constituents as best they can, relying on word-of-mouth and may therefore not be as inclusive as they otherwise might be. They are often given little time to consider fairly major proposals before their considered input is required. They interact with neighbouring Community Councils, local groups and national organisations (e.g. the ASCC). There is a need for better mechanisms for them to be consulted as representing their neighbourhoods, but further for them to have tools to enable them to reach their constituents. Democracy is and should be a bottom-up process.

The project is developing a "community e-democracy model" supported by "community e-democracy tools" that will help to achieve the kind of dialogue and engagement between Community Councils and local communities that will support a broad range of work.

The community e-democracy model is:

- developing efficient ways of summarising and disseminating appropriate information to community groups throughout Scotland.
- enabling interaction within communities and groups of Community Councils both locally and nationally.
- supporting individuals and community groups to participate in informed debate about factors affecting their lives.
- facilitating the identification of issues common to groups of Community Councils both locally and nationally.
- Encourage an increase in responses by those communities that have typically not participated previously.

The community e-democracy tools are being developed so as to support agencies to engage with individuals and groups by facilitating:

- Access through a range of ICT-based devices to allow promotion of any engagement initiative at the earliest possible stage
- Fast, easy access to (plain English) information to support issues
- Informed responses from individuals and groups
- Deliberative dialogue with and amongst groups through interactive facilities
- Feedback to individuals and groups of progress and outcomes.
- Participative (non-legally binding) voting and lobbying.

The project has two phases each lasting one year and each with its own aims and deliverables. In this first phase a model and corresponding on-line tools are being developed for a target community council that is currently familiar with, and using IT to conduct some aspects of their work. This is the Strathfillan Community Council based in Crianlarich. The community is basically a rural one. There are 10 councilors all proficient in IT and they all have access to a PC and internet connection from their homes. By focusing on this IT literate group the impact of some of the known variables - in particular access to and familiarity with technology - is minimised. At the end of year one, and after piloting and evaluation, the initial model and tools will then be generalised and tested again with five other Community Councils with varying degrees of literacy and covering both urban and rural communities. The results of this second phase will allow an overall roll out mechanism for Community Councils and other community groups in a region to be developed.

All the participating Community Councils are being actively engaged in deciding the 'look & feel' and functionality of the on-line democracy tools in order to ensure a feeling of ownership in their future use and development. The pilot tools are:

1. E-consulting

An internet based tool to support Community Councils to gather the opinions about issues from communities. This will allow users to express views on what they want preserved or changed, and so provide a basis for Community Councils to identify collective local policy issues.

2. E-information

An internet based tool for content management which will provide efficient ways of summarising and disseminating appropriate information to community groups throughout Scotland by allowing the groups to contribute news items of interest and to exchange views with other groups.

3. E-voting

An internet based tool to support participative (non-legally binding) voting and lobbying. This will support decentralised voting and counting and will inform voters on the purpose of the voting, the issues under consideration, the voting process, arrangements for the counting of the votes and the subsequent results.

The Community Council web site and associated e-democracy tools are being designed in a modular fashion to allow new e-democracy tools to be added if and when appropriate.

4. CONCLUSIONS

The overarching objective of our work is to investigate renewing local democracy by enabling people and communities throughout Scotland to have greater influence over factors affecting their lives. We address this objective by investigating how ICTs can support community councils. This involves assessing the democratic requirements of community councils and other community groups using ICT in local settings, developing appropriate ICT based democratic community systems and subsequently evaluating their effectiveness and impact. The challenge is to examine ways in which ICT can contribute to democratic participation in local geographic communities. The results of our work will be an assessment of 'local' democratic needs, the e-democracy tools to meet these needs, and recommendations to suggest how best practice e-democracy systems should be rolled out in local communities across Scotland. The work will provide a framework to better appreciate the significance of technology in supporting democracy at local community level, and in so doing enable wider and deeper participation in community planning. In seeking to consult communities, listen to their democratic needs, and consider their perceptions, the work will help to include communities themselves in establishing policy to improve the quality of citizenship across Scotland. Importantly, the work will provide a better appreciation of the significance of technology in supporting e-democracy at local community level, and in so doing contribute to the modernising government agenda of the Scottish Executive.

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WEBSP: A MODEL OF INTER-ADMINISTRATIVE COOPERATION FOR SPANISH AUTONOMOUS PARLIAMENTS

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ABSTRACT

An architecture model of inter-administrative cooperation for Spanish autonomous parliaments based on different layers of functionality is presented in this paper through the WebSpanishParliament project (WebSP) in order to perform one of the major initiatives of COPREPA (conference of presidents of autonomous parliaments from Spain). The goals of this initiative involve the sharing of information among legislative institutions, the increasing of productivity through higher operational efficiency, the offering of better quality services and organizational innovation through the use of information and communication technologies (ICT). The development of the present project is based on three major concepts: (1) the use of standard initiatives, (2) resources that enable management of different languages and (3) the use of Web services technology solutions. The standard initiative approaches were proposed in order to facilitate the access among heterogeneous systems. Management of different European languages was projected for interacting among different European institutions and Web services technology solutions were proposed as wrappers that enable access to and interoperability amongst legislative services.

1. INTRODUCTION

COPREPA (conference of presidents of autonomous parliaments from Spain) and the impact of the eEurope 2005 Action Plan [eEurope2005, 2002] have promoted the improvement of the efficiency of internal operations within parliamentary Spanish cameras and of their intercommunication through the use of information and communication technologies (ICT). Furthermore, CALRE (the conference of European regional parliament's presidents) promote at the same time the relationships between the regional legislative assemblies and the European institutions by means of the fomentation of the exchange of information through the use of ICT. However, public administration is the most complex organization in a society. In particular, Spanish public administration consists of large and complex networks of institutions, administrations and agencies, which are distributed over seventeen autonomous communities. In each autonomous community, the legislative function is carried out by the autonomous parliament. Additionally, the legislative function is carried out by the senate and congress of deputies in the general courts, which are the representative organ in national Spanish state. In this context, the paradigm of eGovernment [Elmagarmid, 2002] offers a way to advance towards a better inter-administrative cooperation between Spanish autonomous parliaments and other European institutions such as European regional assemblies.

This paper presents the pilot project *WebSpanishParliament* (WebSP), where the eGovernment paradigm is used in order to improve the interactions between Spanish parliaments and other institutions through the deployment of a digital infrastructure which allows sharing legislative data information among a number of

distributed hosts. Information about documentation, procedure on the laws and legislative initiatives, statistics data on the legislative activity as well as the consultation of the librarian funds are illustrative examples of the need for cooperation between the different institutions. Moreover, this inter-administrative cooperation involves a significant reduction in the use of paper, mail and phone activities, and consequently higher operational efficiency, and better quality of the services supplied to the legislative authority.

One of the critical issues in WebSP project is the interoperability problem arising from heterogeneous legacy parliament systems that are running under different software/hardware platforms. In order to solve this problem, WebSP project involves the use of Web services technology solutions.

2. WEB SERVICES TECNOLOGY

Web services solutions are a main component in eGovernment infrastructure due to the support of the broad interoperability problem between distributed applications using standard XML-based technology and Internet communication protocols. Interactions among Web services involve three types of participants [Vinoski, 2002]: *service provider*, *service requestor* and *service registry*. The Web services functionalities are illustrated in Figure 1. This way, *service providers* are the owners that offer services. They *define* descriptions of their services and *publish* them in the *service registry*. *Service requestors* use a *find* operation to locate services of interest. The registry returns the description of each relevant service. The *requestor* uses this description to invoke the corresponding Web service. Three standardization initiatives XML-based technology have been submitted to W3C consortium to support interactions among Web services: WSDL [W3C, 2003a], UDDI [W3C, 2003b] and SOAP [W3C, 2003c].
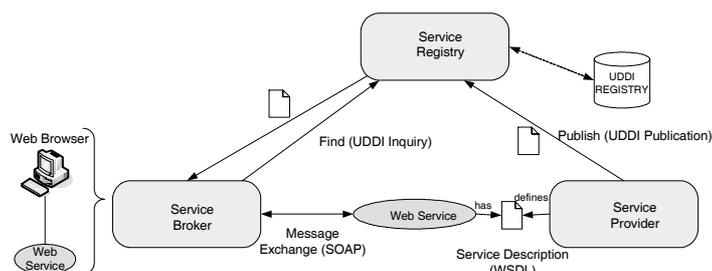
Figure 1. The Web service reference model

3. WEBSP PROJECT

Spanish autonomous parliaments collect, produce and manage massive amounts of data. This information is distributed over a large number of autonomous, heterogeneous and large databases.

The major aim of WebSP is the development of an infrastructure for online legislative services in order to facilitate the access to legislative databases and services between Spanish parliaments and other European institutions using standard initiatives, resources that enable the management of different European languages and Web services technology solutions. Figure 2 illustrates the global architecture of WebSP. The development of three modular Web services in order to provide consultations to: bibliographical funds (B), legislative information data (L) and legislative activities (LA) are initially proposed in WebSP.

In the design of the proposed architecture model, several issues have been taken into account: (1) no additional training for the users is required, due to WebSP can be integrated inside the existent application of the local databases information search. (2) It is each parliament's task to impose restrictions on the access to certain information. (3) Each one of the parliaments can publish new services or modifying the current services in an autonomous way. It is advisable for each parliament to have available a Web Service Registry (UDDI), where all the modifications carried out in each parliament's UDDI would be replied autonomously to the rest of the parliaments. The global architecture of WebSP is integrated by three components or layers

of functionality: (A) Process Manager Layer, (B) Parliamentary Web Services Layer and (C) Security Processors Layer.
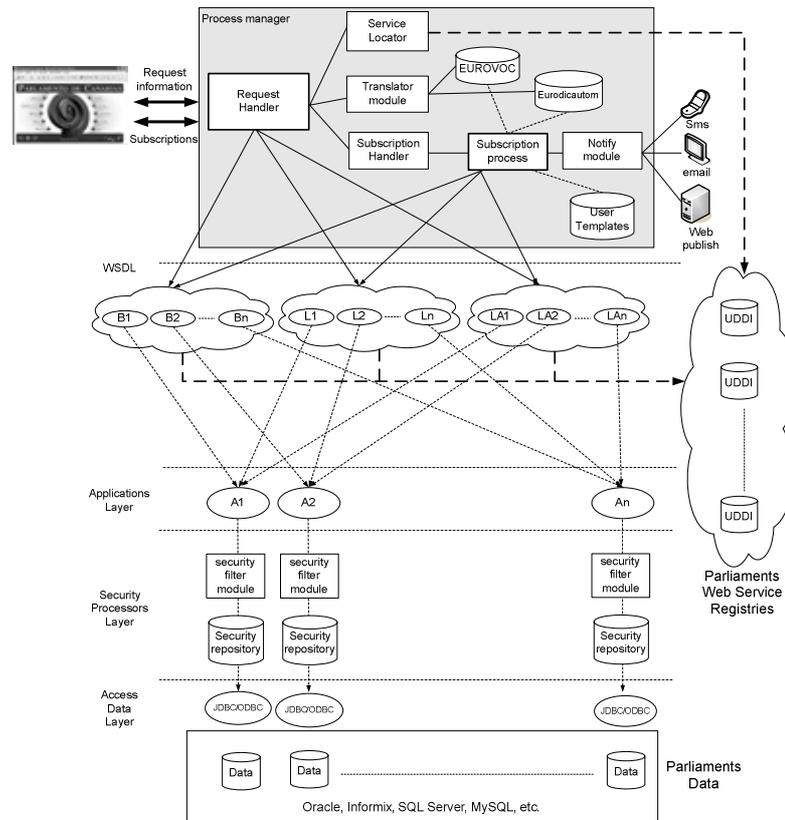
Figure 2. Global WebSP architecture model

3.1 Process Manager Layer

The process manager layer is used to process all the incoming requests from the users of the system. Two types of requests are supported by WebSP: request information and request subscriptions. This process will allow each parliament's user to be able to carry out consultations about certain information in a simultaneous way in all the parliaments that have enabled the appropriate Web service. The process manager will be located in each parliamentary institution and will be implemented in function of the available resources.

All requests are received and processed by the request handler module. To cover all aspects of location, discovery and invocation of available Web services, a service locator module is used by the request handler module. The service locator discovers the available Web services through the examination of the Web service registry (UDDI). The Web service registry will be able to be locally located in a centralized way in a certain parliament or in a distributed way. The request handler module can improve the consultation of the system's information using the translator module. This module is based on the use of the database Eurovoc and Eurodicautom. Eurovoc [Eurovoc] is a multilingual thesaurus covering the fields in which the European Communities are active; it provides a means of indexing the documents in the documentation systems of the European institutions. On the other hand, Eurodicautom [Eurodicautom, 1973] is the European Commissions multilingual term bank. This way, starting from the text that is required to search for in WebSP system, the key words of the search can be extracted and replaced by the equivalent term in another language using Eurodicautom. As a result, we will be able to enlarge the consultation to institutions that present their information in another language, as well as to enlarge the search with synonymous terms using Eurovoc.

Besides requests of information, the WebSP system allows the user to be informed when something of his interest is published in some parliament. Each user will be able to choose the subscription to a collection of established terms from Eurovoc and he will be able to decide the way that the system will notify him. The

user templates module stores all the relative information about the subscriptions of the registered users. This way, the notify module will perform the notification to the user in the mode that has been specified via for example sms, email, web publishing, etc.

3.2 Parliamentary Web Services Layer

For each service that is required to be implemented, an application will be deployed to implement the Web service and this application will allow the consulting to the relative information of that service in a remote way for other parliaments and institutions. Since WebSP architecture model is completely decentralized it allows each parliament to decide to implement his Web services or not to do so. In the same way, each autonomous parliament can only deploy a Web service of all those outlined, or to perform it in a progressive way. When a *provider* parliament chooses to *publish* his new Web service so that the other parliaments can make use of it, he will only have to *publish* it in a Web *service registry* (UDDI) with the idea that the *consumer* parliaments can know its existence and consultation form.

3.3 Security Processors Layer

Preserving privacy is one of the most challenging tasks in deploying eGovernment infrastructures. In order to solve this problem, three issues are required: privacy profiles, privacy credentials and privacy scopes. The set of privacy preferences applicable to a user's information is called privacy profile. The privacy credentials determine the privacy scope for the corresponding user, where the privacy scope defines the information that a parliament service can disclose to a certain user. The system of security will be able to be integrated in a LDAP server [OpenLDAP, 1998] of each institution with the purpose of recovering all the relative information to each user. Each institution will be able to implement a security processor layer with the aim of carrying out a control of who is using the corresponding Web service.

4   CONCLUSIONS

In this paper, WebSP project, an architecture model for inter-administrative cooperation among Spanish autonomous parliaments based on an eGovernment paradigm has been presented. The potential of eGovernment paradigm provides an organizational innovation through the use of services online and more sophisticated forms of consultation and cooperation between parliamentary institutions. Information online about documentation, procedure on the laws, legislative initiatives, consultation of the librarian funds, as well as, statistic data on the legislative activities are illustrative applications of the way that services can be delivered, reduction of administration costs and improvement of efficiency between autonomous institutions.

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E-GOVERNMENT, COMMUNITY AND SOCIAL INCLUSION: A NEW ZEALAND CASE STUDY

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ABSTRACT

As the technological age matures Western governments, in particular, are developing socially inclusive strategies to close the digital divide. One approach is to develop community computing initiatives to up skill individuals and groups identified as being at risk of exclusion from the digital world. In New Zealand the e-Government project is gaining momentum with the expectation that this will allow all New Zealanders access to government information and services, and participate in democracy using the Internet, telephones and other technologies as they emerge. Before this vision can be realized citizens must have the skills and the access in order to participate in government within the digital information age. This paper describes a community digital divide project which was established in Newtown, a low socio-economic suburb of New Zealand's capital city, Wellington. Evaluation of the project is made using Warschauer's (2002) Framework of Technology for Social Inclusion.

KEYWORDS

community computing, e-government, digital divide, ICT, social inclusion

1. INTRODUCTION

The intersection of social inclusion and ICT is a vision of New Zealand's e-Government strategy. Sixteen million dollars have been set aside to fund the four-year e-Government initiative that is scheduled to come to a close in 2004. Much has already been achieved, the most visible being a "one stop shop" web site allowing the public to access government information and services (see http://www.govt.nz). However it is clear that the technical and strategic aspects of e-Government will not ensure involvement of all New Zealanders. For the vision of *all* citizens to participate in e-Government there must be a computer literate population with access to ICT and the government's e-services. What is the reality of realising this socially inclusive goal? This paper describes a case study of a community ICT project in Newtown, an inner-city suburb of Wellington city. Warschauer's (2002) framework of Technology for Social Inclusion is used to evaluate how a community computing hub is preparing participants for the challenges of the information age and e-government.

2. BACKGROUND

Information technologies over the past three decades have radically transformed individuals' everyday lives. The changes these technologies have brought have often been positive but they also have the potential to "deepen existing patterns of socio-spatial segregation" (Castells, 1999, p. 27). Member states of the Commission of the European Communities have recognized the risk of poverty and social exclusion in this new information age. They have agreed to focus on social inclusion strategies so that those at risk will "gain the opportunities and resources necessary to participate fully in economic, social and cultural life and to enjoy a standard of living and well-being that is considered normal in the society in which they live" (Commission of the European Communities, 2003, p. 9). The European communities recognize, therefore, that E-inclusion is necessary for the full exploitation of the knowledge-based society and of new information

and communication technologies. To achieve this goal key policy approaches have been defined which include a broad range of diffusion of ICTs among national populations.

In New Zealand there is a similar concern with social inclusion and the consequences of groups being excluded from the digital economy. In 2002 the Minister of Social Services and Employment launched the Connecting Communities initiative with the aim of improving community access to and use of ICT. Particular groups were identified as being more likely than others to be left behind in the information revolution. These include Maori and Pacific peoples, those on low incomes, sole parents, older people, people with no or low qualifications or poor literacy, the unemployed, people with disabilities and people living in rural areas that lack a sound telecommunications infrastructure. The next section describes the Smart Newtown Project, a community computing initiative, established with economic and social inclusion objectives.

3. THE SMART NEWTOWN PROJECT

The Smart Newtown community project began in 2000 with the vision of creating "a community where all residents have the skills and access to become active participants in today's online world – to make Newtown a 'digital-divide free' suburb" (see www.smartnewtown.org.nz). The Smart Newtown slogan of "People First, Technology Second" suggests the socially-inclusive human versus technological orientation of the project. The New Zealand government has identified those more likely than others to be excluded from the digital society. These include Maori, Pacific Island, people on low incomes, those with no or low qualifications or poor literacy and the unemployed. Newtown was chosen for the project because the suburb has a significant number of residents in these categories. Multiple partners committed to the success of this project. They include the Wellington City Council, a regional economic development agency, a communications-based charitable trust, three educational institutions (a polytechnic and two universities), a computer corporate and community organisations.

Under the "umbrella" of the Smart Newtown Project, The Computers in Homes Project was launched at the Newtown Primary (elementary) School in 2001. This initiative provided a personal computer to families with a child attending the school. Participating families paid a nominal fee and signed an agreement which committed parents to attend training sessions, making family rules about use and supervision of the computer, and teaching a family member or neighbour the IT skills they have learned. The Cannons Creek pilot project was recognised in 2001 with the Stockholm Challenge Award 2001 (see www.computersinhomes.org.nz/stockholm).

The Newtown Computers in Homes digital divide initiative was further supported by the implementation of three community computing hubs with free high-speed Internet access. In 2001 the Fujitsu room at the Newtown Park Flats, a Wellington City Council high-rise six block housing estate for disadvantaged people on low incomes, was launched. Around the same time computers at the Newtown Community and Cultural Centre were installed and a third hub was established in the Pacific Islands Network Centre (PINC) which is adjacent to the Newtown Public Library. In October 2002 three computers were installed in the library as part of the PINC hub. These are used by clients to access a diverse range of CD databases on subjects including Maori and other languages and the use of application programmes. The library has other computers that are not part of the Smart Newtown Project and these offer Internet access for a fee.

4. THE RESEARCH DESIGN

A mixed-method design (Greene, Caracelli & Graham, 1989) incorporating qualitative and quantitative methods was adopted. Data were collected via a purpose-designed user survey, a non-user survey (see Crump and McIlroy, 2003 for non-user results) participant observation, interviews and narratives. Regular hub visits (lasting 30 to 90 minutes) were made over a one-year period at approximately two to three week intervals. Varied observational methods were used by the researchers from passive to participation (Patton, 1990). The participative observation occurred particularly with novice computing users and involved helping students log in and accessing sites in which they were interested. Short conversations were held between the researcher and students, many of these were on-going as users made repeat visits. Formal interviews were

done with the coordinators, implementation partners and hub users. Because of the longitudinal nature of the research (over a two-year period) a rapport and collegial relationships were established with many of the participants.

5.   TECHNOLOGY FOR SOCIAL INCLUSION

ICT projects for disadvantaged communities have often failed (Liff, Steward & Watts, 2002; Morino, 1994; Warschauer, 2002) and reasons suggested for lack of uptake and growth of human capital. A common theme is that the provision of ICT devices and conduits without targeting the needs of potential users or engaging them in the design, development and implementation stages does not make for effective use of ICT. Thus there was a lack of ownership of the project which resulted in the technology not being used and the hopes of increased social and human capital not being realized. Warschauer (2002) suggests a model of access which has social inclusion as its main focus. This involves access to physical artifacts (computers and telecommunications, relevant content, human resources and skills, and social support in the form of community, institutional and societal structures that support access to ICT. The resources have an iterative relationship with ICT use, contributing to effective use of ICTs and, once effectively used, feeding back into promotion and extension of the resources. The next section describes the attributes of the PINC hub and uses Warschauer's Technology for Social Inclusion Framework to evaluate the Smart Newtown project.

6.   THE PINC HUB

The PINC hub is located in a long established community resource and meeting place for Pacific Island peoples and other ethnic groups. It is on a main thoroughfare and the nine computers are located in a glass-fronted room looking onto the street. Behind the computer hub is a room where English classes are held each morning for a class of approximately 20 immigrants. The multi-cultural usage of PINC, together with its reputation for social inclusion gives it a neutrality where people obviously feel comfortable to come and go at will. The PINC director is a highly respected Samoan woman who is a leader in the local community. She has always been a strong champion-driver for the Smart Newtown Project – a feature found in successful ventures of this type (Shearman, 1999). The computer hub coordinator, who was a volunteer at PINC, is an Indian immigrant who has been in New Zealand around three years.

The PINC hub provides introductory and intermediate level computing classes. These range from a basic Equal Skills Programme which is a computer familiarization electronic programme facilitated by the co-ordinator to learning Microsoft applications. The hub is booked for use by a variety of community groups (in addition to the immigrant English language class). For example people recovering from head injuries (the Getting Ahead Group), an intellectually handicapped group (the ACE group), a mental health group and the local Samoan day-care centre. Members of the public are free to use the hub's facilities at times when the groups are not booked.

The PINC hub is successful in delivering ICT to a diverse range of groups and people. The hub has a strong champion who was involved from the start-up phase to the present, maintaining enthusiasm and taking ownership of the project. She has been supported by the hub coordinator who began as a volunteer and staircased into a paid position. While it is difficult to maintain an optimum number of volunteers, there have been three very long-term, committed helpers who give constancy to the environment. The classes are fully subscribed and evaluations are very positive.

7.   DISCUSSION AND CONCLUSION

What are the social inclusion attributes that make PINC a successful hub? Firstly the location is an important factor. The high visibility and accessibility of a public place, in an already established people-centred organization and adjacent to the public library gave the ICT social experiment a head start. This asset-based approach where a community's established resources are used has proven successful in other projects

(Pinkett & O'Bryant, 2003). Secondly, PINC has many of the attributes of Third Place (first place being home and second place work) identified by Oldenburg (1991) as facilitating social inclusiveness. For many of PINC's users, the hub as a Third Place is a neutral place away from home and work where they feel comfortable and can come and go at will. Users experience stimulating connection with others through working and helping each other on the computers and building a collegiality from regular attendance. Nassi (pseudonym) said:

> "I think it's through the very supportive environment that you provide in the learning of it [computers] and the help from friends who are learning, because they like to say how did you do that and get help from their friends … so it's in a non-threatening environment that they are learning."

Another factor in a Third Place is the presence of a responsive "host". The hub coordinator is sensitive to the diverse needs of the users. For example, the content and manner of delivery of classes to the different groups is very much tailored to their capabilities and expectations. The Getting Ahead Group with people who have difficulty concentrating due to their head injuries are treated in an empathetic way and the timing of classes varies according to the capabilities of participants on any particular day. With the ESOL immigrant class there is liaison between the English teacher and the coordinator in deciding on the computing programme which is integrated with the English language class. The introduction of computers into the ESOL class for use by the multi-cultural participants began in an experimental manner by teaching the basics (for example, learning mouse control and essential computer terminology). Accessing the Internet was then taught and sites relating to the immigrants' home countries accessed as well as English grammar and quiz. Users requested lessons in keyboard and this was delivered. The ESOL teacher plans to integrate computing further in her class by getting students to prepare a regular class newsletter, based on their "surfing" results.

Has Warschauer's model of Technology for Social Inclusion been realized at PINC? The four resources of Physical (computers and telecommunications), Digital (relevant content in diverse languages), Human (literacy and education) and Social (community and institutional support) are evident. Perhaps the strongest, and most important of these resources for e-government and the wider e-society, are the Human and the Social Resources. Literacy and education is a prominent feature and the involvement of community and institutional societal structures support the hub. Computing is going well at PINC with access freely available to the Internet and classes in applications. These are of benefit for particular functions and very rewarding to the users but the transformation is in the empowerment of people through engagement of the targeted clients within the Newtown community.

The question of whether a socially inclusive ICT initiative will lead to greater citizen participation in an e-society where e-government is increasingly disseminating information with the expectation of democratic involvement has yet to be decided. It is too early to say how inclusive community adoption of e-government will be. As has been noted by a number of researchers, there will probably always be the "resisters" and "rejecters" (Crump & McIlroy, 2003; Wyatt, Thomas & Terranova, 2002). However what is certain is that without community computing initiatives many people would not have the opportunity for acquiring skills and access would be very difficult. Without the basic foundation of exposing and preparing citizens for participation a large proportion of society would remain excluded.

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AN INTERNET BASED ARCHITECTURE FOR GROUP DECISION SUPPORT: TOWARDS E-DEMOCRACY

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ABSTRACT

We describe an Internet based architecture for group decision support and its implementation. The system allows for problem structuring, preference modelling, problem solving for each participant, negotiation in the event of disagreement and voting, if no agreement is reached. Its implications for e-democracy systems are described. We illustrate the ideas with participatory budget ellaboration.

KEYWORDS

Group decision support, Decision analysis, E-democracy

1. INTRODUCTION

Many authors have dwelt on the on-line support to democratic processes and how the nonhierarchical internal structure developed through Internet is changing the way people try to play games with the legislative process. Virtually, anyone can now send messages, tap into databases, and discuss every topic under the sun. As an example, Iowa Governor's Strategic Planning Council is collecting feedback via computer from Iowa residents on how the state government should be organized by the year 2010. However, most of the information is still held by governments and not accessible to the people. It is time to find out whether politics, as we know them, will soon change.

The world of the 21st century will be electronic and mobile. Last years of the last century clearly showed trends in this digitalization of society, specially as far as business is concerned with the advances in e-business and e-learning. It is therefore not surprising that this digital trend is affecting many other facets of life and thus concepts of e-government, e-procurement, e-administration, e-democracy,... are being debated and implemented in various senses, there being an increasing demand for participation in the public decision process.

Indeed, we could view Internet as an opportunity to bridge the gap between governors and governees. Our current democratic institutions stem from times in which transportation and communications were difficult and time consuming. With the time, politics have evolved little, and politicians have developed a style in which, except at political campaigns, there is little feedback from citizens. This may be stressed by, e.g., the movement towards a more United Europe, with a European Constitution, and citizens feeling that decisions are being made even farther from them. In a sense, our institutions are out of date not having been able to take advantage of novel technologies in a social sense. Think for example, on how little has affected technological changes to voting in rural areas or the voting scandals in the last Florida ballots.

We believe, however, that most ideas, so far, are directed towards traditional political methods enhanced or facilitated through new technologies: electronic voting or Internet voting, instead of voting with a piece of

paper; calling for demonstrations through e-mail or SMS (flashmobs), rather than through paper pamphlets; a political discussion forum, rather than a physical meeting,... Our feeling is that there are ways to transform (rather than facilitate) politics. A general review on the topic may be seen in Bannister (2003).

To wit, we describe here an architecture to distribute rationality, meaning facilitating the use of decision analysis methods, using the mechanisms of the web, to resolve political decision making. It is a tenet of ours that involving and communicating with the stakeholders at all stages of the process leads to better, more consensual decision making.

2. OUR ARCHITECTURE

We propose to migrate to Internet the methodology of decision conferencing, reviewed in McCartt and Rohrbough (1989), to support group decision processes, as illustrated in the Figure, which may be seen as an asynchronous Internet based implementation of decision conferences. Note that standard decision conferences are synchronous and could be implemented, e.g., through videoconferences. But, as we have said for other possibilities, that would be using new technologies for standard approaches.

Browsers on public and stakeholders machines to allow individual exploration of the models

Computer projection of model for consultation with stakeholder group(s), maybe downloaded and stand-alone

Master system controlling decision modelling for DM (and primary stakeholders) and including brainstorming and soft OR problem formulation tools. This is the system on which the decision analysts will work, building a family of interrelated models, which span the variety of perspectives of all stakeholder groups

Web server which provides active generation of pages allowing different stakeholders to see decision model from their perspectives, using AI to generate natural language explanations of the model's implications in their terms

Figure. Our architecture for asynchronous group decision support

The decision analysis would be carried out by a decision analyst or team of analysts on a master system for the problem owner (the president of a government, the CEO of a company, the mayor of a town,...). The system would provide support for the entire decision making cycle, using computer aided brainstorming, soft OR problem formulation techniques and various quantitative modelling techniques such as probability risk assessment tools, multi-attribute expected utility analysis and outranking methods, as appropriate to an application. At various stages of the process, some or all of the models would be fed onto a server, which could be accessed by different stakeholders and the general public. The level of access would vary from stakeholder to stakeholder and at different stages of the decision process. Initially, the server could provide pages simply stating that an issue was being addressed and, perhaps, inviting comments and submissions via email or through a bulletin board. Later, pages could be developed actively which allow users to interact with parts or all of the model to explore the implications of their individual perspectives and value

judgements. These explorations could be kept private if the user so wishes, but more usefully would provide the problem owner with a summary of the stakeholders' views in a format entirely compatible with the decision model. The interactions would be supported by the Internet.

The server would use AI explanation techniques and active pages to help the user understand the model and its implications in plain language, avoiding the use of language which may have unintentional emotional content (e.g., 'fright factors' identified in risk communication studies). Note that, typically, as the problem owner and the stakeholders would have different values and beliefs, they would opt for different alternatives. It might be beneficial, therefore, to enter in a negotiation round, in which a more consensual solution might be sought. This, again, may be supported through the web. Finally, in some contexts, it could happen that no consensus is reached and, in some cases, we would need to support some kind of voting scheme as a way to fix a course of action.

3. SYSTEM MODULES

The current implementation includes the following basic modules, integrated in a web based system using the LAMP environment:

3.1 Problem Structuring

The system includes a module that allows the problem owner to build an influence diagram, see French and Rios Insua (2000) to structure the incumbent decision making problem, in terms of uncertainty and decision nodes and a value node. Influence diagrams have proved effective structures to convey the meaning of a decision making problem to the general public. It is assumed that an analyst would aid the owner in building the diagram and that the stakeholders and other participants will use the same structure to explore issues concerning the problem.

3.2 Preference Modelling

The system includes a module that allows users to build their preference model. The certainty equivalence method is used, see French and Rios Insua (2000), as it relies on relatively simple questions and requires no assistance from an analyst. It is assumed that any user (problem owner, stakeholder) may build his own utility function for the problem at hand. Utility functions are privately assessed and are communicated to the system.

3.3 Problem Solving

The system includes a module that allows users to evaluate the influence diagram, based on his utility function, to obtain its preferred course of action. The problem owner may find out his optimal policies privately, as the stakeholders may do. If they so wish, they may make them public. Again no aid from an analyst is required for this step.

3.4 Negotiating

Typically, various parties involved (problem owner, stakeholders) will reach different optimal solutions. Consequently, a round of negotiations may be undertaken to try to reach a consensus. The negotiation is driven by our modification of the balanced increment method for influence diagrams, see Rios and Rios Insua (2004) and Raiffa (2002). At each iteration of the algorithm, a solution is offered to participants and, if accepted, it stops, that being a consensus. No assistance from an analyst is required.

3.5 Voting

Our (automatic) negotiating scheme converges to a nondominated solution, but it is conceivable that participants may not accept such solution, neither the sequence of solutions offered. In some cases, this deadlock may be solved through voting. For that reason, our system includes a voting module, which permits the design of a voting session, with several voting rules available, and its execution.

4. CONCLUSIONS

Rather than using new technologies to facilitate standard political decision making mechanisms, our scheme would radically modify them by allowing more participation from stakeholders, a more informed and transparent decision by the problem owner, and, even, a more consensual approach.

As case study, we are considering that of participatory budgets. Stemming from Porto Alegre experiences, many European municipalities, are increasingly allowing citizens to participate in discussions on how to spend part of the budgets. However, there is little methodology available to undertake such processes which, moreover, are usually conducted through physical meetings.

We may clearly model such problem as one of (limited) resource assignment in which citizens attempt to maximize their own (multiobjective) expected utility. This fits perfectly within our framework and, consequently, we envision using our system to support such processes. Besides avoiding physical meetings, we expect more focused and objective discussions to be held under our mechanism.

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AN INTERACTIVE E-NEGOTIATION BASED ON DECISION ANALYSIS

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ABSTRACT

Recent developments in Information and Communication Technologies and, specially, advances related to Internet, allow further public involvement in decision-making processes, paving the way for electronic democracy. In this paper, we propose an interactive process based on Monte Carlo simulation techniques for identifying a consensus alternative. The process considers decision-maker preferences and distinguishes between hard and soft negotiation. We study the most general case where the preferences of each decision maker are imprecise and represented by an imprecise additive multi-attribute utility function, which includes classes of utility functions and weight intervals for each attribute.

KEYWORDS

Decision Analysis, e-Democracy, Decision-Maker, Negotiation, Imprecise Additive Multi-Attribute Utility Function.

1. INTRODUCTION

Most major decisions have an impact on many stakeholders apart from the parties who are directly responsible for the decision and benefit from its outcomes. In such cases, many disparate viewpoints need to be brought together and balanced if an agreed course of action is to be reached and implemented. Coherent analysis and evaluation of complex decision problems necessarily involve weighing up multiple sources of uncertainty, highly conflicting objectives and multi-faceted preferences, and the integration of the opinions and wishes of disparate stakeholder groups.

In Mateos et al. (2004 an early version of the approach shown here) was presented. However, here we propose several improvements, such as: i) The way in which attribute weights and component utilities associated with a consequence are randomly generated taking into account decision-maker preferences. We now consider a probability density function, and we distinguish the so-called "hard" negotiation, Jelassi and Foroughi (1989) and Nunamaker et al. (1991), from "soft" negotiation. In hard negotiation, the goals of the negotiators are strongly opposed, while parties in soft negotiation want to reach a jointly beneficial solution; ii) The new approach provides a ranking of alternatives based on the *centroid function,* see Lahdelma and Salminen (2001) and Barron and Barret (1996).

We consider a multi-criteria group decision-making problem with d decision-makers, connected by Internet, where the relative importance of each decision-maker (DM) l is represented by the weight w_l. All DMs can use the *GMAA System* (http://www.dia.fi.upm.es/~ajimenez/GMAA), Jiménez (2002), Jiménez et al. (2003) and Mateos et al. (2003), to elicit their own preferences and they consider the same objective hierarchy with n attributes and the same set of s alternatives. Once the DM preferences have been quantified, the different alternatives under consideration can be evaluated by means of an imprecise additive multi-attribute utility function $u^l\left(S^j\right) = \sum_{i=1}^{n} k_i^l u_i^l\left(x_i^j\right)$, where $k_i^l \in \left[k_i^{lL}, k_i^{lU}\right]$ are the weights for the *i-th* attribute, $u_i^l(\cdot)$ are the utility functions into the class $\left[u_i^{lL}(\cdot), u_i^{lU}(\cdot)\right]$, and $x_i^j \in \left[x_i^{jL}, x_i^{jU}\right]$ are the consequences of the *j-th* alternative on the *i-th* attribute.

In this paper, we propose a method for outputting DM group preferences, depending on the group decision-making situation, soft or hard, when we have the preferences of each member of the group. An approach based on Monte Carlo simulation techniques is proposed as a starting point for a negotiation process. Throughout the simulations, alternative consequences, their associated utilities and attribute weights are drawn at random, taking into account the imprecise alternative consequences, the component utilities and weights, respectively. Taking these values and the centroid function, the expected values for the alternatives are calculated and used to rank the alternatives. The DM group can study whether the ranking is robust by viewing the multiple boxplot and the related statistics output from the simulation and can also find out which attribute should be considered first in the negotiation process to output the best alternative quickly using attribute divergence indexes.

2. INTERACTIVE E-NEGOTIATION

The interactive process consists of six stages. The process is initialized in stage 0. The number of DMs, the negotiation type, and the maximum number of simulations are inputs. In stage 1 the group preferences are assessed on the basis of the preferences of each DM. This stage is explained in section 3. In stage 2 the process outputs a ranking of alternatives based on their expected values, which are calculated by considering the probability of each alternative being ranked in each position and the centroid function. In stage 3, the process computes a multiple boxplot from statistics related to the ranking of alternatives, assessed in the simulation from stage 2. This multiple boxplot is useful for studying the robustness of the ranking. In stage 4, the process displays attribute divergence indexes to find out which of them should be first considered in the negotiation process. Finally, in stage 5, the DM group revises its preferences by tightening or widening some classes of utility functions and/or weight intervals to move towards a consensus.

Before starting with the process, we define two concepts that need to be clarified: *The expected value* for the alternative S^j is $E(S^j) = \sum_{k=1}^{s} p_k^j f(k)$, where p_k^j is the probability of the alternative S^j being ranked in the *k-th* position and $f(k)$ is the centroid function, see Lahdelma and Salminen (2001) and Barron and Barret (1996); *The attribute divergence index* is used to guide the negotiation process (soft situation) after the simulation process has been performed. Attributes will be revised in decreasing order with respect to the divergence index, see Mateos et al. (2004). The divergence index for the *i-th* attribute is defined as $D_i = \max_{j=1,\ldots,s} \left\{ u_i^{j+} - u_i^{j+} \right\}$, where $u_i^{j+} = \max_{m} \left\{ k_{mi} u_{mi}^j \right\}$ and $u_i^{j-} = \min_{m} \left\{ k_{mi} u_{mi}^j \right\}$.

The stages of the interactive e-negotiation process are as follows:

❖ *Stage 0 (Initialization).* Input the negotiation process type, d, w_i, $\forall i$, and *M*.
❖ *Stage 1 (Group preferences).* This stage is explained in section 3.
❖ *Stage 2 (Ranking).*
  ➢ *Step 0 (Initialization).* Let $D_i = 0$, $u_i^{j+} = 0$ and $u_i^{j-} = 1$, $\forall i, j$.
  ➢ *Step 1 (Simulation).* From $m = 1$ to *M*:
    ▪ From $i = 1$ to n generate a weight $k_{mi} \in I_{k_i}$, where I_{k_i} is defined in section 3.
    ▪ From $j = 1$ to s (for each alternative)
      • From $i = 1$ to n (for each attribute)
        ♦ Draw at random a consequence $x_{mi}^j \in \left[x_i^{jL}, x_i^{jU} \right]$.
        ♦ From the value x_{mi}^j, generate a utility $u_{mi}^j \in I_{u_i}\left(x_{mi}^j \right)$.
        ♦ If $k_{mi} u_{mi}^j > u_i^{j+}$ then $u_i^{j+} = k_{mi} u_{mi}^j$, but if $k_{mi} u_{mi}^j < u_i^{j-}$ then $u_i^{j-} = k_{mi} u_{mi}^j$.
        ♦ Compute and save the overall utility of alternative $S^j : u_m^j = \sum_{i=1}^{n} k_{mi} u_{mi}^j$.
      • If $D_i < u_i^{j+} - u_i^{j-}$, then $D_i = u_i^{j+} - u_i^{j-}$.
    ▪ Compute the strategies ranking for the current simulation and update statistics.

➢ *Step 2 (Ranking).* *D*isplay the ranking of the alternatives based on the values $E\left(S^{j}\right)$.
❖ *Stage 3 (Ranking Robustness).* Display the multiple boxplot and the related statistics. If the negotiation process is hard or all DMs agree with the ranking, the process ends.
❖ *Stage 4 (Help).* Display the attribute divergence indexes.
❖ *Stage 5 (e-negotiation process).* The DM group revises their preferences by tightening or widening some classes of utility function and/or weight intervals to move towards a consensus.

3. CALCULATING GROUP PREFERENCES

We only consider the weight interval because to work with the class of utility functions is analogous. For each DM l and for each attribute i, a weight interval $I_{k_i}^l \equiv \left[k_i^{lL}, k_i^{lU}\right]$ and a class of utility functions $I_{u_i(\cdot)}^l = \left[u_i^{lL}(\cdot), u_i^{lU}(\cdot)\right]$ are available.

3.1 Hard Negotiation

In hard negotiation the goals of the negotiators are strongly opposed and the negotiation process is not easy. We have the following two possibilities:
1. If the intersection between the weight intervals is not empty at least at one point, then values will be generated by a uniform distribution function over $I_{k_i} = \bigcap_{l=1}^d I_{k_i}^l$, because I_{k_i} is where the group agrees.
2. If the intersection between the weight intervals is empty, (for three DMs). We have the following cases:
   2.1. If $I_{k_i}^1 \bigcap I_{k_i}^2 = I_{k_i}^1 \bigcap I_{k_i}^3 = I_{k_i}^2 \bigcap I_{k_i}^3 = \phi$, then $I_{k_i} = \bigcup_{l=1}^3 I_{k_i}^l$. Values will be randomly generated from $I_{k_i}^1$, $I_{k_i}^2$ and $I_{k_i}^3$ with a probability of w_1, w_2 and w_3, respectively.
   2.2. If $I_{k_i}^1 \bigcap I_{k_i}^2 \neq \phi$ and $I_{k_i}^1 \bigcap I_{k_i}^3 = I_{k_i}^2 \bigcap I_{k_i}^3 = \phi$, then $I_{k_i} = \left(I_{k_i}^1 \bigcap I_{k_i}^2\right) \bigcup I_{k_i}^3$. Values will be generated from $I_{k_i}^1 \bigcap I_{k_i}^2$ and $I_{k_i}^3$ with a probability of $w_1 + w_2$ and w_3, respectively.
   2.3. If $I_{k_i}^1 \bigcap I_{k_i}^2 \neq \phi$, $I_{k_i}^1 \bigcap I_{k_i}^3 = \phi$ and $I_{k_i}^2 \bigcap I_{k_i}^3 \neq \phi$, then $I_{k_i} = \left(I_{k_i}^1 \bigcap I_{k_i}^2\right) \bigcup \left(I_{k_i}^2 \bigcap I_{k_i}^3\right)$. Values will be randomly generated from $I_{k_i}^1 \bigcap I_{k_i}^2$ with a probability of $p = w_1 + \left(k_i^{1U} - k_i^{2L}\right) w_2 / \left[\left(k_i^{1U} - k_i^{2L}\right) + \left(k_i^{2U} - k_i^{3L}\right)\right]$ and from $I_{k_i}^2 \bigcap I_{k_i}^3$ with *1-p*.

We would proceed similarly in the general case with more than three DMs.

3.2 Soft Negotiation

In soft negotiation, parties want to reach a jointly beneficial solution. We have two possibilities:
1. If the intersection between the weight intervals is not empty at least at one point, then $I_{k_i} = \bigcap_{l=1}^d I_{k_i}^l$. It is the same as hard negotiation, because it is the interval where the group agrees.
2. If the intersection between the weight intervals is empty, then we have the following cases:
   2.1. If $I_{k_i}^1 \bigcap I_{k_i}^2 = I_{k_i}^1 \bigcap I_{k_i}^3 = I_{k_i}^2 \bigcap I_{k_i}^3 = \phi$, then $I_{k_i} = \left[k_i^{1L}, k_i^{3U}\right]$ and values will be randomly generated from I_{k_i} with the probability density function $f\left(k_i\right)$, see Figure 1 a).
   2.2. If $I_{k_i}^1 \bigcap I_{k_i}^2 \neq \phi$ and $I_{k_i}^1 \bigcap I_{k_i}^3 = I_{k_i}^2 \bigcap I_{k_i}^3 = \phi$, then $I_{k_i} = \left[k_i^{1L}, k_i^{3U}\right]$, and values will be randomly generated from I_{k_i} with the probability density function $f\left(k_i\right)$, see Figure 1 b).
   2.3. If $I_{k_i}^1 \bigcap I_{k_i}^2 \neq \phi$, $I_{k_i}^1 \bigcap I_{k_i}^3 = \phi$ and $I_{k_i}^2 \bigcap I_{k_i}^3 \neq \phi$, then $I_{k_i} = \left[k_i^{2L}, k_i^{2U}\right]$, and values will be randomly generated from I_{k_i} with the probability density function $f\left(k_i\right)$, see Figure 1 c).
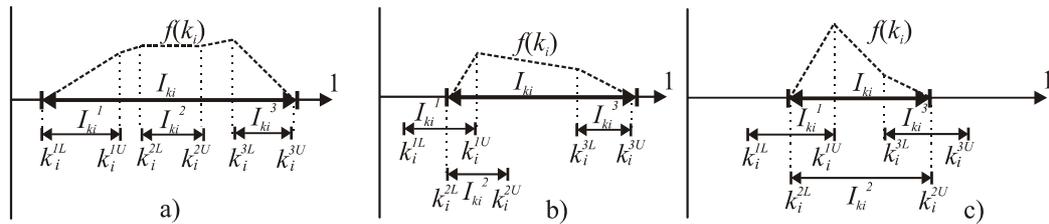
Figure 1. Probability density functions

4. CONCLUSIONS

We have proposed an e-negotiation method that has the following advantages. This method considers the most general case, when there is incomplete information. It outputs DM group preferences, depending on the group decision-making situation, hard or soft, from the preferences of each member of the group. The method ranks the alternatives and it shows the robustness of the ranking. Finally, it outputs the negotiation process that will reach a consensus alternative quickly. However, this approach has a limitation: the computational complexity is high when the number of group members is large because there are very many combinations of interval intersections. This approach can be applied to almost all e-society-related topics provided the number of DMs is not very large.

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MIGRATING PUBLIC ADMINISTRATIONS TO OPEN SOURCE SOFTWARE

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ABSTRACT

In this paper we present some experiences of Public Administrations migrating to Open Source Software and we discuss a project which addresses the migration issue at large. In particular, we discuss COSPA, a research project aimed at studying and supporting the introduction of open source software in the Public Administration. COSPA focuses on office automation and desktop system software and aims at rigorously measuring the effort, costs and benefits of a transition to Open Source. The results of the study would help Public Administration's managers in their strategic decisions for implementing eGovernment services. The project has also established an "observer" status, by means of which interested parties may access COSPA's results, thereby fostering collaboration and increasing dissemination of knowledge.

KEYWORDS

Open source, government, migration, TCO, ROI.

1. INTRODUCTION

Open Source Software (OSS) has recently reached a non-marginal level of diffusion. Linux and the Apache web server are found in respectively 30% and 66% of the Internet's public servers, according to Netcraft's survey (Netcraft, 2004). It is also well-known that half of the world's emails are routed by OSS such as Sendmail and Postfix. We thus have some evidence that OSS can work well, at least for the server side of a client-server architecture. On the other hand, the recent FLOSS project (FLOSS, 2002) of the European Union showed that OSS is seldom used for desktop tasks. In particular, OSS for desktop applications (e.g. client operating systems, office automation, etc.) is employed only by 5% of European public institutions and businesses. If we further restrict to the use of OS office automation software that percentage drops to a mere 2%.

The difference with system software is indeed striking and it has attracted the interest of researchers. Some authors suggest that the difference is due to the fact that developers of OS system software "*knew what they were doing and how to do it*" (Fuggetta, 2003). In the case of Linux, the group of developers headed by Torvalds had a clear idea of the requirements of the system being developed, plus they all shared knowledge of the Unix structure (Raymond, 2001). Another reason for the difference in popularity between desktop and system OSS is the fact that the former is actually much younger, and therefore it has not benefited from the same amount of user testing and feedback as OS system software has had.

However, as we report in the next section, there is some qualitative evidence that OSS can be successfully employed even for desktop tasks. In particular we briefly report about a transition to desktop OSS in the Municipalities of the Province of Bolzano-Bozen, Italy. The transition focused mainly on the OpenOffice desktop suite. The experience indicated that tackling correctly personnel resistance to change may be the most important factor for a successful transition. Effective training and support are other important factors, while technical or functional problems seem to be quite marginal.

That experience served as qualitative basis for a follow-up project at a higher level, the COSPA project. An hypothetical deployment of OSS for desktop applications in a corporate environment, such as Public Administrations (PA), might be hampered by:

- cost of transition from previous solutions (data migration, hardware migration, etc.);

- interoperability and integration with existing solutions (compatibility of standards, etc.);
- cost of training personnel for the new tools and hostility to change (fear of the unknown, CV dilution effect, etc.);
- reduced productivity of the personnel (caused by the new tools).

COSPA aims at studying those issues under a quantitative perspective, in order to provide real numbers of the effort, cost and benefits of a transition to OSS. As far as independent studies on OSS are concerned, we observe a substantial lack. The main effort is the FLOSS project in the 5th EU Framework Programme, which only painted a state of the art of OSS use in Europe.

2. AN EXPERIMENT OF MIGRATION TO OSS

We report on the transition to Open Source Software in several municipalities of the Province of Bolzano-Bozen, Italy. In particular, the transition focused on OpenOffice (OpenOffice.org), a suite of key desktop applications which includes a word processor, a spreadsheet, a presentation manager and a drawing program. The migration experiment was performed by the Consortium of the Municipalities of the Province of Bolzano-Bozen.

The transition started in January 2003 and so far it has involved sixty municipalities and about 1,800 desktop PCs. The latter is the number of PCs where OpenOffice (OO) has been deployed, leaving intact the existing user environment (e.g. MS Windows, MS Office, etc). The transition follows a three-step method:

1. visiting the "candidate" site for the transition;
2. hardware/software set up (OO deployment, etc);
3. personnel training.

The visit to the site subject of the transition aims at introducing personnel to OO and its advantages/disadvantages over MS Office. Furthermore, a work plan for the deployment of the software is established. OO is deployed using a customised package containing components which are not found in the download version, for example language dictionaries[1]. The package installs the software in predefined pathnames and also uninstalls any previous version of OO, in order to have the same "disk image" across systems. That also allows a completely remote update of the software. As mentioned, existing software (MS Office in particular) is not removed until expiration of the license. Next, the most used documents are converted on-site to OO format.

Finally, municipalities' personnel are trained on OO. Training was performed off-site and a total of sixty-seven courses were given in 2003. Courses' length ranged from half-day introductory to two-day intensive sessions. Training was delivered in collaboration with local IT firms.

The lessons learnt from the experience may be summarised as follows:

1. The biggest problem appears to be personnel's resistance to change: the introduction of the new technology it often seen a burden in addition to every day's work. Personnel have to be persuaded that the new tools, after some training, can provide features that allow faster and easier work.
2. The "brute force" method does not work: *i.e.* installing OO and wiping the previous tools out (*e.g.* MS Office) will only result in a even stronger resistance to change. Personnel need time to adapt to the new software.
3. Personnel should be able to produce right after the training: it is crucial to complete set up and test of the work stations before training begins. A delay between training and productive work with the new tools will diminish the effect of the training itself.
4. Converting MS Office macros is in general very difficult. This is perhaps the biggest technical problem encountered, also due to the scarcity of documentation on OO macro development.
5. It is very important for personnel to have a reference point for any problem connected to the transition. This could well be a "champion" inside the same institution, *i.e.* an employee who is enthusiastic of the new tools and might serve as a guide to other employees.
6. The features offered by OO seemed to be more than adequate for the every day's needs of the municipalities.

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[1] OpenOffice 1.1.1, released in March 2004, features an automated tool for downloading and installing any dictionary.

The lessons learnt agree with other studies, such as the IDA Open Source Migration Guidelines (MIGOSS, 2003). In particular, all lessons but 3 and 6 are in line with IDA's recommendations; the issue of training is not fully addressed in the IDA work, so there is no corresponding party for lesson 3. With respect to lesson 6, we note that most municipalities of our experience have quite small population (a few thousands people) so it might be that the scale of problems addressed is feasible for OpenOffice's features.

Overall, this experiment has qualitatively proved that a transition to OS desktop software is indeed possible and may be successful. However, we have no measures of the effort, cost and benefits of such a transition. A quantitative characterization of the process would be helpful for Public Administrations' managers in order to better decide on the use of OSS and better allocate resources for an eventual migration. The issue is addressed at European level in the COSPA project.

3.   THE COSPA PROJECT

The Project aims at introducing, analysing, and supporting the use of Open Data Standards (ODS) and Open Source (OS) software for personal productivity and document management in European Public Administrations (PA).

The Project will analyse and support the introduction of ODS and OS solutions in the PA by:
1.   Deploying ODS and OS software solutions in several European PAs, and benchmarking their effectiveness through a cost/benefit analysis;
2.   Building a European, multilingual, freely-accessible knowledge and experience base by comparing and pooling knowledge;
3.   Disseminating the results and the experiences of the study through a series of workshops at regional and European level.
4.   In particular, the Project focuses on software for office automation and personal productivity, mainly OpenOffice and Linux for desktops.

COSPA is funded with 2,6 million euro by the 6th Framework Programme (FP6) of the European Union and will run from January 2004 to December 2005. The Consortium is made of fifteen European universities and Public Administrations from Belgium, Denmark, Hungary, Ireland, Italy and UK. The structure of the Consortium is centered on university-PA couples. In fact, every PA is co-located with an academic partner, in order to constantly follow the evolution of the transition to OSS.

3.1 Work Plan

The work plan of the project can be divided in five main activities:
1.   gathering and analysis of user requirements from the partner PAs, in order to identify and combine OS software and ODS which fulfill the PA requirements;
2.   pilot projects for deploying in the partner PAs the OS desktop solutions developed on the basis of the previous requirement study, in order to enable the subsequent cost/benefit analysis. Deployment will follow a two-step strategy: in the first step the focus is on desktop applications only (mainly OpenOffice). In the second step desktop operating systems (Linux) are also dealt with;
3.   benchmarking of the deployed OS solutions, through a statistical and cost/benefit analysis. Financial, economic, reliability, effort, cost, and time aspects will be considered and integrated;
4.   building a European knowledge and experience repository by comparing and pooling knowledge acquired in the previous phases of the project. The knowledge base will be placed on the Internet and made freely accessible;
5.   dissemination of the results and the experiences of the project through the knowledge base and a series of workshops at regional and European level.

3.2 Pilot Projects

Activity 2 is the crucial phase of the project. Its objective is to run experiments on the introduction of OSS in the partner PAs, and to benchmark the effectiveness of the deployed OS solutions through a statistical and cost/benefit analysis. The analysis will consider financial, economic, reliability, effort, cost, and time aspects.

Data on usage and satisfaction will be collected in the partner PAs by the universities, both manually and automatically. The automatic data collection of process and product metrics (Humprey, 1997 and Fenton and Pfleeger, 1994) is carried out using the PROM tool (Sillitti et al, 2003). PROM allows a fully automatic and non-invasive extraction of product and process metrics, such as time spent on editing a specific document, or effort spent on a project. In that way it is possible to set up comparative experiments on the usage of proprietary and OS software, in order to quantitatively characterize the transition to OSS.

The results of the pilot project phase would also be of great interest to OSS developers, as they could check how their applications and tools perform in a corporate environment.

3.3 Observers

In order to increase dissemination of knowledge and to promote best practices in Public Administrations, the Consortium has established the role of observer. An observer can access the project's results and experiences in a privileged way. It may also attend project meetings and thus give useful advises on the implementation of the project itself. At the time of writing COSPA has more than forty observers, among which the University of Alberta (Canada), Victoria University of Wellington (New Zealand) and UNESCO. New observers may join COSPA at any time. On the project's website (COSPA) it is available the application form for becoming a COSPA observer.

4. CONCLUSION

Successful OSS seems to be so far confined in the system software area, of which Linux, Apache and Sendmail are notable examples. Desktop OSS does not seem share the same amount of popularity. We reported about a trial transition to OSS for desktop applications in local authorities. The success of the experiment has proved that use of OSS on the client side is indeed possible, as recognised by other experiences. However, we had no measures of the effort, cost and benefits of such a transition. A quantitative characterization of the process would be helpful for Public Administrations' managers, in order to establish the advantages, drawbacks and feasibility of a transition. The issue is addressed at European level in an ongoing research project..

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FROM DIGITAL CITY TO DIGITAL REGION - THE PORTUGUESE APPROACH

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ABSTRACT

This paper is a first approach to a research about the introduction, development and impact of the e-government in local authorities in Portugal, the way it has been implemented and the problems that have been detected.

The evolution of one of the international concepts of digital city, to the implementation of a digital region, in simultaneous with the introduction of the governance at intermunicipal level, using some examples.

It also concerns the impact it will have in urban and regional planning and management, namely in the access that the population will have to these services.

KEYWORDS

Portugal, Digital regions, Digital cities, POSI, local cabinets

1. INTRODUCTION

It is in the scope of the evolution of the industrial to the pos-industrial society that we must frame the introduction of the Internet as a new way of communication within the society, together with a general improvement of school qualifications of the population, and the wish of a larger participation of the population in local decisions.

The concept of digital cities comes from the United States, from political visions and from local spontaneous initiatives. Those ideas are connected with the Community (relations and social links between people that share the same interests and values) and the City (the administrative relations, the links between citizens, policy makers and the local administration) (BASTELAER and LOBET-MARIS, 1999).

Local communities went on-line since the middle 80's; in general they linked three different components: the pre-Internet grassroots movements, the hacker movement and municipal government who tried to strengthen their legitimacy by creating new channels of citizen participation. Social entrepreneurs emerged as leaders of many of these projects.

The different concepts of digital cities can be grouped under three major characteristics:

- They provide information from local authorities, from a variety of civic associations and they became a technologically updated bulletin board of city life
- They organized the horizontal exchange of information and electronic conversation among the participants in the network
- They allowed access to on-line networking to people and organizations that were not into the emerging Internet, and would otherwise not have been connected for quite a long time (CASTELLS, 2001).

2. THE IMPLEMENTATION OF DIGITAL CITIES IN PORTUGAL

The first time the concept of Digital city had been used in Portugal was in 1998, when the government implemented a pilot program for the development of Digital Cities, along with the spreading of the use of Internet in the country.

This process came together with the introduction the notion of e-government at local level, with interesting experiences in Aveiro, a city in the littoral center with a University and a Telecommunications Research Center, that integrated public services through telematic networks, improving city life in all aspects, and Castelo Branco, a city in the inner center, where the main objective was to fight the effects of inland location involving some areas of the community like health services.

In these pilot projects we had other sort of experiences namely digital regions like in Tras-os-Montes e Alto Douro, the northeast region of Portugal, where the project was developed by the University (UTAD) promoting the regional development disseminating local cabinets to support the use of Internet in small villages, these were one of the ways to diffuse the use of a new infrastructure in areas with few educated population.

Following the experimental period of 1998-2000 the development of this area was supported by the 3rd Community Support Framework within the Regional Development Programme 2000-2006.

It was then created the Operational Program for the "Information Society" (POSI) (Final approval 28 July 2000) under the Ministry of Science and Technology with a total budget of 625.035 euros co-financed by ERDF, ESF and national funds.

It was organized according to three priorities and eight measures:

Priority 1: Skills development[1]: 1.1 basic skills, 1.2-advanced formation, 1.3 R&D

Priority 2: Digital Portugal[2]: 2.1 accessibility, 2.2 contents, 2.3 integrated projects: from digital cities to digital Portugal, 2.4 integrated actions of formation

Priority 3: Modernizing Public Administration (MCT, 2000)

It was in the scope of priority II measure 2.3, Cities and Digital Regions, as it received 37% of the financing of the program, that were approved since 2001, projects to promote among other areas, the development of e-government at the level of local government.

At this stage, two types of project were promoted:

-Mainly urban, developed within a municipality, all with more then 120.000 habitants (ex: Gaia, Almada and Maia)

-At a regional level (Portugal don't have regions with administrative autonomy) where a number of communities get together, in order to implement, within economy of scale, the use of Internet through the supply of information and the offer of some municipal services. (ex.: Trás-os-Montes, Ribatejo, Portalegre and Madeira)

All of them intend to reduce administrative bureaucracy connect the population with some services in the area of education ,health and culture, support touristic information and show interest in presenting cartographical information using GIS.

3.   FROM DIGITAL CITIES TO DIGITAL REGIONS

The switch of government in March 2002 (election of the coalition government Durão Barroso PSD – CDS/PP) brought a change in the political objectives of the Program, mainly in the measure 2.3.

The projects mainly urban, and developed by each municipality lose ground to projects within the sub-regional scope controlled by supra municipal entities. (Ex: Associations of municipalities); the concern with the territorial cohesion along with the generalized spread of municipal services, is the main element along

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[1] The development of skills in information technology will be achieved through professional training courses with certification at various levels, study grants for special university students, and the setting-up of a national institute providing training programmers in various knowledge areas which also carries out R&D activities in conjunction with companies and education institutions.

[2] These measures will aim at increasing the population's use of computer and the internet, connecting all primary schools to the internet, promoting the use of high debit networks, and encouraging the availability of public information in digital format. At the same time, this priority will focus on networking projects with the participation of as many cities as possible in order to provide better health services, reduce staffing in the bureaucracy, increase work capacity, simplify and make transparent the decision making procedures, increase access to professional training, make e-commerce more secure, and provide support to those citizen with special needs.

with the visibility given to the economic activities of the areas of the projects through representative business associations.

The city of Aveiro that had a digital city pilot project in the period 1998/2000, with several areas like education, health, social solidarity, culture and e-government at local level is spreading the knowledge developed in the first project to implement a regional project with all areas.

The city of Castelo Branco developed an exchange with a Polish city interested in the way this Portuguese city use the Internet inside local authority.

The new sub regional projects lose some ability to innovation that is inside the spirit of the competition between cities and bring inside the competition between municipalities. They should try to offer something different from one to another in the innovation perspective which was in mind when the projects were under the control of the Ministry of Science and Technology. With these political objectives they are more engaged in the cohesion seen as homogeneity of the space.

In the case of Ribatejo, the necessity of computerize and homogenize the group of local authorities is a priority before the development of the second part of the project. This necessity takes visibily to the other parts of the project.

In Tras-os-Montes project the most interesting part is, by one side, the development of local cabinet and by other side, the health sub project where an hospital connects with the health centers in the municipalities, to support medical diagnostic in some specialties saving the population to travel sometimes more then 100 Km.

A few months ago was created a guide to help the organization of the projects allowing their promoters to choose which areas they wanted to develop constraining them under uniformised procedures.

Within this new instrument of the policy to the information society, any further innovation became more difficult along with the implementation of this new form of governance.

But, as it was referred before, till March 2004, Portugal didn't have any sort of regional institution really able to control this sort of projects. Some of the proposals are mediated by Associations of Regional Development which have not been very well succeed in implementing cohesion between the regional organizations.

The Associations of Municipalities are organizations of the local authorities that can hardly have the control of entrepreneurial organizations or of Universities of the region, which must be in the project.

Some of the first project concerning digital regions created special associations born to lead the project consisting so far the most interesting form of organization. Nevertheless not all the organizations of the region are there or even all municipalities.

4. CONCLUSION (THE FUTURE OF THE PROJECTS)

Last April was implemented a new organization of supra municipal areas which can change the future of digital regions. This sort of projects can be a very interesting instrument to develop new regional authorities organized in modern terms.

At same time all projects have been concerned with the poor ability of the population, specially in rural areas were most of the people is few educates and old, to use these new technologies and intend to create special places, with an interlocutor, where the local population has support to use services in the Internet (the project of Tras-os-Montes, developed this area in a very interesting way).

The digital region projects have in general a critical factor of success concerned the evolution of the distribution of broad band in the territory.

This is particularly important because the most extended projects are in depressed regions with very little access to broad band so, with a very slow and unsophisticated use of Internet.

Some of the Associations of Municipalities that exist now are the embryos of new authorities and at same time are developing and implementing projects of digital regions.

In these new times, planning can have an important role, because local authorities are interested in the implementation of GIS to plan and control these larger territories. They can appeal to the participation of the population to the planning process as a way to create a new identity in these new territorial divisions, by other side some regional services concentrated from municipalities will be more faraway to the population and the use of Internet will be very convenient.

Most of the Digital region projects are now in the implementation period, some already have a site, but some others did not create it yet. It will be need some more time to be possible to take conclusions of the best practice in the development and implementation of this kind of projects.

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Sites of Portuguese digital regions:
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http://www.madeiradigital.pt/
http://www.portalegredigital.pt/

COOPERATIVE LOCAL GOVERNMENT INFORMATION SYSTEMS

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ABSTRACT

This paper presents a prototypal framework which allows cooperation among Local Governments Information Systems. To achieve this goal it adopts the Service-oriented and the Event-driven architecture based on the Web Services technology. The framework is build on an open architecture composed by four levels and on an architectural element called "Cooperative Gate".

KEYWORDS

E-Government, Cooperative Information System, Service-oriented architecture, Event-driven architecture, Web Services.

1. INTRODUCTION

In last years, emerging technologies are transforming society and developments in Information Technology are significantly changing how individuals, public and private sector deal with information. There are new and better ways of presenting, analyzing and selling information. Nowadays, enterprises and Local Government that are developing distributed solutions are adopting the Service-oriented architecture and the Web Services technology. Local Governments that want to operate in real time must adopt event-oriented design, message-oriented middleware and publish-and-subscribe communication. Event-driven and Service-oriented architectures are compatible but distinct concepts, each with its own advantages and limitations. Local Governments need both them.

2. BACKGROUND

2.1 Service Oriented Architecture

Service-oriented architecture (SOA) is a concept specifying that an application can be made up from a set of independent but cooperating subsystems or services. Such a framework isolates each service and exposes

only the necessary declared interfaces to other services. The SOA model isolates aspects of an application so that, as technology changes, services (components) can be independently updated, limiting the impact of changes and updates to a manageable scope. Managing change is an important benefit of leveraging component architectures and models. Today there are many collaboration techniques but they vary from one case to another and are often owner solutions or systems that collaborate without any vision or architecture. A shift towards a *service-oriented* approach not only standardizes interactions, but also allows for more flexibility in the process. The complete value chain within an organization is divided into small modular functional units, or services. A service-oriented architecture thus has to focus on how services are described and organized to support their dynamic, automated discovery and use.

2.2 Event Driven Architecture

Event-driven architecture (EDA) is an approach for designing and building applications in which events trigger messages to be sent between independent software modules that are completely unaware of each other. An event source typically sends messages to the middleware, and the middleware matches the messages to the subscription criteria of programs that want to be notified of the events. EDA applications are intended for situations where a single message is required by, and should be distributed to, multiple users. Their big advantage over other delivery methods is that they keep the source separated from the destination. This means that the source in an EDA application doesn't need to have any knowledge of either the destination's existence or the systems that may use the information. Likewise, the destination doesn't need to know anything about the source system. Messages are typically sent using the publish-and-subscribe approach because this enables the simultaneous delivery of messages to multiple destinations. A simple publish/subscribe [1] application has one or more publishers who publish messages from an application to a broker, and a group of subscribers who subscribe to some or all of those published messages that are held on the broker. The system matches the publications to the subscribers and ensures that all the messages are made available and delivered to all the subscribers in a timely manner.

3. THE FRAMEWORK

Local Governments have to manage and accede to large amounts of information and computing services and need to cooperate with each other. To create a distributed environment where Local Governments can exchange documents and cooperate at application level, the framework has been built on a virtual private network [8] that uses "Cooperative Gates". These interfaces, based on Web services technology, transform LGs legacy Information Systems in Cooperative Systems able to cooperate among them (Figure 1). A Cooperative Architecture's Information System [9] consists of numerous components distributed over large, complex computer and communication networks (e.g., Intranets, the Internet, the World Wide Web) that work together, requesting and sharing information, constraints, and goals [10].
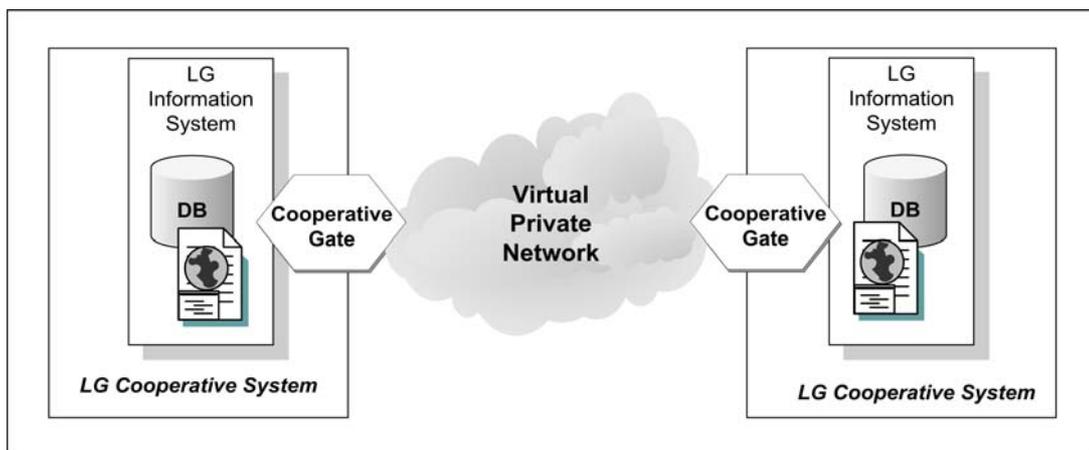
Figure 1. Local Government Cooperative Architecture

The framework, developed in J2EE [14], is based on an open architecture composed by four levels (Figure 2):

Client Tier: this tier is composed by other LGs Cooperative Systems that can communicate in a multi-channel way (Personal Computer, Personal Digital Assistant, Cellular,..).

Cooperation Tier: the main purpose of this tier is to accept requests coming from the Client Tier, by providing a single access interface. The different interaction modes with other Local Government Cooperative Systems are managed by the components of this tier. By adopting the Service-oriented architecture[2] and the Event-driven architecture [13] this tier enables to both the synchronous and the asynchronous types of communication. The support for SOA is provided by the Service Provider, the Service Requestor and the Service Broker, while the support for EDA by the Event Publisher, the Event Subscriber and the Event Broker. All these components are based on Web Services technology. A Web service is a software system designed to support interoperable machine-to-machine interaction over a network [15]. It has an interface described in a machine-processable format (specifically WSDL). Other systems interact with the Web service in a manner prescribed by its description using SOAP messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards [16]. The Web service model is completely independent from the program language, the platform and the model of the objects eventually used. The most recent specifications of this technology support both a Service Oriented and an Event Driven paradigm [3].

Service Tier: this tier supplies the business logic for the Cooperation tier through Façade services. Each façade service manages, by using a workflow engine [7], the interactions among one or more E-Government services coming from the Legacy Tier [5],[11] and hides the complexity of the process. The workflow engine, based on the BPEL4WS standard [4], describes how services can interact at the message level, including the business logic and execution order of the interactions. E-Government services call legacy applications and data in the LG Information System through a Connector Framework. The connection to the legacy applications and data is obtained by using connector (wrapper) [6] based on SOAP, EJB, and MQ technologies. Enterprise JavaBeans (EJB) technology [14] is the server-side component architecture for the Java 2 Platform, Enterprise Edition (J2EE) platform. EJB technology enables rapid and simplified development of distributed, transactional, secure and portable applications based on Java technology. WebSphere MQ [12] is a technology that enables application integration by allowing business applications to exchange information across different platforms, sending and receiving data as messages.

Legacy Tier: this tier is composed by legacy data and applications present in the LG Information System. This tier is usually composed by heterogeneous applications (e.g. Tax payment, Registry, Accounting,..).
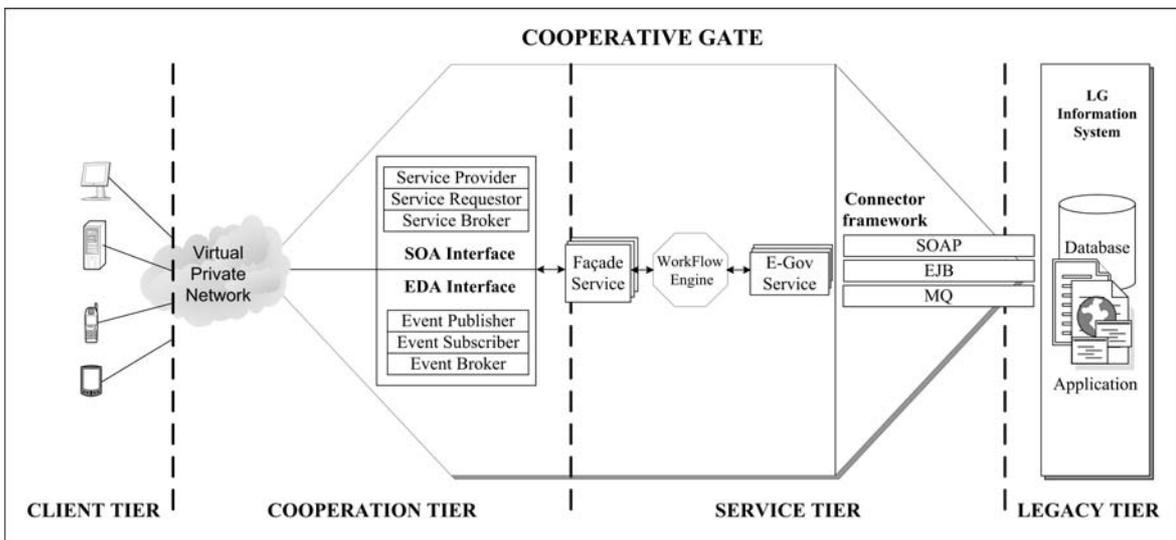
Figure 2. Cooperative Gate and framework architecture

4. CONCLUSION

The study has presented a framework that goes beyond the usual interoperability services and enables Local Governments to new cooperation scenarios by adopting both the Service-oriented architecture and the Event-driven architecture. Each Cooperative Gate exposes integrated and cooperative services to citizens and other Local Governments through a single point of access. Moreover, the proposed framework, composed by four levels and based on open standard, allows reusing of legacy applications and sharing of them in a Local Government network. A network formed by Local Governments that use this framework can realize a real business process reengineering and supply better services towards community.

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BRIDGING THE GAP BETWEEN HTML AND XML FOR ACCESSIBLE WEB SITE GENERATION

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ABSTRACT

From the point of view of accessibility, it is extremely important to separate content & structure from presentation in web pages. That way, the same content can be presented differently to meet the needs and constraints of different users without loss of information or structure. The traditional use of HTML is centered in presentation but lacking in content structuring. XML, on the contrary, focuses exclusively on content structuring but is not a friendly format and needs some transformation to be human-readable. In this paper we propose the structural use of HTML as a way to bridge the gap between both languages. We will show that this way of authoring web pages will help users with special needs (blind, low-vision, colorblind, deaf, motor-impaired, and cognitively-challenged) access to the web in a practical way.

KEYWORDS

Web Accessibility, Web standards, Design for all, HTML, XML, CSS

1. INTRODUCTION

One of the main concerns in web accessibility as stated in the WCAG[1], is the separation of content and structure from presentation. This separation allows web pages to be presented differently to meet the needs and constraints of different users without losing any of the information or structure. In other words, it will allow web servers to provide the same content in several alternative ways by just switching the presentation pattern (accommodating large fonts, special colors, high contrast, etc.). Thus, people using different browsing tools (screen readers or Braille tactile feedback devices for the blind, text browsers, etc), different input interfaces (switches for motor-impaired) or even different devices (PDA or mobile phones) will be able to access the same content just by selecting the appropriate presentation they need. A set of scenarios describing people with disabilities using the web can be found at Brewer J.

The fact of centralizing content as opposed to the creation of multiple alternative versions of each page will also assure that all users have access to the same information regardless of how they access it and will avoid the not unusual experience of web sites with poor or out of date alternative "accessible" web pages.

In this paper we describe a simple implementation of the WAI recommendations through a strict use of HTML in order to achieve this desired separation between content and presentation and the consequent high level of accessibility. As we will show, accessible web authoring relies on well known standards, that's why our approach can be seen as a good practice example in the creation and maintenance of accessible web sites rather than an innovative solution to an old problem. Technologies allowing accessible design already exist, it's then a matter of using them. We also want to point out that the approach presented here particularly fits small and medium sized web sites for which solutions based on XML publishing frameworks are too heavy.

This paper is organized as follows: Section 2 describes briefly both HTML and XML and highlights the main differences between them. Section 3 describes our approach to structural use of HTML with some examples. Section 4 explains how structural HTML documents are associated specific presentations with style patterns and finally section 5 comments the results and conclusions of our experience.

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[1] Web Content Accessibility Guidelines (Chisholm et al.)

2.   HTML AND XML

Basically, HTML was designed to display data and focuses on how data looks. On the contrary, XML as described in Bray T. et al. was designed to describe the structure of data and then focuses on what data is. It is true that version 4 of HTML by Raggett et al. deprecated many presentational features from older versions and added hooks for style sheets, encouraging the separation of a document's structure from its presentation. But the real situation seven years later is that almost all web sites still mix this two concepts and use HTML as a layout and presentation language in a "traditional way" misusing these possibilities.

An ideal scenario such as the one provided by XML-based publishing frameworks like Cocoon (http://cocoon.apache.org/) would completely separate content from presentation, but it is not always possible nor advisable to deploy these kind of solutions for small and medium sized web sites because they are normally unaffordable in terms of complexity and developing time, skills and effort. So, to bridge the gap between XML's structure orientation and HTML's presentation orientation, we propose an intermediate solution that relies on standards and is easy to implement and maintain.

3.   USING HTML STRUCTURALLY

Unlike XML, HTML does not allow the creation of user defined elements (where lies the structuring power of XML) and we have to adhere to the specification to create valid HTML documents. What we suggest in this paper is to simulate the utilization of user defined elements with the DIV tag, which is a generic block-level HTML element, used for defining sections of content inside the page.

Our starting point is quite simple, we will create our web pages using only a subset of standard HTML elements. Just structural ones will be allowed, basically generic block-level elements and lists, and all font style elements and tables will be banned. All layout and presentation stuff will be delegated to CSS style sheets described in Wium Lie et al. and we will try to create "style-free" or "pure content" documents. The basic bridging rule between Structural HTML and XML is informally described as follows:

> **A generic XML element like <elementName id= "elementid"> … </elementName> will be simulated by an "equivalent" structural HTML construct like <div class="elementName" id="elementid"> … </div>.**

The following code shows an example of this idea.

Example 1:

```
<div class="member" id="member1">
    <div class="membername" id="membername1" title="member name">
        Barrasa Rodriguez, Jesus</div>
    <div class="memberdesc" id="memberdesc1" title="member short description">
        Reader in the Department of Intelligent Systems at the UPM. He collaborates with
        the Accessibility Group.</div>
    <div class="memberlocation" id="memberlocation1" title="member location">
        Room:4205 (Building 4, 2nd floor)</div>
    <div class="membercontact" id="mc1" title="member contact info">
        Tel:(+34) 913365133; Email:jbarrasa@eui.upm.es</div>
</div>
```

This valid HTML code uses the structural DIV tag to simulate the use of user defined xml tags for describing a person (name, short description, location and contact information) which are all structural and "style-free" elements. This structure can resemble quite intuitively the following XML fragment:

```
<member id="member1">
    <membername id="membername1" title="member name">
        Barrasa Rodriguez, Jesus</membername>
    <memberdesc id="memberdesc1" title="member short description">
        Reader in the Department of Intelligent Systems at the UPM.
        He collaborates with the Accessibility Group.</memberdesc>
    <memberlocation id="memberlocation1" title="member location">
        Room:4205 (Building 4, 2nd floor)</memberlocation>
```

```
<membercontact id="membercontact" title="member contact info">
        Tel:(+34) 913365133; Email:jbarrasa@eui.upm.es</membercontact>
    </member>
```

If we try to express schematically the structure we've just created with HTML, we can use the DTD notation. Obviously DTD is an XML document definition language and in this context it is only used to illustrate the idea behind the example, so every XML element defined in the DTD has to be understood as it's HTML equivalent <elementName id= "elementid">.

```
<!ELEMENT member(membername,memberdesc,
                 memberlocation, membercontact)>
<!ELEMENT membername (#PCDATA|structHTML)>
<!ATTLIST membername
        id ID #REQUIRED
        title CDATA #REQUIRED>
<!ELEMENT memberdesc (#PCDATA|structHTML)>
<!ATTLIST memberdesc
        id ID #REQUIRED
        title CDATA #REQUIRED>
<!ELEMENT memberlocation (#PCDATA|structHTML)>
<!ATTLIST memberlocation
        id ID #REQUIRED
        title CDATA #REQUIRED>
<!ELEMENT membercontact (#PCDATA|structHTML)>
<!ATTLIST membercontact
        id ID #REQUIRED
        title CDATA #REQUIRED>
<!ATTLIST member id ID #REQUIRED>
```

[1] structHTML is any "structural" HTML fragment.
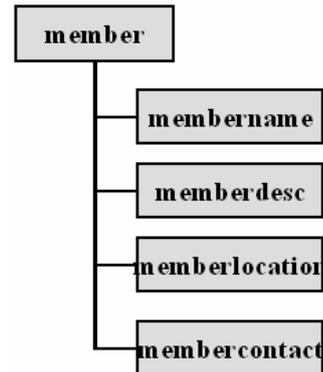
Figure 1. Graphical representation of the structural elements in a member description

The following example illustrates the same idea structuring some sort of table of contents:

Example 2:
```
    <div class="section_table" id="table1" title="Table of sections">
      <div class="section" id="sect1" title="link to member list">
       <a class="one" href="../sect2"><span class="inicial">m</span>ember</a>
      </div>
      <div class="section" id="sect2" title="link to teaching resources">
       <a class="one" href="../teach"><span class="inicial">t</span>eaching</a>
      </div>
      <div class="section" id="sect3" title="link to projects">
       <a class="one" href="../proj"><span class="inicial">p</span>rojects</a>
      </div>
      <div class="list_item" id="sect4" title="link to research">
       <a class="one" href="../res"><span class="inicial">r</span>esearch</a>
      </div>
</div>
```

And its corresponding "equivalent" XML code:

```
    <section_table id="table1" title="Table of sections">
      <section id="sect1" title="link to member list">
       <a class="one" href="../sect2"><span class="inicial">m</span>ember</a>
      </section>
      <section id="sect2" title="link to teaching resources">
       <a class="one" href="../teach"><span class="inicial">t</span>eaching</a>
      </section>
      <section id="sect3" title="link to projects">
       <a class="one" href="../proj"><span class="inicial">p</span>rojects</a>
      </section>
      <section id="sect4" title="link to research">
       <a class="one" href="../res"><span class="inicial">r</span>esearch</a>
      </section>
</section_table>
```

Validates to the following DTD

```
<!ELEMENT section_table (section)+>
<!ATTLIST section_table
        id ID #REQUIRED
        title CDATA #REQUIRED>
<!ELEMENT section (#PCDATA|structHTML1)>
<!ATTLIST section
        id ID #REQUIRED
        title CDATA #REQUIRED>
]>
```


Figure 2. Graphical representation of the structural elements in a section list

[1] structHTML is any "structural" HTML fragment.

4. STYLE PATTERNS

A style pattern is charged of mapping structural elements in the HTML document to their graphical counterpart (a box, a list, a line…) in the final web page. In our approach Cascade Style Sheets (CSS) are used for this purpose. As we said before, an structural HTML document is "pure content" and if we don't associate some presentation with it, browsers will show it as plain text. Similarly, multiple alternative style patterns can be associated to a single structural HTML document allowing different presentations.
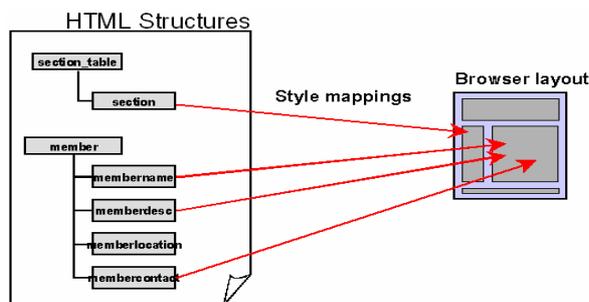
Figure 3. Graphical representation of the structural elements in a member description

Style patterns can be also organized in levels. For instance, a first level can be charged of size and positioning issues and a second level of text formatting and details (this division has nothing to do with level 1 CSS1 and level 2 CSS2 style sheet specifications). Multi-level style sheet patterns will allow structuring and reusing them between different documents. The following are samples of a first level pattern (left hand side) and a second level pattern (right hand side).

```
div.member {                        div.member {
position: absolute;                 font-family:'Arial Narrow', Arial;
top: 5px;                           font-size:99px;
left: 5px;                          line-height:120px;
height: 110px;                      color:rgb(194,203,207);
width: 800px;                       word-spacing:-45px;
z-index:5;                          padding:0px;
overflow:visible}                   text-align: right}
```

5. CONCLUSION

Our example of good practice in generation of accessible web sites is just based on the correct use of existing web standards (similar ideas can be found in Zeldman), and subsequently it's not limited to static content pages and can easily be integrated with dynamical HTML generation approaches like PHP, JSP or other.

In our case this pragmatic separation of content and presentation has proved to be an easily deployable solution with extremely good results from the point of view of the development and maintenance of accessible content. Needless to say that the pages created following this procedure are WCAG compliant.

This approach is also interesting from the point of view of automatic treatment of information. The work of web agents is much easier on structural HTML pages than on typical ones where document structure is very light and changes in their HTML code can confuse the operation of agents based on HTML tags parsing.

Some sample pages implementing this approach with its corresponding style sheets are available at http://harrison.eui.upm.es/. The following figures show two snapshots where we can have a quick look at their appearance with different style sheet patterns and a diagram with the different elements involved in this experiment.
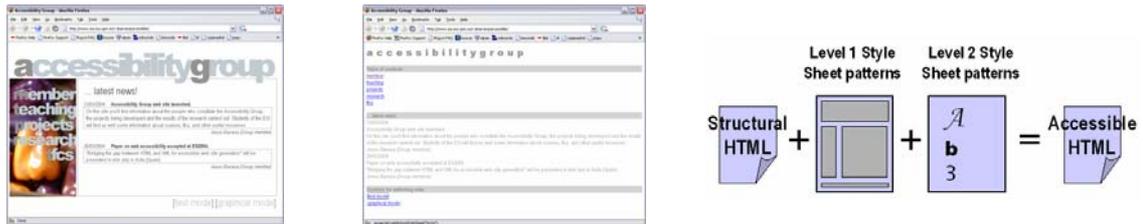
Figure 4. Pages implementing our approach and its schematic description

Our experience implementing the approach described in this paper has also shown that during development and maintenance, content providers' work (focused on content structuring and organization) is clearly separated from web designers' work (focused on how content is displayed), reducing interferences between work teams. This approach also avoids duplication of content (static accessible alternatives for pages) which leads to problems of coherence and synchronization. And finally, accessible web content means also accessibility to a variety of Web-enabled devices, such as phones, handheld devices, kiosks, network appliances, which is an added value.

Summing up, we think that accessibility is not something that can be thrown in at the end of the web design process (patching the warnings of an accessibility validation tools), it needs to be made central to it. Besides, a continuous tracking and monitoring is required as the site evolves. That's where many sites often come up short and where our approach is strong and manageable.

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SUPPORTING E-TENDERING PROCESSES: A PROCESS MODELLING APPROACH

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ABSTRACT

Advancing the application of information technology in tendering is a major international research and innovation endeavour for both scientific establishments and industry. The aim of this work is to discuss an architecture for modelling and coordinating decision-making activities in tendering processes. A Web-based Decision Support System has been developed to collect information about the contractors and facilitate the evaluation process. Process Modelling is used to capture human behaviour, interactions with computer systems and flows of information through tendering processes. The constructed process models are implemented using process support technology. They can be used to facilitate the understanding and communication of e-tendering processes to stakeholders such as construction managers and contractors.

1. INTRODUCTION

The rise of internet-based technology initiatives in the construction industry has made the exchange of information simple, fast, accessible and accurate (Shen et al, 2003). In the past few years research on the adoption and use of information technology integrated with the internet in construction projects, such as work by Zift, (2000); and Mohamad Noor et al, (2003) has emphasised the critical role of web-based technology and promoted its usefulness for improving efficiency, simplifying operations and document management processes.

Construction Management is the administration, management, and coordination of all aspects of an engineering project. The engineering project can take many forms; from the design, tendering process and construction of office buildings, housing subdivisions to an endless variety of other projects. The project can be for new construction or improvements to an existing facility that is owner or regulatory driven. Each project has its own special needs and requirements that need to be understood and engineered.

This work discusses a process support system that coordinates tendering activities. The tendering process is modelled by a generic architecture called Decisioning for Decision Support in Process–D2P that represents decision making processes at a high level. Process modelling is used to analyse, study and support the tendering process. The process is decomposed into phases such as formulating, appraising and evaluating and doing. The approach is prescriptive; it provides guidance while capturing the way that individuals arrive to a decision. The structure of this paper is as follows. Section 2 describes the process modelling approach and tools. Our research architecture (D2P) is presented in section 3. Section 4 describes the implementation of D2P for supporting tendering processes. Finally, section 5 gives the benefits and conclusions of our study.

2. A PROCESS MODELLING APPROACH

Models provide a way of abstraction by mapping and preserving a clear relationship between model and real-world subject. Models are representations, expressed in some modelling medium, of something of interest. Models help people to understand clearly and precisely about abstract concepts (Warboys et al., 1999). Process modelling is used in this work to represent process models. It is based on main concepts such as organisational goals, activities (process steps), roles and their interactions in e-tendering processes.

An important step in process modelling is process mapping i.e. capturing and building a process model. This is relevant in the analysis and evaluation of the redesign of work, and also for allocating responsibilities to all involved agents. Many organisations have placed significant effort in mapping their processes with the aim of gaining a better understanding of them. Process models help people coordinate and better perform their tasks in order to achieve the process objectives; they are also used to find duplicated or obsolete procedures and use technology to monitor their processes.

Thus, process models can be used to support the coordination of different elements in a socio-technical system. These models are represented and visualised using different diagrammatic techniques in their corresponding automated tools. Role activity diagram–RAD (Holt et al., 1983) is one of a structured technique for modelling processes. RAD displays the sequence of actions within roles and the interactions between them. Thus, process models represented in a RAD can be easily implemented in a process support system. They illustrate roles, their interactions and their constituents' activities, as well as the connection with external events. Thus a process is described as a set of roles carrying out activities and interacting together to achieve a goal. This technique provides a comprehensive approach to representing most of the features of a process: goals, roles, decision, etc. Another important aspect is that people without experience of the RAD notation can easily understand the models (Hunt, 1996).

3. DECISIONING FOR DECISION SUPPORT IN PROCESS (D2P)

Decision support has been encapsulated in a new architecture. This architecture is known as Decisioning for Decision Support in Processes' - D2P (Oquendo et al, 2000; Papamichail and Robertson, 2003). The decision making process at the *Decisioning* level comprises three stages. In Formulating, the decision model is formulated and a list of alternatives and objectives is passed to *Appraising*. Appraising refines the list and sends it to *Evaluating*. *Evaluating* has access to a library of methods for the ranking of the alternatives. A suitable method is selected based on the constraints and requirements of the decision problem at hand. The alternatives are ranked taking into account the objectives and their importance and sent back to *Appraising*. In *Appraising* there are two options: either the decision maker is happy with the ranking of the alternatives and is able to choose one, or the decision maker is not satisfied with the evaluation process and wants to reformulate the decision model. In the former case, *Appraising* implements the activities associated with the most preferred alternative and in the latter, a refined decision model is passed as feedback to *Formulating* for re-formulation. The phase of 'refining the decision model' is supported through this feedback loop between *Appraising* and *Formulating*. The adopted approach is to use a real case study to demonstrate the complexity of decision-making. This work exploits a particular concept of D2P, which is an implementable framework for supporting the process of decision-making.

4. IMPLEMENTATION

Process enactment involves the construction of a detailed process model, using a specialised language. The enacted model or 'process program' is executable using a process support system (PSS), and a process model to be carried out by a person is called 'human script'. ProcessWeb (Greenwood and Warboys, 1996) is a process support tool designed to enable process modelling and coordination via the World Wide Web. This tool combines PWI and a Web browser through the PML (Process Management Language). The user interface in ProcessWeb is provided by the protocol of a network browser (HTML).

In order to demonstrate the applicability of the approach using a real-world scenario we develop an efficient Web-based Decision Support System (DSS) for tendering processes. The system analyses tender

information from government sites and supports the procurement process. Since this Decision Support System is used over the Web, the user interface makes use of a Web-browser. It uses the concept of a visual interface and dynamically generates HTML documents. It is an effective communication medium that allows clients (e.g. procurement managers) to view, explore, navigate, search, compare and classify submitted bids. Information is delivered to the user via the produced HTML and related files, which are displayed on the Web-browser.

The tendering Web site contains pages that are is designed to be non-intrusive and flexible enough to display all the projects. They exhibit details about the project such as project name, class of contractors who are eligible to tender and expiry date. Contractors choose the projects based on their qualification. The criteria for the tender evaluation include financial capacity, technical capability, past performance, past experience and availability of technical staff. Mathematical models are used to evaluate the tenders. As a means of reflecting the different degrees of importance attached to different criteria in a complex tender analysis, the decision-makers will assign weights (in the form of points or percentages) to important measurable criteria before tenders are received. Each tender is then assessed against these criteria, and is assigned scores reflecting how well it satisfies each of them. The weighted scores for each criterion are calculated and aggregated.

The D2P process model is mainly concerned with supporting the selection amongst alternatives within a decision process. The D2P is, in fact, the result of an attempt to capture and refine a real-world decision-making process, and support decision makers in tendering processes. In the refinement process, efforts were made to enhance the generic property of the existing D2P model to cope with the context of the case study, while retaining the current implementations available. Primary roles in D2P are *Formulating, Appraising* and *Evaluating*.

• Formulating

Based on the D2P model, the typical decision making situation is thought of as one that requires a choice among alternatives. Decision-makers adopting the D2P model have to define their decision model in Formulating by identifying alternative potential solutions to the stated problem as well as criteria which these alternatives are judged upon. This list of alternatives and criteria are then passed as parameters to Appraising. In this D2P for e-tendering processes alternatives are contractors namely contractor1, contractor2 and etc. The list of criteria / objectives include financial capabilities, compulsory documents, equipments and etc. However, the decision context of the tendering processes is mainly involved with the deciding on the adequacy of a single solution to the problem at hand. Thus, an additional element, strategies, is put in place. Under this D2P model, the elements of alternatives, criteria and strategies are passed on as parameters to Appraising.

• Appraising

The decision makers / clients get another opportunity to study thoroughly and refine the decision parameters before passing them on to Evaluating for analysis. Appraising subsequently receives the analysis results, in the form of a ranked list from Evaluating. The decision makers then get to choose a solution from the ranked list of alternatives. Having made changes to the decision parameters received from Formulating, the decision maker is also given the option of passing all three parameters back to Formulating to gather more views or any comments. In short, the process model supports an iteration of negotiations between Formulating and Appraising.

• Evaluating

In Evaluating, under the current D2P model, the user is able to select from a library of multi-criteria decision-analysis methods to obtain one that is most appropriate for the problem at hand. This analysis is then performed based on decision parameters received from Appraising, as well as other variables and evaluation factors obtained through input from the decision makers in Evaluating. The output from Evaluating depends on the method chosen. In this case, the generated output sent to appraising would be in the form of a ranked list. Communication from Evaluating to Appraising is accommodated in the form of 'meta feedback'.

5. CONCLUSIONS

This work has several benefits. First, it supports clients that are considered to be the owners of the decision making process. A successful client/owner is one who is able to choose the right contractor for the right project. Second, it reduces the time needed to complete tendering. Third, it increases the openness, transparency and fairness of the e-tendering process. Fourth, it improves communication between clients, consultants and contractors. Last, it reduces the cost of engaging in transactions with the government.

E-tendering processes aim to meet the government's need for goods and services through efficient, effective and ethical practices to secure the best value without compromising the quality. Tendering is based on the principles of public accountability, transparency, value for money, open and fair competition. However, recently, tendering practices using Internet technologies have promised to reduce the time, effort and cost involved. The process modelling approach is used in tendering processes to determine the outcome of decision choices made by the client/owner. This work is still at an experimental stage, but we expect the result to be useful for those decision actors who are involved in tendering processes in the construction industry.

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ENACTING E-PROCUREMENT TECHNOLOGIES WITHIN UK LOCAL AUTHORITIES

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ABSTRACT

In the United Kingdom there is a significant amount of interest in the area of electronic procurement in both the central and local government agendas. This paper suggests Jane Fountain's (2001) concept of 'technology enactment', as a guiding framework to analyse the implementation and impacts of e-procurement technologies within public sector institutions. Within this context the implementation of e-procurement technologies can only be understood as part of the broader public sector's socio-technical mechanisms. Individuals and public sector institutions enact e-procurement technologies by their interpretation, design, implementation, and use of them in their specific organisational/institutional settings.

KEYWORDS

e-procurement, technology enactment, techno-organizational change

1. INTRODUCTION

In the United Kingdom the landscape of public sector procurement has undergone a paradigm shift in the last few years with radical government-based initiatives that fundamentally affect the way that local authorities perform their procurement activities. As part of a long-term strategic approach the UK Government launched the "Delivering e-procurement"[1] initiative, in an effort to speed up the technology's introduction in local government. The project provides practical support and guidance to 388 local authorities in England, based on a structured framework to help authorities to plan the stages of implementation and identify key elements of the e-procurement process. Following this initiative the government has set targets for the use of e-procurement by central government departments and it is seen as an important aspect of the drive by local authorities to e-enable services by 2005 (OGC, 2002; ECOM/CIPFA, 2002; NAO, 1999). The rationale behind those targets and the focus on procurement operations is to improve public sector procurement through: enhanced compliance; enhanced control and increased efficiency (McConnell et al, 2003). At the same time it is expected to raise the profile of procurement in all councils in line with the most recent Local Government White Paper and the Byatt Review (LGO, 2003). As Neef notes "…if there is one sector in the economy where e-procurement can and will have an enormous effect, it is government" (2001:109).

Whilst the interest in public sector e-procurement is growing steadily, relatively little research has been conducted towards its wider adoption. While some authors have noted the practical difficulties in getting the systems operational (Coulthard and Castleman, 2001), alongside with the specific political-structural elements that characterise public sector procurement (Henriksen and Andersen, 2003; Henriksen et al, 2004) to date, there has been no systematic examination or formulation of the organisational changes around e-procurement solutions in the public sector. Most of the literature (Henriksen et al, 2004; McConnell et al, 2003; Neef, 2001; Coulthard and Castleman, 2001; Vaidya et al, 2002; LGOL, 2003; NAO, 1999; ECOM/CIPFA, 2002; Byatt, 2001; Gershon 1999) on e-procurement technologies has tended to focus on discrete outcomes, such as productivity, systems quality, streamline processes, measuring performance and cost-cutting, while neglecting the intentions and actions of key actors, the process by which e-procurement

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[1] http://www.nepp.org.uk/

technologies are developed, adopted and used, and the organisational context (e-government) within which such events occur.

The purpose of this paper is to present a theoretical framework towards the implementation of e-procurement solutions within UK local authorities from the perspectives of different actors involved, including public sector institutions, users and developers[2]. The core objective of this framework is to examine the significance of the cultural setting in mediating processes of techno-organisational change related to e-procurement technologies. The next section of this paper outlines the specific public sector arrangements regarding e-procurement adoption. This will help to better understand the notion of e-procurement implementation within UK local authorities and within the broader e-government context.

2. THE INSTITUTIONAL ARRANGEMENTS OF PUBLIC SECTOR PROCUREMENT

In order to understand the concept of public procurement it is important to discuss first the fundamental differences between the operating philosophies of private organisations and public sector institutions. Public sector institutions certainly have different priorities than private sector organisations. Fountain (2001:12) argues that "organisational environments reward effectiveness, efficiency, and control over production (where)…institutional environments reward normative requirements for appropriateness and legitimacy and, in some cases, conformity to procedure, presentation, symbols, and rhetoric". Within the e-procurement context "whereas private sector organisations are focused on bottom line profits by reducing costs to the organisation often by reducing the number of staff as well as by driving down prices of goods procured, the drivers for public sector institutions are different" (LGOL, 2003:11). Public sector institutions need to meet targets set by government for adopting e-procurement initiatives. e-Procurement is seen as an opportunity to release staff for more value added activities, rather than reducing head count (*ibid*). Therefore applying the e-procurement evaluation and ROI concept to the complex environment of the public sector is not as easy as it is in the private sector where everything is translated into business profits. As Coulthard and Castleman (2001:2) note "government agendas are more extensive and complicated than those of private sectors where efficiency, cost reduction and time saving are sufficient justifications to adopt e-procurement".

Fountain (2001) observes that public sector institutions possess both organisational and institutional elements and must function in both environments. She argues that public institutions "are expected to be efficient and effective in their core activities but operate in a legislative, oversight, and political environment that requires conformity to a range of requirements that have little or nothing to do with economic output. Institutional arrangements range form micro-level elements within the organisations to macro structures in the society" (Fountain, 2001:12). Within this context two further aspects need to be considered regarding public e-procurement adoption, those of regulation and social responsibility. Unlike procurement in the private sector, public sector procurement requires a bureaucratic procedure to be followed due to the nature of the institutions (Henriksen and Andersen, 2003; Henriksen et al, 2004). One reason for this is related to the complexity of the regulations and policies regarding the tendering process (*ibid*). For example within the UK, public bodies are subject to EU Procurement Directives, which provide a framework of rules for the procurement activities. Regulations "embraces audit, accountability and compliance with national and international rules ensuring competition for supply and transparency in the award of contracts" (NAO, 1999:99).

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[2] This study is drawn from a major research programme being conducted by the Centre for Social and Business Informatics (http://www.ncl.ac.uk/unbs/sbi) at the University of Newcastle upon Tyne. The programme is examining various aspects of the move towards e-government in the UK and Europe in a variety of contexts including health care; social and health services for children; higher education and virtual universities; public transport; and local government. The research reported in this paper was funded by the UK Engineering and Physical Sciences Research Council (EPSRC) as part of their 'Systems Integration Initiative' (http://www.ideo.co.uk/SII/). The project, "Advanced Multi-Agency Service Environment" (AMASE) focused upon the problem of socio-technical integration in the development of information sharing and multi-agency working in the delivery of public services in the UK. The study involved several pilots focused on: the development of multi-agency working in Children's Social Services (involving inter-agency information support to professionals at different levels); the reorganisation of IT supported services that explores the formation of a partnership between a city and an IT solutions provider to integrate back office and front office systems as part of an overall move to 'e-government'; and a region-wide introduction of a public sector smart card.

The second priority of the public e-procurement adoption refers to that of the social responsibility of government. There is a paradox between the desire to reduce costs and efficiently manage a supply base, and a requirement to support the local economy and ensure full competition (LGOL, 2003). For example "local government has responsibilities to local communities including promoting local economic development" (Byatt, 2001:6). Local business should be able to compete for work alongside other contractors from outside the area and local authorities should encourage and support them in doing this. However it would not be consistent with fair competition to give them an advantage. Policies aimed at meeting social objectives should be legal, transparent and effective within government (Byatt, 2001; NAO 1999).

3.   ENACTING E-PROCUREMENT TECHNOLOGIES

Following studies on the social shaping of technology (MacKenzie and Wajcman 1985; Bijker and Law 1992; Grint and Woolgar, 1997) and their focus on the construction of socio-technologies[3] this paper's starting assertion is that there is still much work to be done on technology when it enters an organisation. The acquisition of new IT is only the start of a long-running process during which both the technology and the organisation are shaped by complex processes of configuration in their development, deployment, implementation and use (see e.g. McLoughlin and Clark, 1994; McLoughlin, 1999). However in order to understand this complex relationship between technology and organisation it is important to consider how technologies emerged in particular organisational/institutional settings and contexts and then become more widely diffused/valued and further implemented to other organisations/institutions. That's it according to Williams (1997:174) "to look at the biography of technologies as they develop over time".

According to Orlikowski (1992) in the early adoption of a technology, 'cognitive and structural elements' play an important role in influencing how people think about and assess the value of the technology. 'Cognitive elements' are mental models or frames of references that users have for interpreting and understanding the role and function of a technology and 'structural elements' are the configurative settings (properties) of the environment in which the technology is used (ibid). These elements significantly influence how a new technology is implemented and used. Within the public sector context Jane Fountain (2001) captures something of this point by distinguishing between what she terms 'objective technology' – essentially the available hardware, software, the Internet and other digital telecommunications – and 'enacted technology': 'the perceptions of users as well as the designs and uses in particular settings' (Fountain, 2001:10). In this way technology is shaped by contextual institutional and organisational conditions. There is no direct and predictable relationship between the characteristics and capabilities of information technology and the outcomes in terms of organisational/institutional change (McLoughlin et al, 2004). 'Enacted technology' is an outcome of the mutual interaction between technical and organisational/ institutional factors (Fountain, 2001:10):

"Information technology and organisational/institutional arrangements are connected reciprocally. Both function in this framework as dependent and independent variables. Each one has causal effects on the other. Institutions and organisations shape the enactment of information technology. Technology in turn may reshape organisations and institutions to better conform to its logic. New information technologies are enacted – made sense of, designed, and used (when they are used) – through the mediations of existing organisational and institutional arrangements with their own internal logics or tendencies. These multiple logics are embedded in operating routines, performance programs, bureaucratic politics, norms, cultural beliefs and social networks" (Fountain, 2002:12).

In consequence the outcomes of application of information technologies are unpredictable, variable and often unexpected. Choices over its use may reinforce existing "organisational, political and institutional logics", whilst other approaches may lead to fundamental change and transformation (McLoughlin et al, 2004). As such, "information technologies are not so much adopted or implemented but enacted by decision-makers" (Fountain, 2001:12). The framework is summarised in Figure 1.

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[3] SST argue that no neat distinction can be drawn between the social and technical aspects of change, hence the concept of socio-technical change
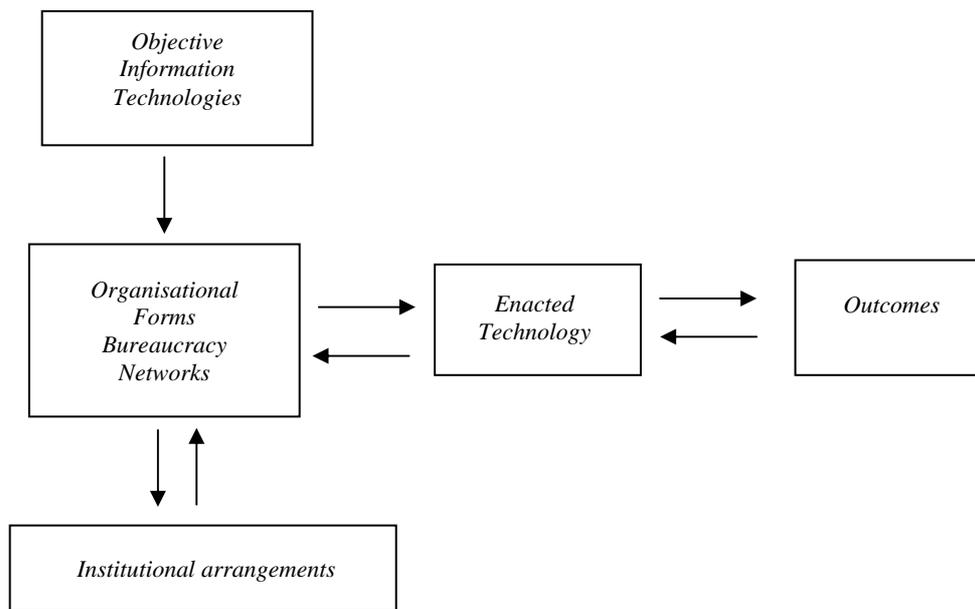
Figure 1. Fountain's Technology Enactment Framework
Source: Fountain (2001, Figure 6-1)

4. CONCLUSION

e-Procurement lies within a broader range of government initiatives in doing business electronically such as the electronic delivery of services and the goal of achieving seamless integration of transactions across Government departments and public sector agencies (Lenk and Traunmüller, 2002). An institutional (public sector) perspective alerts us to the fact that government adopts e-procurement solutions differently than private sector companies. Undoubtedly public sector institutions have different objectives towards the implementation of e-procurement initiatives and those cannot be seen simply as extensions of commercial e-procurement applications because government institutions pursue a wide variety of goals due to their different nature. As Fountain (2001:13) argues "the development of the virtual state (or e-government) is not likely to resemble the growth of electronic commerce. Government reform is qualitatively different from restructuring in firms and industries". Within this context the substantial efficiency gains driving the development of e-procurement and industry change are disincentives for public sector institutions to use such technologies.

This paper suggests Jane Fountain's (2001) concept of '*technology enactment*', as a guiding framework to analyse the implementation and impacts of e-procurement technologies within public sector institutions. Fountain's conceptual framework illuminates the critical role played by socio-technical structures in organisational and institutional arrangements. Within this context the implementation of e-procurement technologies can only be understood as part of the broader public sector's socio-technical mechanisms. Individuals and public sector institutions enact e-procurement technologies by their interpretation, design, implementation, and use of them in their specific organisational/institutional settings. Fountain's 'technology enactment' framework can help us to identify the ways in which e-procurement technologies are perceived by different actors, who then attempt to shape the use of such technologies. This will help to visualize the process by which e-procurement technologies are implemented within public sector institutions together with the key factors that affect that process.

ACKNOWLEDGEMENT

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E-GOVERNMENT AND INFORMATION SOCIETY THE FIRST REGIONAL LAW IN ITALY

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ABSTRACT

The law recently approved by the the Regional Administration of Tuscany (January 2004) regulates the promotion of electronic administration and the development of the Information Society in the regional system as well as the regional telecommunications network. It represents the first example of Italian regional legislation in this vast and complex field after the constitutional reform of 2001 (which has changed the division of legislative powers between State and regional governments), after the beginning of the e-Europe plan and of the Italian e-government national action plan.
It is the result of a research and study activity made by ITTIG i collaboration with the regional government of Tuscany. Therefore this law has an important political, strategic and symbolic value not only for the Tuscan Region, but within the Italian political strategies for the public administration innovation process.
The A. Illustrates the legal background and the major aims of the law, the leading principles, criteria and tools of the regional political action.

The regional law of Tuscany Region (Italy) on the *The promotion of electronic administration and of the information and knowledge society throughout the regional system. Regulating the Tuscany Region Telecommunications Network* is an essential step for the technological and organizational renewal of the regional and local system - according to the new requirements of public administration governance and e-government already taken on board at the supranational, community and national level - and for the promotion of the regional information and knowledge society.

With this law the Region intends to systematize institutional consensus in the subject underhand, consolidating the experience of the Tuscan regional telecommunication network and expanding its aims and functions connected to the development of the information society in the regional system.

The principal aim of the Region is that of expanding the rights of citizenship and participation, to render this developing society as inclusive as possible, removing and preventing all possible causes of marginalization and social exclusion connected to the use of information technology (what has come to be called the digital divide).

The Tuscany Region has thought opportune to emanate this law for the following purposes: i) to give sufficient political importance to the initiative; ii) to render the visibility of the public administration more apparent as a model and tool for the support of civil society as a whole; iii) to set up an effective development policy in the sector and to determine the tools required; iiii) to ensure an adequate degree of consistency with the new regulations via the involvement of the Tuscan public administration system in order to develop the organization and established rules.

The present law represents the first example of regional legislation in this vast and complex field after the reform of the Constitution (Title V, part II).

Whilst respecting the various competences of State legislators in this area – particularly with regard to "coordination of information, statistics and electronic data", the present law occupies the sphere of legislative competences (also referred to as "residual competences") exclusive to the Region.

The subject that the law deals with, is in fact mostly to do with the organization of the Region and, within the limits of new constitutional regulations, to do with the organization of local bodies (see article 118,

paragraph 1, of the Constitution). On the other hand the Region places the socio-economic development of its territory including the encouragement of equality between citizens (a task that the Constitution assigns to regional legislation article 117, paragraph 7 of the Constitution) at the center of the proposal.

Notwithstanding this the law takes into account existing State legislation on the subject of communication and information technologies, and assigns to them the role of innovation in the Region and other local Tuscan organizations.

Given the complexity of the plans of action that are envisaged, this law has a promotional character. Regulations therefore are organic but "light-weigh" as a framework-law requires and is purposely bereft of technological and applied contents, which are left to be dealt with by specific technical definitions and programs; thus they are not effected by technological change.

The first Part contains *general provisions*; within it are stated the aims and the object of the law. This Item also defines concepts, especially technical ones, relevant to the law's objectives and it also provides a clear indication of the principles and guiding criteria (taken from the wide-ranging political and technical debates held at the community and national level), as well as the strategies and methodologies for action (treatment of personal data with regard to the law; institutional coordination; regional and local planning).

The perspective that the Region takes as the basis for this legislative action is regional interest in encouraging the development within its territory of an administrative and social context favorable to a maximized and widespread use of new technologies; this, so as to be able to, via the use of these tools, achieve social and institutional aims of much greater importance. These aims will give a direction to interpretations of the law and will, when and if required, lead to effective action in response to needs.

One of the elements of Regional action, in relation to the process of technological innovation which will inform the activity of the area as a whole's Public Administration, is, as is stated at letter a) of paragraph 1, the context of institutional cooperation within which this process will develop.

An equally important aspect of the law is the aim to expand the rights of participation and citizenship, of social and digital inclusion that the Region must follow in pursuing the law's objectives; bearing in mind, in view of human equality of dignity, the particular personal circumstances of disadvantage that of themselves obstruct the individual's full equality of access to both information and information technology.

This law contains principles and guideline criteria relative to the promotion and implementation of electronic administration. Each of the principles and guideline criteria indicated are the fruit of institutional debate, generally accepted technical solutions or experience. Taken as a whole, these aim at the efficient and effective use and the sharing of public information data and are at the basis of public information policy.

Particularly distinctive aspects of the Region's strategy include:
- the efficient and effective use, within the overall aims of the law, of the unified regional networks and other organizational groupings that have come together on a territorial or thematic basis;
- guarantee of data security including via electronic marking and encrypting techniques;
- promotion, support and preferential utilization of solutions based on open code source programs.

This law contains also the principles and guideline criteria relative to regional policy for the development of local society.

Among all, stand out: the beneficial use to be made of the various (institutional, economic and social) subjects as on-line information and content producers; accessibility and usability of information systems (something to aim for and where possible to guarantee) are correctly indicated as one of the most important ways of facilitating subjects affected by psycho-physical difficulties; the use of technology is indicated as an element facilitating the evening out of territorial socio-economic development (at present it is uneven).

With regard to support for families, schools and other social categories the "gaining of tangible access possibilities to services provided with technological and telecommunications tools" has been preferred over the acquisition of connecting and technical tools. Priority is therefore given to access structures and use.

Altogether, these criteria aim at creating on the demand side a condition that facilitates the tendency to use the Network, at developing forms of partnership and at promoting the cultural and technological transferal and the social and productive innovation.

This law gives a legal basis to the Regions and other organizations in the regional system of local bodies for the treatment of personal data connected to the creation of public information systems and services, and to the development of the information society.

This law aims on the one hand to connect the Region's actions with those of the State and of other Regions, and, on the other, with the territory's local bodies, to guarantee a coherent strategy of regional

government; this is usually regarded as the most suitable level for action in this sector; and indicates the Conference system and contractual activities as the preferable instruments whilst not excluding others.

This law introduces the sector programming tools via regulations based on the general approach of existing regional norms; it does this in its essentials and is therefore able to be framed within possible new regulations on programming.

The three year Program is implemented through the annual Network's plan of action which is the principle tool for planning the activities of the Network as "the permanent coordinator of the Regional system of local bodies".

The Regional Government accepts and approves it for the part that concerns its own competences and communicates this to the Regional council.

On their part, local organizations – on the basis of the obligations assumed in the participatory agreement – will enact the contents of the Annual regional Plan and Regional program according to their respective legal set up or, possibly, via potential contractual tools that may be put into effect.

With the this program the Region intends to provide a permanent reference framework not only for the Public Administration, but also for the many operators in the sector and the various social categories operating throughout the territory.

The second Part of the law deals with the regulation of the Tuscany Region Telecommunications Network.

The Network – understood as the permanent means of coordination of the Regional system and local autonomies and of cooperation between the system itself and other public and private bodies in the fields covered by the law – constitutes the structural strong point of the development of policy in this sector.

In fact the law sees the Network as the motor for the accomplishment of the broad aims of the law and therefore ensures full participation in the administration and government of activities in the sector via the procedures and joint decisions adopted in the context of the Network. The Network is not a new legal subject, but a system of subjects that coordinate their activities and services with a view to integration (using, that is, a common telecommunications infrastructure and according to shared and uniform technical modalities) and with common aims and a specialized and innovative "mission".

The organizational model to which the law implicitly refers (at least for describing, if not for legally defining the phenomenon) is that of mixed administration which has already been profitably used by the National State and the Health System. This model, which fits in with the current experience of the Regional Telecommunications Network that derived from the 1997 directive, is the most satisfactory for the implementation of structural integration between the participating subjects and therefore for ensuring the best relationship between different levels of government as well as for meeting possible institutional changes in public powers. Furthermore this model has the advantage of not incurring added costs; in fact it has already demonstrated the capacity to ensure a broad economy of scale.

As far as administrative science is concerned, the Network can be defined as the result of a *community network.*

The Network subjects are: i) the Region and regional agencies *ex lege*; ii) the local autonomies on the base of specific convention with the essential contents; iii) other subject private publics and (institution, economic categories, professional orders and private associations) based on conventions of operating character.

In conformity to the current experience of the Regional telecommunications Network, the law gives the Region a general energizing role but in its actual construction, a role that is limited to the infrastructure. The Region also ensure via its offices, support for the organs of the Network.

The law introduces a simple but essential regulation. In fact it ties the subjects that belong *ex lege* to the Network (the Region, regional organizations and agencies as well as health authorities) to fulfill in a electronic format the obligations of information provision already set out by State or regional laws, making use of the Network and its operative modalities, unless otherwise specified.

The Region does not impose anything autonomously; it keeps to what are already a vast number of regulations: sector laws and general administrative reform laws that also regulate the management and coordination of public information. The Region imposes nothing here; it merely singles out the modalities in which these obligations are met, that is electronically and via the Network.

For the local autonomies that participate in the Network by a convention a similar ruling should be present in the participation convention. In this case too we are dealing with obligations and duties of an informative character that derive directly or indirectly from State or regional laws or regulations, or of a

technical character, in fulfillment of the programs and decisions adopted by the Network organs. The law has taken the opportunity to blend the obligations of the local organizations on the autonomous desire to participate in the Network. These obligations are justified in the contest of legitimacy and relevance, by the particular governance context outlined in the present law. In fact on the one hand it is true that local organizations participate in the plans and programs of the Network that may effect their autonomy, on the other it is obviously true that also (and perhaps particularly) in this sector there is the necessity to ensure a minimum level of uniformity in the exercise of their functions, thanks to which it is possible to activate in an efficient and effective manner the policy that the present law wants to promote. It is also worthwhile considering that we are dealing with a behavior that is necessary in order to broaden citizenship and participatory rights as well as to render developing information society as inclusive as possible, enhancing therefore real social progress.

E-DEMOCRACY PROSPECTS: E-CITIZENSHIP WITHIN THE EUROPEAN AND ITALIAN POLICIES

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ABSTRACT

A citizen is an active member of a community or society provided with rights and duties conferred by that community. In the Information Society and the World Wide Web context the citizen becomes an *e-Citizen* The creation of an *e-Democracy* system will allow citizens to participate more actively in politics, subsequently bringing greater clarity to the decision-making process of their elected political representatives and taking part to local government's activities through online tools, or using the Internet for expressing their opinion or suggesting new important initiatives. On the other side, citizens will have the opportunity to access any kind of information of interest for them at a convenient time and place through websites which are rich of updated and relevant information.

KEYWORDS

e-Citizenship, Knowledge Society, e-Democracy, e-Voting, e-Partecipation, e-Government, Learning**.**

1. E-CITIZENSHIP IN THE KNOWLEDGE SOCIETY

A citizen is an active member of a community or society provided with rights and duties conferred by that community. In the Information Society and the World Wide Web context the citizen becomes an *e-Citizen*: this means that citizens must learn how to turn real citizens of an electronic community and how to use the Internet possibilities in order to become aware of what *e-Citizenship* implies. Generally speaking the concept is integrated with aspects specifying it significantly: that is *e-Democracy* and *e-Government.*

e-Democracy refers precipually to the participation in an online government or democratic activity or to using the Internet to further a cause or express an opinion, that is online participation in an *e-Society*. It is widely believed that the Internet enables people who share the same beliefs and principles to connect from all over the world through websites or e-mail discussion groups and this would result in the changing of government policies: existing communities would be altered and new ones might emerge with new relationships and new citizenship scopes.

The notion of *e-Government* is very recent and covers the possibility of public administrations to offer services and information through new media or interactive tools, taking advantage from the innovative means brought about by ICT. *e-Democracy* and *e-Government* issues are therefore key factors for the development of *e-Citizenship.*

In order to take advantage of new *e-Democracy* and *e-Government* resources, individuals need to attain an interdisciplinary basic education giving attention to those issues referring specifically to the implementation of *e-Government* policies and to the new citizens' possibilities arising from an *e-Democracy* prospect. This may include an understanding of how change can be brought about and what individuals can do in relation to these issues. So, attention is to be focused on those features of *e-Government* and *e-Democracy* which are essential for developing and implementing *e-Citizenship*, also in consideration of

European and Italian political actions where these approaches are identified as priorities for the promotion of the Knowledge Society.

2. E-DEMOCRACY DEFINITION AND APPLICATIONS

In recent years, when dealing with *Electronic Democracy* and the new communication space offered by telematics networks, reference is made to those aspects which identify computer-aided democracy with direct democracy, that is the access to politically relevant information (*teleconsulting*), the availability of pluralistic discussion places (*electronic conferences, newsgroups and e-forums*) and the possibility for all to intervene in decision-making (*e-voting, permanent polls, televoting*). Therefore, *e-Democracy* means that citizens will not only use technology to inform themselves about current events, but will also use it as a *voting tool* in both their national and local elections and as a means for *active participation* to their administration governments.

In more developed countries *e-Citizenship* is tested at some level of governance and public life, while in the majority of countries the impact of *e-Democracy* reaches actually most of the public through its influence on traditional media.

When enhancing *e-Democracy*, not only can citizens provide feedback, they can interact through discussions, negotiations, and other methods that would have normally required personal interaction. These tools may increase citizen participation in policy and complement existing democratic structures and may become the premises for two new potential and specific instances, such as *e-Voting* and *e-Participation.*

e-Participation focuses its attention on the implementation of digital tools for developing a new kind of relationship between the citizen and the public decision-maker, that is, a direct and immediate dialogue between them, while e-*Voting* means that the citizen's right to vote will be expressed utilizing new technologies.

However, both approaches such as *e-Voting* and *e-Participation* are not yet a generalized practical reality: many achievements are to be attained yet, although some limited cases have been experienced all over the world. The first example may be considered the distant *e-Voting* procedure applied in Arizona in 2000 during the election of the representative of the Democratic Party to the US Presidency. The voters, besides the traditional method, were able to express their preferences by means of a special electronic voting card going into specially equipped polling stations spread all over the State or by simply utilizing their personal computers. A recent trial is represented by the last municipal elections held in Great Britain in 2002.

The Danes will experiment with e-Vote in the European Parliament election 2004. In fact, 15,000 Danish voters in the Council of Ishoj, near Copenhagen, are to participate in an experiment on Internet voting in the European Parliament elections of next June. The Ishoj Council joined up with the European Parliament office in Denmark in order to enable Internet voting on voluntary base. The Estonian government recently announced its plan to introduce on-line voting for general elections. The canton of Geneva in Switzerland is planning to allow remote voting by the Internet for its local elections this year and, in Germany, cities such as Bremen and Cologne have announced that citizens will be able to vote online by 2006.

Also in Italy some municipalities have experimented *e-Voting* procedures, participating at a large European project called *e-Poll (Electronic Polling System for Remote Voting Operations)* financed by the European Commission. The first pilot phase was experimented between 2001 and 2002 by the municipalities of Avellino, Campobasso and Cremona.

As to Italian *e-Participation* trials the *Iperbole* Project experimented by the Municipality of Bologna in 1999 is the first significant case; other municipalities followed this example, such as Rome, Milan, Turin and Venice. However, the evolution towards the implementation of *e-Democracy* models is speeding up day after day all over the country.

3. E-DEMOCRACY IN EUROPEAN AND ITALIAN POLITICAL ACTIONS

e-Democracy implementation is being greatly stressed by the European Union, as it appears in recent political actions, two of which are to be mentioned as particularly significant.

On 6 December 2001 the Committee of Ministers of the Council of Europe adopted the Recommendation No. 19/2001 addressed to Member States on the participation of citizens in local public life. The participation of citizens is seen as the core of the idea of democracy and their involvement in political activity and in decision-making as the lifeblood of any democratic system. Member States are to adopt some basic principles for improving local democratic participation within their national system, must seek for new modalities to enhance civic consciousness, promote a culture of democratic participation shared by citizens and give basic importance to communication between public authorities and citizens, so that local administrators pay attention to demands and expectations of the population.

Two general measures are indicated for encouraging and reinforcing citizens' participation in local public life. One key measure is that which aims at "*improving citizenship education and incorporating into school curricula and training syllabuses the objective of promoting awareness of the responsibilities that are incumbent on each individual in a democratic society". A*nother key measure refers to enhancing participation in local elections through more convenient voting procedures, such as the introduction of new voting options (*postal voting, post office voting, electronic voting,* and so on).

The European Union, in order to promote the implementation of these actions, during the Greek Presidency (2003) undertook a very important initiative: *e-Vote: vote for the EU YOU want*.

The project aims at experimenting the use of the Internet and of new technologies for getting more people involved in the discussions and decision-making process of the EU government. According to the project a website (http://evote.EU2003.gr) has been organized into different sections (*Online Voting, Special Votes*, *Your Question, Your Voice, New Features)* through which Europeans may have access to different relevant topics, can make their comments and offer their ideas and suggestions.

Following up the strategies set out by the European Union, also the Italian government has shown great attention to change and innovation not only in the digitalization of public administrations *(e-Government)*, but also in the contemporary enlargement of citizen participation to political strategies in order to move communities towards global *Governance*. In fact, *e-Government* is committed to making public organizations citizen-centric, that is citizens are to become active partners of new Public Administration models.

Italian political major steps are represented by the adoption in 2000 of an *Action Plan for the Information Society*, integrated by a specific *e-Government Action Plan* and by the approval in 2002 of the *Government's Guidelines for the Development of the Information Society*. Anyhow, only the action launched recently (2004) by the Italian government as the second phase of the *e-Government* implemention within regional and municipal authorities represents a real progress towards the application of new *e-Democracy* tools, with specific attention for those relating to *e-Participation and e-Voting*.

Another action recently promoted refers to education and training as ways for enhancing innovation and *e-Government* implementation. The stress is on *virtual education*, based both on *e-learning* tools and on the creation of *specific masters on e-Government issues* to be organized in collaboration with University centres.

4. PROMOTING E-DEMOCRACY THROUGH LEARNING

As already underlined, it is difficult to attain huge transformations within the social or public administration system without focusing attention on human resources involved (*citizens* and *public servants).*

Digital literacy initiatives are, therefore, the major tool for promoting innovation and for moving towards the Knowledge Society. Schools and universities are the basic channels for digital literacy: proper training and updating courses are to be implemented and present university curricula are to be adjusted in order to offer global responses to innovation problems.

It is therefore useful to focus the attention those educational initiatives recently carried out in Italy for the training and updating of public servants and for the acquisition of basic digital literacy by general citizens. A few Master's for lifelong learning were organized by different Universities (Camerino, *Law, Economics and New Technologies*, Bologna, *Information Technology Law and Legal Informatics*, Pavia, *New Technologies for the Public Administration and E-Government,* Rome, *Ma.Go.L. -Local Government Management* and *Institutional Communication and Organisation through Advanced Technologies,* and *European Citizenship and Public Administrations* and others). However, the initiatives are ever increasing throughout the country day by day and a more specific consideration for adequate notions relating the development of *e-Democracy* and *e-Citizenship* will gradually come out.

5. CONCLUSIONS

At the moment, the participation of citizens to public administration policies is to be considered a necessary tool for strenghtening government-citizens relation, that is democratic governance and *e-Citizenship*. Therefore, in the near future the strategies for implementing an e-Democracy system are to be directed to the promotion of *e-Voting* and *e-Participation* applications within regional and municipal authorities especially in those small communities where the relationship between citizens and local administrators is easier. National political actions, such as those launched by the Italian Government, favouring the introduction of these strategies at local level may accelerate the innovation process.

From the other side, to make full use of *e-Democracy* resources, individuals need a basic level of technological, legal and political literacy. Thanks to *technological literacy*, in particular, they would be able to access to the Net for analysing information sources contained in available telematics networks, while through *legal literacy* they could become aware of their rights and duties with respect to the Knowledge Society and, finally, through *political literacy*, they will become able to interact and debate with their local governments and control the administrators of their community.

The right to digital literacy as lifelong education becomes fundamental for the development of the Knowledge Society and represents an evolution of the fundamental right to education.

Anyhow, if we consider the present panorama outlined above, we can observe that we are far away from the globalization of the *lifelong education right* as a fundamental right of each citizen. Courses oriented to offer basic digital literacy to ordinary citizens are still rare. Only some post-graduate (Masters') were promoted in some main university centres for preparing graduate students new to professional figures particularly skilled in the application of technological tools and in legal issues arising from the development of the Information Society.

If we consider that *e-Government* and *e-Democracy* raise instances relating both to public and private law, it is to be pointed out that the attention of the courses is focused almost exclusively on private law issues and no reference is made to topics of public and constitutional law (European and national legislation, European and national political strategies) nor to topics of a social nature which, on the contrary, should be known if citizens are to become actors of social transformations.

Furthermore, even if priority should be given to the training of public servants, who are the first actors involved in the development of the Knowledge Society, it is also necessary to organize specific courses on *e-Democracy* culture and tools for offering the general public the opportunity to become aware of their new rights and possibilities.

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QUALITY IN ELECTRONIC COMMERCE B2C: ANALYSIS LEVEL EMPIRICAL CONSEQUENCES

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ABSTRACT

The increasing competition and market globalization, favored by the development of new information and communications technologies has increased the importance of a quality management approach in companies. However, the digital economy has changed the theoretical and practical precepts established in the relevant literature by switching attention from a transactional level to a relational level. Within that framework, this paper aims to make a theoretical proposal that integrates the transactional vision with the relational vision from the customer perspective in the context of electronic commerce B2C (business to consumer) transactions. It contributes empirical data about the influence of quality on the customer's disposition to repeat the purchase experience.

KEYWORDS

Electronic commerce, quality, customer satisfaction, relational quality.

1. INTRODUCTION

Quality is considered a multi-attribute construct, the result of the comparison between the customer's expectations and perceptions of the service provided (Parasuraman et al, 1985, 1988, Grönroos, 1994; Boulding et al, 1993; Bolton and Drew, 1991; Bebko, 2000; Teas and Palan, 1997). With regard to what determines quality from the customer perspective, there are two large schools of thought: the Nordic and the American. Grönroos (1994), as a leading exponent of the Nordic school, proposes that the customer values the functional quality of the service (process and interactions with the vendor) the technical quality of the service. For the American school, with Parasuraman et al (1985, 1988) as representatives, the customers focus on five factors: tangibility, reliability, response capacity, security and empathy. However, both schools tend to emphasize the transaction rather than the company-customer relationship. This makes customer retention very difficult in highly competitive markets, such as the digital market. This new situation makes it necessary to redefine existing models and seek an effective frame of action. To reach a coherent result, in this paper, we establish a dual scheme that integrates a transactional and a relational vision. This does not prevent the theoretical development from beginning with the treatment of service encounters, since it is the minimum unit of analysis of company-customer interactions.

2. SERVICE ENCOUNTERS AS A UNIT OF ANALYSIS IN COMPANY-CUSTOMER INTERACTIONS

The *encounter* covers any interaction between the customer and the company, even if it does not result in the effective delivery of a product or service. It includes a phone call from the customer to the company, when a customer goes to an establishment to ask for product information and even when the customer receives a letter in response to a complaint. Carlzon (1987) called service encounters "moments of truth" and in the words of that author, they correspond to the time and place, when and where, the service providers have the opportunity to show the customers the quality of their offer. In this respect, as Day (2000) indicates, a customer's decision to be loyal, or to leave, is the sum of many small encounters with the company. That is, there is not normally only one reason why a customer leaves a company; there is a series of dissatisfactions and frustrations with the company that lead the customer to seek an alternative offer. The company must avoid arriving at this situation, and so, for that reason, an additional concept appears in the relevant literature: service recovery. This new term identifies the company's will to provide the service well the second time by correcting the faults occurring in the initial encounter (*e.g.*, Grönroos, 1994; Berry and Parasuraman, 1991; Berry et al, 1990). From a relational perspective, the main objective of service recovery would not be only to correct specific problems or faults; consequently the faults will be excluded, the overall quality perceived by the customer and strong, long-term relationships with loyal customers assured. From that approach, service recovery would constitute a basic task for the development of long-term relationships with the consumer.

3. THE TRANSACTION IN THE LITERATURE ON CUSTOMER SATISFACTION

The *transaction* covers the customer looking for a product or service and getting in touch with a company to perform the entire series of operations necessary to achieve the objective, including after-sales service. The transaction has been dealt with in the literature on customer satisfaction as the center of debate in practically all the texts, with notable treatment being given under the term paradigm of disconfirmation. El paradigm of disconfirmation, widely accepted in the literature on satisfaction (Woodruff et al, 1983; Cadotte et al, 1987), links satisfaction with the size and direction of the disconfirmation, with the consumer's initial expectations being a determinant in this comparative process (Churchill and Surprenant, 1982). Oliver (1980, 1981) explains this model of disconfirmation of expectations as a process by which the consumer compares his/her expectations or predictions of the company's actions in a series of attributes with its real actions.

4. THE RELATIONSHIP AS AN ACCUMULATED EXPERIENCE

A significant number of authors in the relevant literature treat the perceived quality of the service as an attitude, while customer satisfaction is interpreted as the evaluation of a specific transaction. In other words, the perceived quality of the service is the result of an evaluation of a series of transactions. Among those authors, Parasuraman et al (1985, 1988) differentiate the quality of satisfaction in which quality is an overall opinion, or attitude, about the superiority of the service, while satisfaction refers to a specific transaction. The two constructs would be related insofar as satisfaction over a time produces the perceptions of the quality of the service; therefore, the incidents, whether positive or negative, affect the perception of overall quality. Other authors also consider that consumer satisfaction is a transient opinion formed on the basis of a specific transaction (*e.g.*, Bitner, 1990; Bolton and Drew, 1991; Cronin and Taylor, 1992, 1994). In other words, satisfaction is an evaluative exercise that is performed in each transaction, while the perceived quality of the service represents a lasting evaluation. However, the quality of the service as an attitude is subject to modification after each transaction since the level of satisfaction is going to affect the attitudinal profile. Faced with that situation, companies must not only consider the creation of an image of quality among their potential customers (perceived quality of the service), they must also improve each specific transaction (satisfaction) (Martínez-Tur et al, 2001).

5. ENCOUNTERS, TRANSACTION AND RELATIONSHIP IN ELECTRONIC COMMERCE B2C

In a reflective exercise, encounters in electronic commerce B2C would correspond to each interaction of the customer with the website. Therefore, this mode fits any phase or stage of electronic commerce, for example, an encounter would be: navigating to find out how the page functions, seeking determined information (products on sale, payment and delivery terms, novelties, related interesting information) accessing the "Frequently Asked Questions" section, or sending an e-mail to complain about late delivery. On the other hand, the transaction covers the purchase in its entirety and, therefore, includes all the phases related to the purchase act and after-sales service. Finally, the relationship would be all the transactions over a time and would be based on trust and loyalty but only considering the transaction-relationship combination. We exclude encounters because, although they serve as a catalyst of the transaction and relationship, a true evaluative perspective requires, as a minimum, that the delivery of the service has been completed in its entirety.

Consequently, an integrative model is proposed for transactional quality; aspects typical of each purchasing act, and for relational quality; aspects typical of the continued purchase experience. In other words, if what forms the opinion is the action of the company in a single interaction, then we are dealing with a transactional evaluation. However, a company may act impeccably in one interaction but inefficiently in another. Therefore, it will be the accumulated perspective after successive company-customer interactions that really provides the consumer with more complete, integral information. This accumulated evaluation is called relational quality since it stems from a process of relations over a time and deals with the sum of different transactions. Furthermore, and as Wong and Sohal (2002) establish, relational quality represents the overall impression that a consumer has of the relationship that occurs after different transactions. Those authors also state that it is a bi-variant construct that comprises trust and satisfaction since high relational quality means that the consumer trusts in the integrity of the vendor company and has confidence in its future actions; the logic is that, if the past transaction has been successful, a similar behavior should be predicted in later service encounters. In other words, relational quality will be what generates true sustainable competitive advantage and contribute to explaining the quality perceived by the customer by introducing service aspects with a wider range than the transaction, which appear and are consolidated with time.

Some important aspects of transactional quality, that is, of a purchasing act, in electronic commerce B2Cs will be, among other matters, that the company puts on the website all the relevant information about the products and services offered, prices, terms of delivery, after-sales guarantee, contact address, the data confidentiality policy and navigation. Although these and other factors contribute to the success of the electronic transaction, customer loyalty is really achieved by giving the customer different added value from the competition. In this respect, the literature supports personalization of the offer from a broad conception, going beyond the adaptation of the characteristics of the product or service to the tastes and needs of each customer. Another area of relational quality hardly addressed in the literature but clearly important, is the proposal of dimensions and attributes referring to trust and collaboration between company and customer.

For empirical proof of the association between overall quality, the disposition to repeat the purchase experience and the disposition to recommend it to others, we can refer to Table 1. It shows the level of association between overall quality and the disposition to repeat, on the one hand, and with the disposition to recommend, on the other, as measured by Pearson's correlation coefficient. These data refer to a research work with the participation of 191 Internet shoppers who had made purchases in the period 2001/2002 (Melián Alzola, 2003). They also met determined criteria such as a memory of the purchase and having purchased standard products (mainly books and airline tickets). One significant conclusion of the work was that the quality of the purchases from the customer point of view was determined by an intuitive and orienting design, a coherent sales policy, the transmission of security, especially that of personal data, reduced prices and early delivery date. However, questions of personalization of the offer were statistically excluded from the study since companies operating on the Net do not yet have a clear personalization strategy. This contributes to the fact that the customers do not demand such attitudes either. This has logical consequences, since relational quality is what retains the customer, while transactional quality only leads to optimum completion of one transaction. This was revealed in this study, since, as shown, the relationship between overall quality and the disposition to recommend is slightly stronger than that between overall quality and the disposition to repeat. To be specific, the relationship between overall quality and the

disposition to repeat is 60%, which means that there is a 40% shortfall for companies to cover if they wish to retain the client. This shortfall must be covered by attention to relational, rather than transactional variables. In other words, once the customer is satisfied with each transaction, the company must focus its efforts on personalizing the offer to the customer, so increasing the exchange costs to the customer and contributing to mutual trust and collaboration.

Table 1. Relationship between overall quality, the disposition to repeat and the disposition to recommend

	Disposition to repeat	Disposition to recommend
Overall quality	0.576*	0.654*
	(0.000)	(0.000)

* Significance level of 0.01

6. CONCLUSIONS

The economy has recently been marked by the companies' predominance over the customer; that is, the offer was configured by the organizations. However, greater competition, market globalization and the development of the Internet have enabled the customer to reach a position of hegemony, with roles being exchanged; it is at this point where customer satisfaction and all the principles of quality management reach their maximum expression. Nevertheless, this new frame of action raises the level of debate to the relational sphere, which implies that the treatment of the company-customer combination goes beyond the encounters and transactions traditionally addressed in the relevant literature. Based on that approach, a dual model is proposed for organizational success in the new economy, with special emphasis on electronic commerce B2C. The model is determined by two spheres of action: transactional quality and relational quality. While transactional quality represents a basic level of action, what will determine short-term survival is relational quality; the alternative to be adopted in order to reinforce long-term customer loyalty. Therefore, a good part of future research must focus on relational quality.

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CULTURAL HERITAGE TOURISM AND MOBILE ICT

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ABSTRACT

Increasingly, citizens in developed countries have mobile access to various information sources. One application area that has attracted a lot of attention in recent years is tourism. Tourists by definition are on the move, i.e. mobile, and the features of advanced mobile ICT (e.g. personalization, localization, interactivity and context-awareness) suit admirably for delivering the sort of relevant and timely content that cultural heritage tourists demand. This paper presents a research and development project in which we focus on the potential of ICT to provide relevant services for cultural heritage tourists. The main goals of the project are the creation of a shared, one-stop digital repository of cultural artifacts and services, and the design and study of mobile applications and services for cultural heritage tourists in the region of Turku, Finland.

1. INTRODUCTION

The Institute for Advanced Management Systems Research (IAMSR) is a research institute at Åbo Akademi University, Finland, and it is presently researching and developing mobile applications and services for cultural heritage tourists and residents in the Turku region (see IAMSR Annual report 2002). The development work is intended to take place in close cooperation with the local municipal authorities, cultural institutions, schools and research institutions. The project is called *Culture and ICT in Turku*, and it is part of a larger development and research project that is called *Virtual Turku. Culture and ICT in Turku* has three major goals: 1) to build a network of cooperation between cultural institutions, municipal authorities, research institutions, schools and entrepreneurs; 2) to build a repository of digital content that from the user's viewpoint appears as one; 3) to design mobile services for cultural heritage tourists, conduct usability studies as well as develop and test business models. The first two goals the IAMSR shares with the larger framework of *Virtual Turku*, and they function as a prerequisite for the third goal. The IAMSR is directly responsible only for the third goal, i.e. the design and study of cultural services, but takes actively part in the work on the two first-mentioned goals, too.

2. ICT, MOBILE TECHNOLOGY AND CULTURAL HERITAGE TOURISM

ICT can be used to benefit every individual citizen in his/her everyday life. It can for instance be used to support health care services, distance learning, e-government initiatives, peer-to-peer sharing of digital

artifacts, virtual communities, and so forth, but it can also be used to provide access to cultural events as well as to interact in many ways with a wealth of cultural artifacts.

For the last fifty years or so tourism has been the fastest growing industry in the world, making it presently one of the world's largest industries (EC Statistics 2002; Europa, Undated). The tourist industry has also been quick to adopt new technology. ICT has a central role in the various businesses connected to tourism and travel. Hence it is no wonder that e-commerce as well as mobile commerce have been widely utilized in the tourist industry already at an early stage (Anckar 2002; Buhalis 2003). The information intensity of the tourist industry makes it exceptionally well suited for the utilization of the latest ICT solutions.

The wireless and mobility are generally recognized as technological spearheads in the Finnish ICT. The penetration rate of mobile phones in Europe is over 60%, whereas the corresponding figure in Finland is over 90%. Although almost every Finn owns a mobile phone, the demand for mobile services has not taken off as expected. After the commercial disappointment of the Wireless Application Protocol (WAP) services, many decision-makers and designers alike have turned their eyes towards new application areas, areas like health care and culture. As we all are – at least according to some visionaries (see e.g. Keen & Mackintosh 2001) – turning into nomads, it makes sense to provide cultural services using technology suitable for nomads.

3. RELATED PROJECTS

CHIMER (Cultural Heritage in Interactive Mobile Evolving Repositories) is one of the *Heritage for All* projects from the Sixth Call, funded by the European Commission's *Information Society Technology R&D* programme. It sets out to capitalise on the natural enthusiasm and interests of children in developing new approaches to the use of evolving technologies for documenting items of cultural interest in their local communities. Twelve-year-olds in different parts of Europe follow the guidance of museologists and teachers in building digital maps by combining geographical coordinates detected using GPS devices with the creative use of mobile technologies and digital cameras.

The IAMSR is responsible for the development of a *3G Mobile Geo-Heritage Guide*. The so-called M-guide is a multilingual multimedia tool. It uses the results of other CHIMER workpackages (cognitive methodology, digital heritage archive platform) to enable a mobile personalized access to geo-heritage data. The M-guide can be used on any 3G wireless information device, and will be able to run applications developed for the UMTS technology; but users will also be able to access part of the content (for example, only text) through WAP or GPRS, if they do not have access to a 3G phone.

Work on the project began in March 2002 and will be completed by late 2004. Some aspects of the project will emerge as early operational prototypes over the next few months (see Tétard, Forthcoming).

4. PROJECT DESCRIPTION, RESEARCH QUESTIONS AND OBJECTIVES

In order to provide suitable technological tools for the local and national memory institutions and cultural organizations, the IAMSR will focus mainly on system design and user and usability studies. To simplify things we could say that the memory institutions and cultural organizations will provide the content, ICT companies will provide the technology and the IAMSR will provide the system design and usability studies for the mobile applications, as illustrated in the following framework for research on cultural heritage tourism and ICT (See figure 1).

Of particular interest are the capturing, preservation, distribution, presentation and personalization of cultural artifacts by digital technologies in general and by mobile technologies in particular. Three major steps need to be taken: (1) to establish a network of memory institutions, cultural organizations, research institutions, municipal authorities, schools, private enterprises, volunteer organizations and volunteer associations; (2) to create a repository of digital content that from the user's viewpoint appears as one; 3) to develop and study location-based cultural services. In other words, the networking of memory institutions serves the creating of a common cultural repository, which makes multiple collections of cultural artifacts available to the users as

one digital source. By mobile technologies the cultural resources, pulled from the digital repository, may be made accessible to the users at the right time and place.
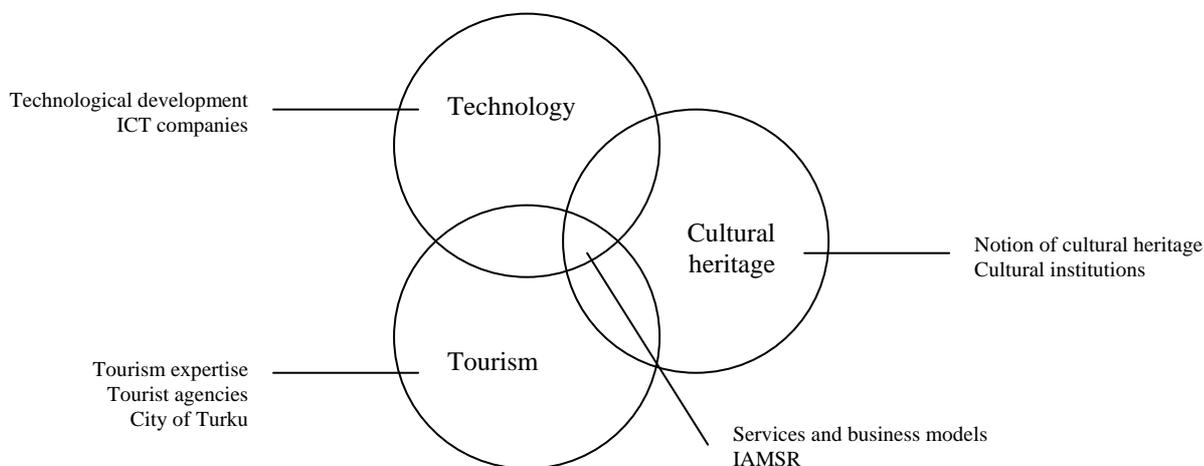
Figure 1. A framework for research on cultural heritage tourism and mobile ICT

The guiding principle of the design work for cultural services is to give the individual user maximal freedom in accessing, selecting, personalizing, creating archives and sharing the cultural artifacts pulled from memory institutions. In view of the individual user, the high quality of the user experience of artifacts is stressed. In other words, rather than focus on the quantity of cultural artifacts we focus on the quality and intensity of the individual experience. One memorable experience may lure individual users to visit a memory institution and perhaps awaken a life-long interest in a subject. To achieve this goal we will utilize and create various interactive digital techniques.

The individual users are not the only group that has to be taken into consideration. The project aims to keep an eye on the needs of five main stakeholders: individual users, curators, researchers, the community and entrepreneurs. The curators' and the researchers' interests are served by the digitalization and distribution of the resources and research findings. The entrepreneurs are also encouraged to take advantage of the cultural artifacts and create economically viable cultural products for tourists and other interested parties.

5. RESEARCH IN PROGRESS

So far we have conducted a preliminary survey on various memory institutions in Turku. We set out to find out what kind of memory institutions (art museums, cinemas, museums etc.) there are in the Turku region? What content do these institutions already have in a digital form? What is the most interesting thing that each institution has to offer for the general public or for some other party? What kind of systems could be applied to enhance the institution's products or services? Could these products or services be made available through a mobile device? The survey continues but we have already visited the foremost memory institutions in Turku in the summer 2003. In our discussions with the managers it came out that the institutions have already specialized in the course of the years so that each one has their own fairly well-defined niche. For instance, Wäinö Aaltonen Museum has responsibility over all outdoor monuments in the Turku region, whereas the Turku of the Middle Ages belongs to Aboa Vetus' area of expertise.

At a later stage, it will be important to conduct *expert interviews of the curators of memory institutions*. The interviews will answer questions like: What does the institution under scrutiny have to offer for individual users, researchers or other institutions? What would they like to offer/produce, given the technology? Develop some visions/scenarios for 2006-2007. The output of these interviews and the abovementioned surveys will be reported in *case studies of memory institutions*. At the same time, s*takeholder analysis and network analysis* will aim at finding ways to support cooperation and to coordinate cultural resources: to treat multiple digital collections in various cultural institutions as one. This goal entails

agreement on the creation of metadata standards to ensure accessibility and sharing of cultural heritage content across several digital platforms.

Our project benefits from previous research and development made in the CHIMER project. One of the applications developed in CHIMER is the M-guide (see chapter 3). One of the challenges in building the M-guide is the creation of the service concept: it is possible to build such an application from a technical point of view, but doubts remain about the adoption of such a service by a large user community; issues such as pricing are unresolved. The solution to this problem is partly in the creation of a sound service concept, which would take into account relevant business, technological and usability issues. We use a user-centered design (UCD) approach to build service concepts: UCD promotes involvement of users in the design process, thus ensuring that user needs are taken into account. To test the concept, we have set up a pilot for a mobile guide with Vanhalinna, a local museum in Turku. The mobile guide enables users to download localized maps of the territory and find places of interest in their surroundings. By selecting an object of interest, users can access related multimedia information and a wide variety of services (such as routing, for example).

In terms of mobile systems design, the following activities will take place: (i) Empirical studies on the *usability* of mobile systems and *user behaviour* studies will be conducted (theoretical conclusions on the user studies will be used in further design activities); (ii) design of *intelligent agents* for the purposes of user interfaces and collectors of data from identified data owners; (iii) mobile system design work in various institutions will be reported in *system development reports* (one concrete task is the design and implementation of a *mobile calendar* for cultural events); (iv) dissemination and *commercialization* plans and the study of *business models* for cultural heritage tourism.

6. CONCLUDING REMARKS

A successful completion of our project depends on a skillful combination of the three core areas outlined in the framework: technology, tourism and culture. More specifically, we have to first find institutions which are willing to cooperate, then find interesting cultural artifacts; digitalize the artifacts (if not already digitalized); find a suitable technology (on a mobile platform) by which to preserve, present and disseminate the artifacts; wrap the artifacts in a service concept; identify end user groups; study and develop the usability of the services; develop economically viable and ecologically sustainable business models for mobile location-based cultural services.

As was mentioned earlier, *ICT and Culture* is part of a larger ICT project in Turku, and the latter has various technological, economic and administrative goals of its own. Our biggest fear is that the cultural aspect does not get the attention it in our opinion deserves.

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THE IMPACT OF CULTURAL DIFFERENCES ON TRUST IN E-COMMERCE

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ABSTRACT

Although there has been a substantial amount of research on the importance of trust and cultural differences on trust in traditional business contexts, little is known of the impact of cultural differences on consumer trust in e-commerce. Based on previous studies on cultural factors and a consumer trust model that this study develops, this study examines the impact of cultural differences on consumer trust. First, this study will separate trust in e-commerce as a channel from trust in an e-tailer as a specific web vendor. Second, in selecting two distinct cultures to be compared, the relative levels of maturity of e-commerce of the two nations are considered. Lastly this study will select a society far more collectivistic than those that have been examined in previous studies.

1. INTRODUCTION

In a typical e-commerce environment, a high level of trust is required for both the buyer and the seller because of lower identification they can get from each other during the exchange. Trust has become one of the most critical factors that determine whether an e-retailer will be successful in the e-commerce environment.

In the current literature dealing with issues of trust in e-commerce, the importance of cultural difference to trust is recognized but not yet fully demonstrated. Owing to the difficulty of integrating all culture-related variables into one study, existing literature focuses on the impacts of culture on the propensity to trust. Although little has been discussed about the impact of cultural differences on trust in e-commerce, some variables and methods in a traditional business environment can also be applied to a study of e-commerce.

Most studies on cultural differences on trust have dealt with business professionals. Jarvenparr et al. (1999) suggested that culture affected the antecedents of online consumers. Strong and Weber (1998) conducted a cross-national survey to test the common assumption that cultural differences influence business professionals to trust others differently. Griffith et al. (2000) developed a four-country (United States, Canada, Chile, and Mexico) research. Some thoughts can be generated from the literature review. First of all, existing literature provides the direction of categorizing different cultures, so this study also will employ the classification of different cultures. Second, this study will support the assumption that cultural differences result in a different effect of trust antecedents.

This study proposes and tests a theoretical model about the antecedents of trust in e-commerce as a channel and trust in e-retailer as a specific seller. And then, based on the model regarding trust in e-commerce, it will examine the trust and the antecedents of trust in a cross-cultural setting. To do so, the United States will be assigned as an "individualistic-small power-weak uncertainty" type of culture while

South Korea will be assigned as a "collectivistic-large power distance-strong uncertainty avoidance" type of culture. This study attempts to provide an empirical validation of the impact of cultural differences on trust in e-commerce.

2. LITERATURE REVIEW

2.1 Trust in the Business Environment

The finding of Griffith et al. (2000) demonstrated that higher level of external trust than manager from Asian. National culture is discussed in these studies (Strong and Weber, 1998; Griffith et al., 2000). Since there are hundreds of countries in the world, there must be a proper way to put hundreds of different types of cultures into some categories to allow for comparison. These studies are summarized in the table 1.

Table 1. The Summary of Culture-related Studies

Authors	Main Idea	Variables
Strong and Weber (1998)	Examine the common assumption that trust is culturally determined and differentials in trust exist globally between cultures.	Level of self-interest Power Distance
Griffith et al. (2000)	The study tests the construct relationship between trust, commitment, conflict and satisfaction through manufacturer-distributor relationships.	Commitment Type 1 culture Type 2 culture

2.2 Cultural Difference of Trust

Inspired by the fundamental piece of Fukuyama's (1995) *Trust*, later trust studies focus mainly on the different propensities of organizational trust and inter-organizational trust in different countries. Specifically, the cultural background usually affects the way people trust. Different ethnic groups have different trust propensities regarding whom they consider trustworthy and how well they can put trust in others.

Strong and Weber adopted Hofetede's framework and used individualism (individualism/collectivism) and power distance (small/large) as independent variables. Griffith et al. (2000) assigned the United States and Canada as Type 1 culture with an "individualistic-small power distance-weak uncertainty avoidance" type of culture to contrast with Type 2 culture countries (Chile and Mexico) with "collectivistic-large power distance-strong uncertainty avoidance" characteristics. This study did discover that Type 1 culture has a higher possibility to form a trusting relationship with other Type1 culture countries rather than with other Type 2 culture countries. This study will extend this finding into trust in e-commerce context.

3. RESEARCH MODEL AND HYPOTHESES

This model comprises a wide range of the antecedents affecting trust as confirmed by previous studies on trust in e-commerce: Privacy (Miyazaki and Fernandez, 2001), disposition to trust (McKnight and Chervany, 2002), familiarity (Gefen, 2000), presence of a third party seal (Kimery et al, 2002), web site reputation (Doney and Cannon, 1997). This model is designed to indicate that these antecedents have a significant impact on trust in e-commerce and each arrow in the model refers to the fact that each antecedent is associated with trust in e-commerce/trust in an e-tailer (See Figure 1).

The impact of cultural differences on trust in e-commerce can be illuminated by testing the theoretical model that covers a wide range of antecedents affecting trust in e-commerce. The antecedents affecting trust

in e-commerce will vary from an individualistic-low uncertainty avoidance type of culture to a collectivistic-high uncertainty avoidance type of culture. For instance, in an individualistic culture, factors such privacy and presence of a third party seal are important, whereas, in a collectivistic culture, factors such as familiarity and disposition to trust may play a more important role. In the same manner, the degree of the influence of the antecedents of trust in e-commerce will depend on cultural differences. As will be dealt with later on, the influence of the 6 antecedents included in the research model will vary, depending on cultural differences. Analyses of the two sample groups based on the structural equation model will show the relative degree of significance and strength of the paths. Therefore, it follows that the 6 antecedents plays a role whose significance on trust in e-commerce varies, depending on cultural differences.

In this research model, trust in e-commerce should be considered in two aspects. One deals with e-commerce as a channel, the other with a specific web vendor. This is because each consumer has a different attitude on e-commerce as a channel and a specific web vendor. It does not necessarily lead to conclusion that general trust in e-commerce guarantees trust in a specific web vendor. The path from trust in e-commerce/trust in e-tailer to willingness to buy has been tested empirically and supported theoretically in previous research (Jarvenpaa and Tranctinsky, 1999). In line with the purpose of this study, it does not include testing these two paths (refer to a dotted box in the figure 1). A third-party seal, such as TRUSTe, has served to guarantee that a specific web vendor is reliable or legitimate, and that another antecedent - reputation - has been formed only for that specific vendor. Therefore, there is no reason to consider the linkage between a third-party seal/reputation and trust in e-commerce as a channel.

Research questions
1. Is there a significant difference in the effect of several significant antecedents of trust in e-commerce, depending on cultural differences?
2. What kinds of antecedents will play a significant role in explaining trust in e-commerce, depending on cultural differences?

In order to test the research question 1, the differences of all of the 6 antecedents in the two groups (American college students and Korean college students) are identified by an independent t-test. In order to test the research question 2, a SEM (structural equation model) analysis will be made on the data collected from American college students and Korean college students respectively. It will be tested by investigating the significances of the paths coefficients and comparing their respective strengths.
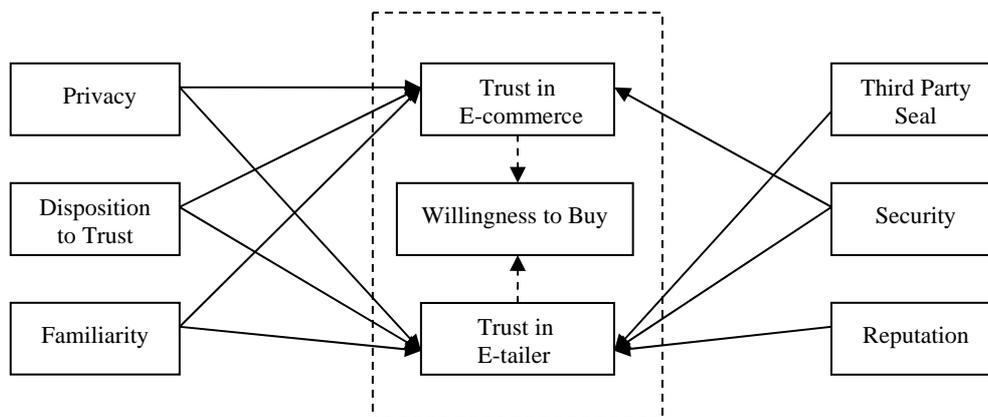
Figure 1. The research model on the effect of antecedents of trust in e-commerce and e-tailer

3.1 Privacy

Privacy refers to the rights of individuals and organizations to determine for themselves how, when, and to what extent information about them is to be permitted to others (Udo, 2001). Privacy issues come from concerns such as unauthorized sharing of personal information, contacts from the online retailer, and disclosure of the patterns of the customer's shopping behavior (Miyazaki and Fernandez, 2001). In Miyazaki and Fernandez's literature, although privacy concerns did not predict online purchase rates, it is still

identified as significant concerns for online consumers. Concerns about privacy are likely to raise perceived risk and lower purchase intentions (Labuschagne and Eloff, 2000), and it is expected to result in this findings that privacy issues are highly related to low trust in e-commerce.

H1-1: There will be a difference in the effect of privacy on trust in e-commerce (and H1-2: e-retailer) between the online consumers in an individualistic culture and those in a collectivistic society.

3.2 Security

Security is defined as the protection of data against accidental or intentional disclosure to unauthorized persons, or unauthorized modification or destruction (Udo, 2001). Online consumer's concerns regarding security affects purchase behavior (Miyazaki and Fernandez, 2001). If concerns about security issues are more likely to raise higher risk perception and lower purchase intentions, they will be expected to result in lower consumer trust in e-commerce.

H2-1: There will be a difference in the effect of security on trust in e-commerce (and H2-2: e-retailer) between the online consumers in an individualistic culture and those in a collectivistic society.

3.3 Disposition to Trust

Disposition to trust reflects the extent to which the trustor has a general expectation of how other people and entities should be trusted (McKnight and Chervany, 2002). According to McKnight and Chervany, disposition to trust is "cross-situational" and "cross-personal", that is, it is not based on experience or knowledge of a specific trustee. Gefen (2000) showed that disposition to trust has a significantly positive impact on trust. Therefore, it is posited that the stronger consumer's disposition to trust, the more he or she is likely to trust an e-commerce retailer.

H3-1: There will be a difference in the effect of disposition to trust on trust in e-commerce (and H3-2: e-retailer) between the online consumers in an individualistic culture and those in a collectivistic society.

3.4 Familiarity

Gefen (2000) stated that familiarity is a prerequisite of trust in that familiarity provides a framework for future expectation. This concept enables consumers to for specific opinions as to what to expect based on previous experiences. Familiarity is thought of as an understanding of a certain environment based on previous experiences. Gefen's study (2000) shows that the increased degree of familiarity with the specific e-retailer and e-commerce procedures increases trust in the vendor, furthermore, he suggested that the influence of familiarity on trust should be extended to existing trust-models.

H4-1: There will be a difference in the effect of familiarity on trust in e-commerce (and H4-2: e-retailer) between the online consumers in an individualistic culture and those in a collectivistic society.

3.5 Presence of a Third Party Seal

The study (Kimery et al, 2002) has shown that there is no significant direct impact of a third-party seal on consumer trust in a specific e-tailer. Since the meaning of third-party seal has not been known to people, they tend not to consider it a mechanism to guarantee trust. However, the privacy assurance seal has a positive impact on consumer trust in an e-tailer (Kimery et al. 2002). The consumer is more likely to be willing to disclose personal information to the vendor posting a third-party seal (e.g., TRUSTe).

H5: There will be a difference in the effect of a third party seal on trust in e-commerce between the online consumers in an individualistic culture and those in a collectivistic society.

3.6 Web Site Reputation

Web site reputation refers to the degree to which consumers are familiar with a Web site. Reputation has been frequently suggested as factors that result in consumer trust in a seller organization (Doney & Cannon, 1997). Reputation has been examined as a stronger antecedent of trust in e-commerce (Jarvenapp and

Tranctinsky, 1999). McKnight also posited that reputation is the "the second-hand rumor" that makes someone have positive traits and perceptions. Therefore, reputation provides people with a measure of how much the other party can be trusted in terms of ability, integrity, and benevolence.

H6: There will be a difference in the effect of Web site reputation on trust in e-commerce between the online consumers in an individualistic culture and those in a collectivistic society.

3.7 Trust

Trust in e-commerce can be distinguished into two aspects: trust in a channel and trust in a specific vendor. As trust in an e-commerce channel, institution-based trust is posited as an antecedent to trusting beliefs and trusting intentions (McKnight et al., 2002; McKnight and Chervany, 2002). It can be understood as an individual's perceptions of the institutional environment (e.g., e-commerce on the Internet). According to McKnight et al (2002), the perceptions of a specific Web vendor can be distinguished from the beliefs on the institutional environment. That is, although someone trusts e-commerce on the Internet, the consumer's trust does not necessarily guarantee she or he will trust a specific Web vendor. There has to be trust in the specific Web-based vendor. This trust is to be distinguished from the trust in the Internet, which is the basis of e-commerce.

4. METHOD

To test the proposed research model, two sets of data were collected from students enrolled in two universities in Korea and public universities in the United States. Korea has a collectivist cultural type characterized as strong and intimate social relationships among the member of society. Korea that belongs to Asia has been thought of as this cultural type (Markus and Kitayama, 1991; Griffith et al., 2000). The choice of the United States and Korea as the two samples can be justified that the two countries are representative of two typical cultures and they are also similarly positioned in terms of the maturity of e-commerce. Previous studies did consider cultural differences, but they had a shortcoming in failing to consider the relative maturity of e-commerce in the two countries. Although the student sample has a limitation, online consumers are generally younger and more educated than are conventional consumers (Kotkin, 1998; OECD, 1998). The students were asked to complete an online survey regarding their recent online purchase experience.

The research instrument to measure the constructs was developed either by adapting existing measures to the research context or by converting the definitions of the constructs into a questionnaire. Cross-country validation of the model will be implemented to examine the cultural differences. To test this, it will be examined by a structural equation model (SEM) results of the United States and those obtained in South Korea. The t-tests for independent groups will be conducted for each of these variables in order to confirm the differences between the groups.

5. CONCLUSION

This study is expected to show that the impact of some antecedents of trust will be influenced by cultural differences between different cultural environments. By comparing two different cultural environments, we may better understand the influences of cultural differences on trust in e-commerce and trust in the e-tailer. This research is expected to provide both theoretical explanations and empirical validations of the impact of cultural differences on trust in e-commerce and the e-tailer. Since there has been no study on what kinds of antecedents of trust in e-commerce have more effects on trust, depending on cultural differences, this study will focus on examining the significant impact of the differences in culture on trust on the part of the online consumers in respective societies. There is a limitation of this study. As westernization is rapidly sweeping across the world, a collectivist culture is likely to lose its traditional characteristics. Therefore, this phenomenon may weaken the validity of this study.

Previous studies on the effect of culture on trust and risk perception in e-commerce have been focused on how culture influences trust-building and risk perception. The result of this study would be used in following research that aims to expand our understanding of the effect of each antecedent of trust in e-commerce, based

on distinct cultural environments. This study also widens our understanding of what kinds of factors –based on cultural characteristics—should be considered relatively more seriously by the online vendor in establishing trust in e-commerce.

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AN INVESTIGATION OF THE USES OF DEPTH OF FIELD AND STOCHASTIC CONCEPTS IN FINE TUNING STRATEGIC PLAYS IN THE AUSTRALIAN STOCK MARKET AND ITS IMPACT ON SYSTEMS DEVELOPMENT

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ABSTRACT

This paper identifies the role and use of Depth of Field in fine tuning strategic positions in the Australian Stock market resulting from the use of tools made available using the Internet. It examines the threats and opportunities exerted on the activities of the traditional stock broker in the Australian market as a result of the Internet being used by individual traders, and discusses the importance of fine tuning strategic plays using Depth of Field analysis combined with the use of Stochastic techniques in the Australian Stock Market during 1999/2004. It also shows how such analysis impacts upon the design and development of an information system and how it may be used to aid students in the analysis and development of DSS implementations.

1. INTRODUCTION

Developments bought about by the Internet have forced many international financial service institutions to re-examine the way they conduct their existing business practices and develop new ones. Brokers have to respond to a range of services and techniques available via the Internet and to the demands of a rapidly expanding group of "Internet educated" independent traders. These "Techno-traders" access information that is freely shared and analysed, instead of being filtered through a traditional stock broker who decides what a client "needs to know". Independent traders challenge this traditional role by demanding On-Line Internet broking services that provide them with tools and information to make better trading decisions.

This paper is organised as follows: first, it briefly examines the structure of the Australian Internet On-Line Industry and the evolving relationships between the various participants. Second, it shows the tactical approach using Stochastic concepts and Depth of Field techniques. Thirdly, it illustrates the impact of analysis on designing DSS systems by students in our courses.

Current Australian Internet Setting

Since March 2000, rapid corporate developments have had a dramatic impact upon the current Internet Broking Scene. On-Line broking sites have formed alliances with well-established companies such as the ANZ Bank and E-TRADE. Thus forcing traditional brokers such as J B WERE to compete on fees and service. This can be seen by comparing the traditional minimum $100 fee and up to 2% of the transaction costs with the table below.

On-Line Broking Costs			
Value of trade (A$)	**1,000**	**10,000**	**30,000**
Transaction costs			
COMSEC	**$24.95**	**$29**	**$29**
GREENLINE	**$29**	**$29**	**$29**
SANFORD	**$28.95**	**$28.95**	**$30**
E*TRADE	**$49.50**	**$49.50**	**$49.50**

Potential On-Line Customers of Major Banks

	ANZ	CBA	NAB	WBC
Total On-Line customers	200,000	170,000	18,000	60,000
Also On-Line brokingclients	30,000*	60,000	5000	20,000

Potential E-Trade Business Trends

Another clue to the huge growth potential of Internet broking can be gleaned from Ecorp's prospectus where it forecasts 181% over the pcp. These projections have been made on the basis of the increase in monthly trading volumes since commencement of its operations via "ShareTrade". Note, only 16% of trades are conducted On-Line compared to 95% of E*TRADES On-Line service, with the remainder being trades initiated by other methods such as telephone or e-mail. In the USA, already 45% of trades are conducted On-line with the rest of the world to follow.
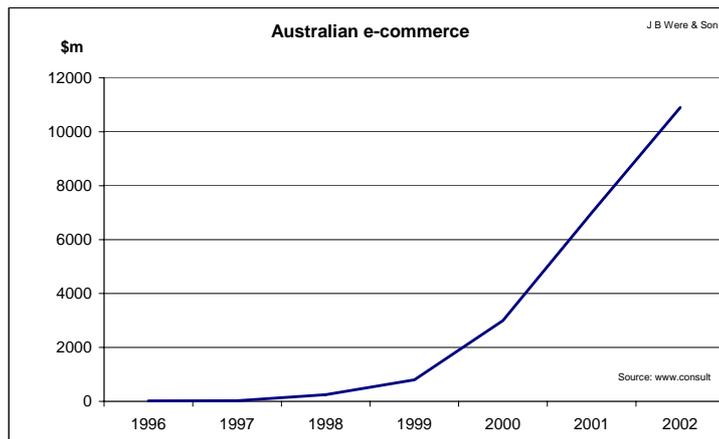
Clearly, the traditional stockbrokers are threatened by the rapid expansion of On-Line brokerage. Most studies show that the best way to make money from the Internet lies in the provision of services and in the manipulation of information. However, more time must be spent on disciplined analysis and reflections made on their impact on designing superior decision support systems, if we are to leverage this mass of information.

Tactical Approaches Using Stochastic Concepts and Depth of Field

After completing an analysis of the strategic timing plays by reference to the seasonal pattern in Australia (see table below eg the All Ords Industrials), it is important to look at particular stocks and tactical plays using the Stochastic and Depth of Field techniques to determine exactly **when** to transact.

Slide 1: Depth of Field for NDY on Dec 1

Depth of field is a feature of the Australian Stock market where open orders for buying and selling a stock are tracked On-Line second by second. Analysis of this unique Australian feature of the ASX enables discerning tacticians to exit or enter at the right price for the day. Not only can prices at the margin be discerned but also by noting the buyers and sellers entering or exiting the market lower down the open order list (see slide 1). When analysed over time, many broad strategic plays can be fine tuned, thus affording more realistic exit and entry points. In this example of Normandy, clear signals make NDY a buy at 1.31 on 15 October 1998 (See slide 2) and a sell at 1.53 on 15 November (See slide 3) - a nice monthly trade of 22 cents, which could have been repeated at least **Six times** during the year.) **Stochastic** is a moving average indicator that gives some precision as to when a stock is in an oversold or overbought state. This normally corresponds to the 20 or 25 and the 75 or 80 percentile positions on a chart. Using the %d moving average a sell or buy signal is indicated. (See slides 2 and 3).

Slide 2: Stochastic Analysis - showing a 'buy signal'

Slide 3: Stochastic Analysis - showing a 'sell signal'

Superior results must be obtained when the strategic analysis of the Index and the Industry of the stock is combined with the tactical tools of the Stochastic and Depth of Field analysis. It is clear that timing in the market as well as time in the market is superior to the marketing hype, particularly when time and effort is expended into the analysis of the problem.

Returns of 50% plus per annum are consistently achievable, whatever the state of the market, provided the strategic quality of analysis and the tactical application of these tools is applied with rigour and discipline.

The Impact of Analysis on Designing DSS Systems

It should be clear that even a simple concept of plotting price requires the assumptions to be clearly analysed and made explicit when designing a system to aid a sell or buy decision. For instance what is a buy price? It could mean a variety of things such as: last selling price, closing price, opening price, highest price of the hour/day/week/month/year. Or, all of the above plus duty and brokerage, capital gains tax, cost of money, etc. Likewise, the selling price requires as examination of many assumptions such as: when it earns a profit of 10% plus, when it reaches the 80th percentile on the daily stochastic, when the price has fallen more than 2% of our Stock Loss/ Stock gain filter, when the price gives a "good" return, when the price matches the best month of the year, when the price has exceeded the return required in our parameter list, and so on. In addition, it is important to look at historical monthly trends over some defined period – not only in the stock itself, but also its relationship to the All Ords Index, or to the index of the country concerned. This is a key design question often overlooked.

Below, are monthly charts supplied by JB WERE Stockbrokers. They indicate the typical strength of the tax loss selling pressures, and show the typically poor performance of the equity market during June, and stronger performance during July (both in absolute returns and probability of the market returning a loss) since 1980. It is clear that timing in the market is crucially important both in terms of probability of outcome and average monthly performance. They show a consistent pattern of a typically poor June followed by a stronger July. This suggests that a strategy to exploit any opportunities from tax loss induced selling pressures during June will typically be supported by a stronger seasonal market pattern in July. Other buy periods, such as Feb/Oct should also be mapped into a design concept.

Seasonal Pattern of the Australian Market
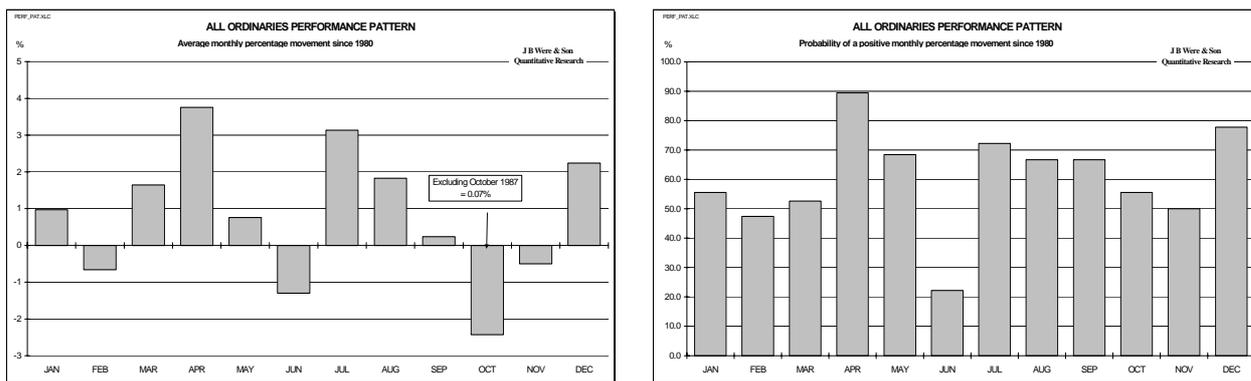
2. CONCLUSION

There are many tools available via discussion groups on the Internet which could be incorporated in a DSS system. Regardless of the technology that exists or that developed in the future, nothing will work effectively unless the strategic quality of analysis and the tactical application of these tools are applied with rigour and discipline. It is imperative to force developers or traders to be very explicit about what is implicit in their trading systems in the design process before successful applications can be implemented so other people can understand and duplicate them. Thus we need to encourage developers and students to explore and examine such issues. Making these explicit issues will go a long way to helping traders beat the market – enabling them to design systems that will ensure annual returns that exceed 50% when the norm is 15%.

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THE POLISH E-COMMERCE MARKET
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ABSTRACT

With the development of the Internet a new medium of communications, e-commerce grows in importance. The history of electronic commerce in Poland is merely 8 years old. The article outlines the picture of Polish internet users in the aspect of potential e-shop customers. Then, it characterizes the development of the Polish e-commerce market. The B2C sector was subjected to analysis. Quantitative variations in the number of e-shops, their range of goods, and the methods of payment and distribution were determined. In qualitative studies, the functionality of the aspects of these shops was assessed. By analyzing the problem of e-commerce in Poland, barriers have been identified, which hamper its development. Surveys carried out by the author on the group of enterprises in the Częstochowa area reflect, to a great extent, the concern of all Polish enterprises. Based on the results of the author's own studies and the opinions of respondents, forecasts for the development of the Polish e-market have been given.

KEYWORDS

Polish e-commerce market, barriers to development.

1. INTRODUCTION

For the purposes of further considerations, we will define the concept of e-commerce as the process of selling and buying products and services, and thus concluding commercial transactions with the use of electronic facilities, conducted through the Internet (often, traditional tools, such as fax or telephone, are also useful) [1]. E-commerce is not limited to the Internet only. EDI, t-commerce, m-commerce, Intranet, Extranet or telephone cards are also used in this process.

Internet electronic commerce should be regarded as a development, enrichment or even complement of previous solutions (e.g.. EDI). The Internet, as a new medium of communications, has many advantages, such as: accessibility, cost-effectiveness, possibility of transmission customization (one to one model), interactivity, flexibility, possibility of improving offered services, increasing transaction safety, and possibility of selecting solutions matched to the needs of a particular firm.

Among Polish shops, there are most of all vertical shops that sell goods within a single product-range group. Most often, these shops have also other, non-internet distribution channels which provide them a considerable support in gaining profits. The role of horizontal shops with a broad product range intended for a wide group of customers is being taken over by virtual shopping malls. The largest Polish virtual shopping malls include "Zakupy Onet", "Pasaz handlowy WP" and "Aleja Handlowa". A barrier that restrains shops from accessing a virtual shopping mall are relatively high annual fees.

2. THE USER OF INTERNET INPOLAND

As an Internet user, that individual is defined, who has access to the Internet and uses it. In 2003, 21% of adult Poles (above the age of 15) declared to have access to the Internet. Polish internauts are, in most part,

young people at the age of 15-24 (56%), and at the age of 25-39 (26%). Individuals with medium-level (41%) and higher (20%) education and students (29%) prevail. In the structure of internauts as determined by gained incomes, the "no incomes" declaration (42%) and the declaration of medium-level incomes (19%) are prevalent .

The cost of connection with the Internet (dial-up access) for 20 hours monthly is about $70, whereas the European average is $40 [3]. These costs can be reduced by using so called internet packages. The high costs determine a low frequency of using the Web and a short time of staying online. Nearly half of those surveyed only use the Internet once a week. Individuals using the Internet are, in most part, the residents of large cities, which is closely related with the technical infrastructure of telecommunications networks. Internauts connect with the Web at home (44%), at the university/college/school (31%) and at work (21%) [8], [9].

The selected statistical data presented above create rather a poor image of a Polish internaut as a potential e-commerce client. A key to the increase in Internet popularity seems to be Poland's economic growth, and the appearance of new means of connection with the Internet (such as satellite lines).

3. THE POLISH B2C MARKET

The internet shop is defined as "a firm located in Poland, which offers the customer a possibility of acquainting himself with a goods and placing an order through the Internet, paying for the goods without having to "leave the home", and assures the goods to be delivered to the home". The first Polish internet shops came into being in 1996. There were merely 30 of them at that time. At present, 800 internet shops are active in Poland.

The analysis of the selection of goods offered by Polish internet shops reveals a significant similarity to internet shops in other countries. The selection of goods have not changed considerably during recent months. Books and publications are in the first place – as many as 30% of shops offer this type of product. The second place is occupied by multimedia, that is music and CDs. The number of shops that include multimedia in their offer has increased from 12.2% of shops to 18.2% of shops. Software comes third (with the drop from 16.3% to 15.5%). Then, electronics (with the increase from 10.6% to 13.6%) and computer hardware with a level of 10% follow. The percentage of shops offering clothing, foodstuffs or cosmetics is very low. The range of goods offered by e-shops reflects the preferences of Poles. These do not deviate substantially from the preferences of the statistically average internaut. Some differences can only be observed in demand for foodstuffs. A majority of Polish e-shops, i.e. 56.4%, continues to offer only a single product-range group.

Substantial differences between Polish and the world's e-shops occur in the form of payment. A vast majority of Polish internet shops (84%) use C.O.D. as a form of payment. Payment (to the forwarding agent) upon receipt is also preferred (67%), and transfers from an electronic account, payment by a credit card, and other forms are accepted, too. Among the methods of delivering products purchased on the Web, postal consignments (76%), the use of the services of forwarding firms (61%) and, to a less extent, the seller's own transport (16%) means are prevalent [8], [9].

4. E-COMMERCE DEVELOPMENT BARRIERS- THE RESULT OF RESEARCH

In the first part of research the structure of business market in Czestochowa was investigated 60 businesses agreed to conduct research. They represent different branches of business: production, wholesaling and retailing, transport, business services and tourism.

Researching using of Internet was not the aim of research. During interviews the answer to the following question: *What is stopping companies from entering e-commerce market?* was researched.

On the basis of gathered material the list of most often appearing barriers that stop management from spreading or changing present actions was created. On the list 15 barriers were specified. Below the list is presented. For easier understanding, the barriers were called: barrier 1, barrier 2, etc.

Barrier 1:   e-commerce will cause changes in the way of doing business and work organisation,

Barrier 2:   net transactions safety scares, especially safe payment forms – ones that unable catching the signal by somebody who is not authorised. Different companies work on new payment forms (like digital cash) but these are just trials,

Barrier 3:   limited access to the Internet, the poor telecommunications infrastructure,

Barrier 4:   resistance of employees based on fear of: need of widening qualifications, growth of responsibility, reorganisation, reduction of posts,

Barrier 5:   tradition and habits (work culture),

Barrier 6:   Internet language is English,

Barrier 7:   too high cost of product delivery,

Barrier 8:   imperfection of Internet technologies,

Barrier 9:   law level of Internet knowledge and its practical usage by directors and high level management all businesses and public institutions,

Barrier 10:   crowded net and technical problems caused by slow technical progress in the area of data transmission compering to a speed of growth of net users' number. This causes a long time waiting for page loading and increases costs for users (mostly using modems and paying higher phone bills),

Barrier 11:   lack of effective and spread spedition and delivery system,

Barrier 12:   high costs of connections, teleinformation equipment, basic software, etc. at the beginning

Barrier 13:   too high current costs – using links, Internet

Barrier 14:   lack of lawful rules (basing lawful procedures on paper documents

Barrier 15:   lack of effective payments by credit cards service,

   Then the second part of research took place. Managers were asked to value the created list of barriers. Every barrier could get one mark according to a following scale: very high barrier, high barrier, medium barrier, law barrier, that barrier does not exist.

   The last part of research was an analyse of research results. For questionnaire answers according to the above scale (from very high to non existing), the following scale was used: very high –5, high – 4, medium – 3, law – 2, no existing – 0. Then average was estimated, and the results are presented in the Figure 1.
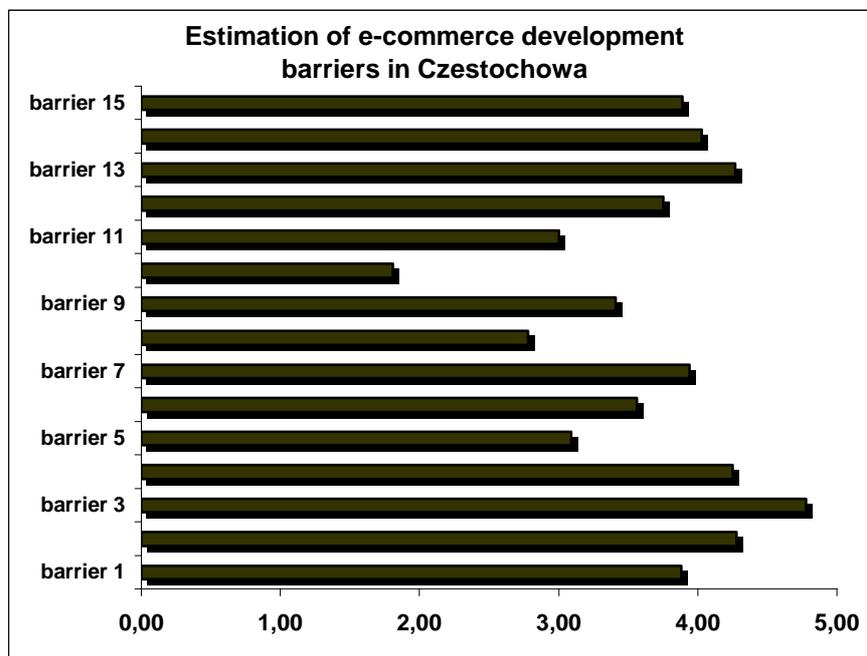
Figure 1. Estimation of e-commerce development barriers

   The analyse of prepared graph indicated which barriers are really holding back e-commerce development in Poland. Optimal would be graph with values close to 0. This kind of results would suggest almost sudden and very dynamic e-commerce development in Poland. Unfortunately, analyse of the graph shows that in

Polish conditions there are many factors holding back e-commerce development. Conducted research as the most important of them identified limited access to the Internet, the poor telecommunications infrastructure, net transactions safety scares, too high current costs – using links, Internet, and resistance of employees based on fear of: need of widening qualifications, growth of responsibility, reorganisation, reduction of posts. Many companies stop lack of lawful rules, because all lawful procedures are based on paper documents. Too high cost of delivery products to a client, transactions and payments in net safety are the next barriers.The barrier characteristic for Polish conditions is quite high initial costs of connections, teleinformation equipment, basic software and technical problems that cause very long time of loading WWW pages and increase costs for users (potential clients), who mostly use modems and pay higher phone bills.

Research conducted in the group of businesses from Czestochowa reflect fears of all Polish businesses of introducing e-commerce.

Assuming, the main barriers of e-commerce in Polish businesses, are characterised as economic or they are linked to law quality of connections and high costs of telecommunication services. Conducted research put social and cultural barriers on the top position and it must be remembered that surmounting of this kind of barrier is the most difficult for potential clients.

It is worth mentioning that any of respondents did not exclude possibility of using e-commerce in their business and in the closest future.

5. CONCLUSION

Firms should be aware of benefits gained from the use of the Internet in commercial activity and in the exchange of goods. E-commerce is a chance for business, for the owners of internet shops and for service-takers (customers), as it provides a new, convenient means of access to many products.

Poland, as a potential e-commerce market, is large, but not economically strong enough. Polish e-shops account for less than 1% of share in the European B2C [4]. Poland's population is 39 million people, and we have the largest number of Internet users in Eastern Europe. However, the analysis of the percentage share of Poles who use the Internet compared to other Eastern European countries shows that Poland is in a low position. We are surpassed by such countries, as Estonia, the Czech Republic, Croatia, Latvia, Slovakia, Bulgaria and Hungary [4]. The main causes of this situation are due to the low incomes of Poles, high telecommunications costs, and limited access to the Internet for about 38% of people living in rural areas. Thus, the Polish e-commerce remains far behind the European countries.

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THE PROMISE AND REALITY OF INTERNET-BASED INTERORGANIZATIONAL SYSTEMS

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ABSTRACT

When a firm needs to comply with the diverse information system requirements of its trading partners, switching cost between interorganizational information systems (IOS) becomes an issue. Internet-based IOS promise seamless integration with less switching cost due to the widespread standards they use. This paper hypothesizes that despite the common myth Internet-based IOSs still incur switching costs to the extent that affect the system adoption decision of decision-makers. We propose a model to examine the switching cost between IOSs based on their compatibility and relation specificity. These two factors are separately viewed at the infrastructure, application and business process levels.

KEYWORDS

Interorganizational systems, Adoption, Switching cost, Compatibility, Business processes

1. INTRODUCTION

1.1 From EDI to XML

Interorganizational information systems are information systems that span organizational boundaries (Gregor and Johnston, 2001). In the context of supply chains they enable integration between trading partners through faster, more efficient and more accurate data exchange, thus offering ample benefits for companies (Bakos, 1998; Banerjee and Golhar, 1994; Heck and Ribbers, 1999; Krcmar, Bjorn-Andersen and O'Callaghan, 1995; O'Callaghan, Kaufmann and Konsynski, 1992; Vlosky, Smith and Wilson, 1994). Despite these benefits many projects to introduce such systems fail before they reach the implementation phase.

The field of IOS adoption already has a long history (Somasundaram and Rose, 2003). Most of the research focuses on electronic data interchange (EDI). EDI has been used for more than 30 years now (Stefansson, 2002) to exchange structured data electronically in a standardized format between organizations (O'Callaghan and Turner, 1995) and is being intensively researched since the mid 1980s (Chan and Swatman, 1998; Somasundaram and Karlsbjerg, 2003). EDI however is an old technology that requires considerable investment that can act as a barrier towards adoption.

Chwelos et al. (2001) has suggested that knowledge obtained from studying IOS adoption could be extended by studying the adoption of Internet-based systems that interconnect businesses. Extranets, XML-based messaging and web services carry the promise to drastically reduce switching costs between systems

and the cost of integration with legacy systems. (Papazoglou, Ribbers and Tsalagtidou, 2000). The main proposition of this paper is that although newer technologies allow for better interoperability, costs incurred from business process changes are increasingly becoming proportionately higher cost factors and should not be overlooked.

In order to test this proposition we intend to collect and analyze empirical data on EDI-based IOS adoption and Internet-based IOS adoption. The later group includes technologies that use XML, SOAP, WSDL and other application programming interfaces (APIs) that have become integral in the development and deployment of cross-company business process IOS standards (Nelson and Shaw, 2003).

1.2 Economics of IOS

Firms act strategically when they decide not to adopt a certain IOS (1993), therefore we assume that companies act rationally and estimate not only the benefits (Chwelos et al., 2001; Jones and Beatty, 1998), but also the perceived costs (Ekering, 2000) and perceived risks (Kumar and Dissel, 1996) of an IOS project. In this paper we are focusing on the perceived switching costs as the composition of compatibility and relation specificity and we ask the questions: what is the switching cost of Internet-based IOSs and which cost components are more important in the adoption decision?

Compatibility of an innovation with existing organizational policies, procedures, values and systems is considered to be a relevant aspect of innovation adoption (Rogers, 1995) and often has been applied in IOS adoption studies. O'Callaghan et al. (1992) distinguishes technological compatibility and operational compatibility.

Compatibility is viewed here as the effort needed to bring the current technological and operational procedures to the level required by the proposed IOS. We distinguish infrastructure-, application- and business process level compatibility, and hypothesize that the more a firm need to invest into any of these, the less compatible its current systems are.

Another factor that affects switching cost is the relation specificity of the proposed system. High relation specific investments have little or no value outside the relationship in which it is realized and bear high sunk costs. Relation specificity is derived from asset specificity (Williamson, 1979) and was developed by Ekering (Ekering, 2000).

2. RESEARCH MODEL
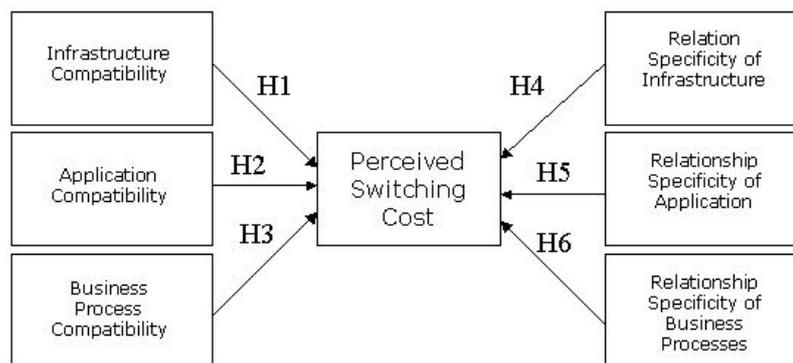
Figure 1. Research Model

Switching cost is defined as the cost incurred by the organization when deciding to adopt a new IOS compared to the current technological and operational level.

Compatibility

Infrastructure compatibility

Infrastructure compatibility pertains to the adjusting of existing information and communication technology (ICT) infrastructures of the organizations in order to realize a new IOS. These adjustments are aimed at the realization of a technological foundation for this IOS. Due to the fact that this foundation will often be distributed, diverse and heterogeneous in nature, achieving infrastructure compatibility can be a complicated issue. However, most organizations are now connected to the Internet, providing them an easy and cheap means to communicate with other organizations, reducing the costs of realizing infrastructure compatibility.

Application compatibility

Application compatibility is related to the integration of applications operating in (often) different computing environments. In enterprise application integration (EAI), the aim is to enable communication between diverse, heterogeneous applications. The issues that need to be resolved to achieve the latter, are similar to those for integrating applications from different organizations. These issues originate from the fact that applications may differ in their abilities to communicate, their representation and interpretation of data, the manner in which they expose their functionality to others, and etceteras.

Until recently application compatibility was achieved through the development of custom connections between applications (such as EDI). Web services offer higher scalability and flexibility by enabling standardized and platform-independent communication between applications. The advantages of this approach are apparent: 1) standardized development of application interfaces will reduce the efforts and costs associated with application integration; 2) developed application interfaces can now be re-used across multiple integrations, making application integration more efficient and flexible. As such, we expect that application compatibility will become less and less a contributor to the switching costs of an IOS.

Business process compatibility

The purpose of an IOS is to facilitate business interactions, as described in policies that define the overall flow of information between multiple enterprises, as such functioning as an agreement. However, actual realization of the agreed upon activities in the business interactions is achieved via the internal business processes of the organizations involved. It is for this reason that business process compatibility is an issue in IOSs.

Compatibility of business processes concerns the reshaping of internal organizational processes to the practice required by the new IOS. It involves redesign of process activities, reallocation of resources, redefinition of internal norms and rules, etc. However, business processes are usually of a complex and intricate nature, making the effectuation of changes an (often) painstaking endeavor.

Although several approaches have been developed that may increase the ease with which business process compatibility can be achieved (e.g. in Curbera et al), business process compatibility will (for the time being) remain a serious inhibitor for switching partners.

Relation Specificity

The essence of transaction cost theory is that the choice of optimal and efficient coordination structure in every situation minimizes both the transaction cost between the parties and an internal coordination cost for each partner. In the world of EDI, there is a significant investment made by both parties in the optimization exercise.

Relation specificity of an EDI cooperation is defined as the degree in which relationship specific investments are being undertaken in the characteristic element of the EDI cooperation, which specifically related to EDI application of the trade partner concerned. Relation specificity does not need to be equally high for both trading partners, but has to be mutual (Nooteboom, 1992; Nooteboom, 1993). It is therefore important for trading partners separately to define the EDI cooperation from their side of the relationship.

Relation specific investments have been suggested to increase if there is a more closed or proprietary implementation of EDI. Even going forward into more open standard environment, there are still elements of relation specificity in the IOS infrastructure. This therefore potentially impacts switching costs. Table 1 highlights the operational aspects of EDI cooperation that contribute to relation specificity costs (Ekering, 2000).

Table 1. Relation Specificity in EDI Cooperation (Ekering, 2000)

Overall relation specificity in EDI cooperation is determined by the correlation between the relation specificity of the separate categories aspects of EDI cooperation (which can be considered to be part of the automation-technical or logistic-organizational components respectively).
The higher the degree of relation specificity of the separate categories aspects, the higher the degree of relation specificity of the EDI cooperation.
Relation specificity of each of the separate categories aspects is determined by the characteristic elements of the EDI cooperation, which can be considered to be part of these particular category aspects and which specifically pertains to the EDI application with the particular trading partner. Other aspects, such as costs and the relative part of the total throughput time of the realization of the EDI application, may play a role.

3. HYPOTHESES

We developed several hypotheses to be tested based on the research model. H1-H6 tests the relationship of each independent variable with the dependent variable.

H1: Infrastructure compatibility of a proposed IOS significantly affects the perceived switching costs of the organization

H2: Application compatibility of a proposed IOS significantly affects the perceived switching costs of the organization

H3: Business process compatibility of a proposed IOS significantly affects the perceived switching costs of the organization

H4: Relation specificity of Infrastructure requirement of a proposed IOS significantly affects the perceived switching costs of the organization

H5: Relation specificity of Application requirements of a proposed IOS significantly affects the perceived switching costs of the organization

H6: Relation specificity of Business process requirements of a proposed IOS significantly affects the perceived switching costs of the organization

Increased standardization of information technologies makes integration between trading partners easier, faster and cheaper. Internet-based technologies have widely proliferated and decreased the weight of interconnectivity.

H7: Application compatibility has a larger effect on the perceived switching cost of an organization than Infrastructure compatibility

The resulting improved information exchange of an integration changes business processes. Business processes are harder to change, especially when a firm is faced with several requirements from diverse trading partners.

H8: Business process compatibility has a larger effect on the perceived switching cost of an organization than Application compatibility

H9: Relation specificity of Business process change requirements has a larger effect on the perceived switching cost of an organization than Relation specificity of Application change.

The research method for data collection is a longitudinal case study. The selected company is Trespa International BV, which is an international company in the Netherlands that develops and manufactures high-quality paneling for façade cladding and interior applications. Trespa has about 600 international buying customers who generate about 60.000 order lines a year. Trespa is currently planning to establish electronic linkages with all of its customers to automate order processing. A questionnaire will be sent to all the customers to gather survey data on their expected switching costs between IOS and their willingness to adopt. Statistical analysis will be used to corroborate the propositions.

4. CONCLUSIONS / CONTRIBUTIONS

The main proposition of the paper is that the business process change required by the implementation of a new IOS has a larger impact on the adoption decision than the technological integration itself in case of Internet-based systems. We proposed a model to test the switching cost of IOS on three levels: infrastructure, application integration and business processes. The paper has two contributions to the existing body of knowledge: First, it proposes that the standardization of information technologies in itself is not sufficient to assume seamless integration between organizations; derived costs resulting from changing business practices are still taking a large portion of the costs and can act as a barrier to adoption. Second, we aim to compare the much-researched EDI with current Internet-based systems and to provide empirical evidence on switching cost difference between the two and on the composition of these costs. There is an increasing need for such empirical work, because 1) more and more businesses migrate to Internet-based IOS 2) a single firm faces different system requirements per trading partner 3) but we do not know whether Internet-based systems deliver the modularity and flexibility they promise.

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STRENGTHENING THE POSITION OF PERIPHERAL REGIONS BY IMPLEMENTING DIGITAL VALUE CHAINS (DVC'S)

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ABSTRACT

Based on Porters idea to model enterprises by chains of value-creating activities this paper presents an approach to develop digital value chains within the Networked Economy especially fitting to the circumstances given in peripheral regions. This is motivated by the fact, that the new ICT allow peripheral regions at least partly to compensate their location disadvantage employing appropriate eStrategies to exploit their regional cultural and other digitizable assets.

KEYWORDS

Digital Economy, Digital Value Cain

1. INTRODUCTION: THE DIGITAL VALUE CHAIN

Peripheral regions typically do not have a strong industrial branch, suffer from limited research and education institutions as well as from other location disadvantages. Exploiting strategically the potentials of modern ICT for participating in the networked economy, however, they may overcome these handicaps to some extent. The project TEDIP (Technology, Economics and Diversity in the Periphery, EU IST-1999-20193, http://tedip.joensuu.fi) accomplished by research and development organizations from 6 European regions, investigated such opportunities. It focussed on the convergence of media into an interactive network for trans-regional collaboration by establishing digital value and supply chains that, in their turn, sustain and exploit the regional cultural diversity.

This paper outlines some of the TEDIP results with a special emphasis on Digital Value Chains (DVC, see Porter 2001) and Regional Network Modeling, both having been an essential part of the Carinthian project team contribution. Basically, our model of DVC's and value network concepts (see Bovet, D.; Martha, J., 2001) follows Porter, who proposed to model a firm as a chain of value-creating actitivies. The key concept of Porter's approach is an intraorganisational view of the combination of traditional resources and processes. With the shift from the Old to the Networked Economy based on the new ICT new kinds of activities came up, so that these concepts have to be revised in order to better integrate the customer's viewpoint and the possibilities emerging from digitalization:

- The digital value chain reveals the value-adding process of featuring **digital** products and services and deals with the **transformation of non-digital raw materials into digital assets** (see figure 1), which in turn may be marketed or used as a basis for creating **digital content** or **digital service systems** (see also Williams 2003).
- It is rather unusual that a single company performs all chain link activities of the DVC from product design, production of components, final assembly and delivery to the final user by itself. Most often, organizations are elements of a value system or supply chain. Figure 1 represents a model of such an intraorganisational value chain, which forms one "link" in the entire DVC-process (one part of the supply chain) beside of the supplier-, channel and customers value chains. The supply chain consists (as a chain of value-creating activities) of a linkage (**network**) of intraorganisational value chains. The completion of the DVC-process consists in linking all individual intraorganisational value chains together which are

necessary for the DVC-completion. The number of supply chain partners is not predefined and depends on the individual DVC-business process.
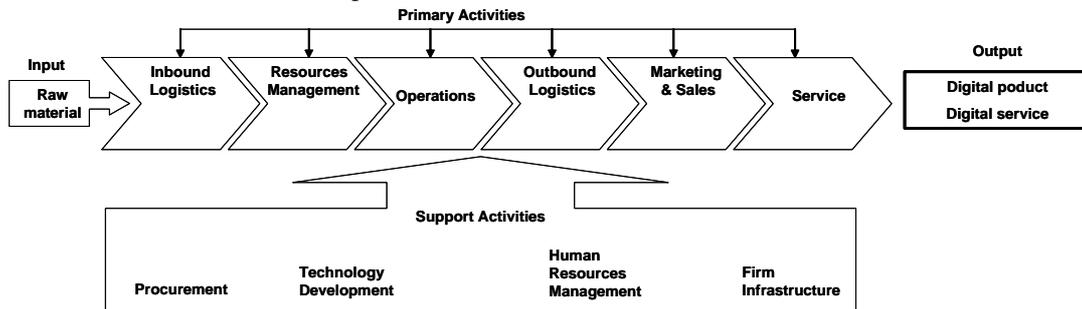
Figure 1. The basic digital value chain model

2. BUSINESS MODELING ANALYSIS

2.1 The Basic DVC-analysis

The DVC, as shown in Figure 1, consists of *primary* business processes that directly add value for the customer and *secondary* processes that add value indirectly by supporting the primary processes (see also [Porter 2001]). Value adding activities in primary processes are for example:

- Digital Resources Production (DRP),
- Retro Digitizing (RD) of existing non digital resources,
- Translation (T) of digital resources,
- Indexing - Repository Holding (IR): operating a digital asset repository and offering retrieval using metadata,
- Content Creation (CC): creating new products/services by use of the 'digital raw material' stored in the repositories,
- Retailing (R): distributing services/products/repositories via, e.g., portals.

Organizations/enterprises may perform several of these activities thus being linked into the DVC at different locations according to the respective role. Examples for value adding activities in secondary processes are:

- Training / Knowledge Providing (TK),
- Infrastructure Providing (IP),
- Regional Technology Planning (RTP).

2.1.1 Primary Process Activities in the Value Chain

Primary activities are directly concerned with the creation or delivery of a product or service. They may be grouped into five main chain link types: *inbound logistics* (resource recruitment), *resource management* (preparing for operations, storing and movement of resources), *operations* (product or service creation processes), *outbound logistics* (delivery of goods or services to the customer), *marketing & sales* (identifying customer needs and processing customer orders) and *service* (after sales relations with the customer).

Each of these primary activities is linked to support activities which help to improve their effectiveness or efficiency and each category is divisible into a number of sub-activities, depending on the particular business process:

- Inbound logistics are activities in external (for free/for fee) and internal recruitment of digital resources (raw material), receiving, storing, and disseminating inputs to the product, like material handling, warehousing, inventory control, shipment scheduling, and returns to suppliers.
- Resources Management consists of activities making available inputs to operations as required, like indexing (metadata), storing and material handling.

- Operations are the activities in transforming inputs (digital resources) into the final product/service. Subareas are:
  - aggregation of resources,
  - production of individual parts (raw products),
  - packaging of the individual parts into integrated products,
  - technical production (e.g. CD, newspaper).
- Outbound logistics consists of activities required to get the finished product to the wholesalers, retailers, further processing industry or end user along the supply chain, including warehousing, order fulfillment, etc.
- Marketing & Sales activities deal with with getting customers to purchase the product, including channel selection, advertising, pricing, and promotion.
- Service activities are those that maintain and enhance the product's value including customer support, complaints handling, repair services, training service etc. before delivery and after-sales service once the transaction is completed.

Each chain link type displays a special profile which is built of special characteristics. These characteristics are the basis for the analysis of regional organisations/enterprises by reference to their suitability for playing a part in a concrete DVC business process.

2.1.2 Support Activities in the Value Chain

Support activities consist of *procurement* (purchasing materials and equipment used in primary activities), *technology development* (technology improvements in all activities that involve technology like manufacturing processes; R&D), *human resources management* (all activities related to managing the firm's staff), and *firm infrastructure* (the administrative and managerial setting of the organization, systems for planning, finance, quality, information management etc.).

Each category can be subdivided into a number of distinct value activities which depend on the given industry or industry section.

2.2 Evaluation of the Regional DVC-potential

After defining the basic DVC-model the next step of the Regional Netwok Analysis is the development of one or more DVC-vision(s) of great promise for the region and the evaluation of the regional DVC-potential for the defined vision(s). The evaluation of the regional DVC-potential takes the following 3 steps:

a. Develop DVC-vision(s), define the needed digital content for that vision and model the possible value chain of the vision(s). This top down procedure of finding the DVC-vision(s) will be influenced by b) in practice. (see below). The DVCs are influenced by certain external factors like the global market, public subsidies and the behaviour of state authorities in general. All possible regional DVC-candidates involved in the vision have to be identified.

b. Evaluation of properties of the potential regional DVC-participants: This bottom-up approach includes the assessment of all identified regional DVC-candidates on the basis of defined assessment criteria. This evaluation gives a clear picture about those link role(s) each DVC-candidate could play, whether he is able to work as one (possible) link within a DVC or a cooperation with some other organisations is necessary and/or possible in order to form a common chain link acting as a virtual enterprise. The result is the classification of best performing candidates to chain link roles as stand alone or common chain link.

c. Identify the „possible" regional DVC-completion (regional integration) and DVC-gap identification: As a result of the designed DVC of the vision and the assessment of the regional candidates those chain links (processes and subprocesses) can be identified which can be covered by the investigated regional candidates and those which may not. The best result would be if a candidate could be found for all defined chain links.

The result of this first attempt to establish the DVC will probably be like an uncompleted puzzle with missing parts and also parts not fitting perfectly together. Missing regional chain link candidates reveal a regional DVC-gap. Due to any identified DVC-gap, the complete implementation of the DVC at that time is not possible and steps which make the DVC-completion possible have to be undertaken.

2.3 Strategies for "final" DVC-completion

Strategies for closing an identified DVC-gap are regional development and transregional integration. The regional development focuses on the regional promotion of the formation of suitable, DVC-gap customised DVC-candidates which can be assigned to the position of the missing chain link. A far better alternative could be to initiate a kind of outsourcing-strategy and to close the identified gaps by a transregional integration.

3. CONCLUSION

It has been shown within this paper, that based on our Regional Network Model (RNM) complete regional or transregional DVC's may be established. RNM is generalized in a way, such that the same process is applicable in various regions. This allows for a regional and transregional management of processes and for the completion of (fragemental) DVC's by regional and transregional integration .

But there are still substantial barriers against the development of digital value chains that reduce the opportunities for implementing the complete Regional Network Model including trans-regional integration. The most important of these barriers are (see also Williams 2003):

- the relevant stakeholders' lack of understanding the Knowledge Economy and its needs,
- stakeholders tend to operate by reference to institutional rather than collective interests,
- the developments tend to be driven by memory institutions, partly in response to the eEurope initiative which leads to a "library mentality',
- large public sector media collections will be made available for public viewing but not for commercial exploitation,
- regional media players are not fully exploiting the potential of convergence,
- the lack of investment.

Consequently, awareness has to be strenghened and pilot projects have to be established in order to generate 'success stories' that will help to pull down these barriers. Clearly, this needs the support of the regional and central authorities.

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SPREAD OF AN E-LEARNING SYSTEM IN A POLYTECHNICAL UNIVERSITY

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ABSTRACT

This work details the dissemination and implantation process of an e-learning system in the Universidad Politécnica de of Madrid. AulaWeb is an interactive web-based teaching and learning system with password authentication, web publishing facilities, self-assessment,…. More than two thousand of teachers and twenty thousand of students at this University have taken advantage of its funcionalities since 1999 as a didactic support in presential courses. Implantation strategy and remarks as well as profits and difficulties for all kind of users (system administrators, teachers and students) are illustrated.

KEYWORDS

e-learning, b-learning, University

1. INTRODUCTION

AulaWeb is a WWW-based interactive e-learning system which assist students/teachers to learn/teach subjects (García-Beltrán and Martínez, 2002). This web-based tool has been developed by the División de Informática Industrial of the Universidad Politécnica of Madrid (UPM). From the beginning the AulaWeb development staff has been driven by two assistant professors that, in 1999, used the system with one subject and seven hundred students (Martínez and García-Beltrán, 2001). The results were good enough to start the implantation of the software application in other UPM faculties, with other users, other courses and other subjects. UPM is a public University that has not a common guideline to use this kind of software tools, so it is necessary to carry out a dissemination strategy with the corresponding academic staff in order to convince them (a) that the use of ICTs can improve their tasks effectiveness and (b) to incorporate the most valuable item in a e-learning system: the contents. There are several obstacles for this task implementation: no technology knowledge, no economical or curricular motivation, faculties self-government and teachers autonomy, some courses have already their own websites... and preparing online resources is normally an expensive time-consuming process. Furthermore, the online publishing might affect the teachers' control over intellectual property.

1.1 The University

UPM is the largest technological university in the country, with almost 50.000 students, 3.400 professors, around 800 financed research assistants and an annual budget over 200 million Euros. It is organised in 20 Engineering Faculties, 110 Departments and other Units and provides engineering programs (from 3 to 6 year curricula) in Civil Engineering, Industrial Engineering, Computer Science.... Since its foundation, the institution is strongly research-oriented and has an enormous amount of research facilities, from thousands of computers to large scale laboratories such as Si and GaAs chips fabrication, material-testing, mechanical fabrication, etc. More than 20% of its total income comes from research, with comparable shares from National Agencies, EU and other international Programs and Private Companies. The majority of its professors are involved in some research or consultancy activity but very few of them are experts in

Information and Communication Technologies or are trained and motivated to employ ICT tools in teaching tasks.

1.2 The e-learning System

One restriction in the implantation of educational online systems is the lack of technology knowlegde and experience teachers have (García-Beltrán and Martínez, 2003). Most of them, even in a Polytechnical University, are not familiar with the required technologies. So, the first step is to get an easy-to-use and accessible technology to all kind of users. Very few of the commercial e-learning systems have suitable features in this way, so a Computer Science Department in the University began to design a new e-learning platform. The following system specifications were performed:

- Very simple system requirements for all kinds of users (system administrator, teachers and students): a computer connected to internet and a web browser.
- Providing an easy-to-use and intuitive graphical interface based in a combination of a menu bar and icons with different colors and facilities depending on the user type.
- Implementation of a secure and personalised user access with password authentication.
- Supplying a system online help.
- Incorporating educational contents is very flexible and does not required of high-level knowlegde of software applications. All kind of online resources (documents, hyperlinks, questions…) can be integrated by means of an step-by-step assistant.
- Development of a complete support documentation: tutorials as visual guides for the three kinds of users (System Administrator, Teacher and Student).

The result was the simple architecture system and graphical user interface of AulaWeb. The system includes a password authentication (for students, teachers and general administrator) and four modules:

- Subject information database: syllabus, theoretical contents, documentation, references, external links, related software, timetable, calendar, previous exams and problems and solutions.
- WWW-based collect and deliver module of practices, homeworks and exercises.
- Self-assessment module with multimedia questions and several types of answers: true/false, single o multiple choice, numerical, string or programming code.
- Communication tools: news publishing system, frequently asked questions board, chat room, forums and user on-line questionnaire.

The system environment facilitates students to get course contents, to deliver practices and homeworks, to do self-assessment exercises, interactive communication... Furthermore, the application provides teachers with the possibility of contents web publishing, exercises generation and configuration and students learning progress tracking. In addition there is a System Administrator in order to carry out users management and administrative tasks.

2. STRATEGY FOR THE PROPAGATION

The AulaWeb dissemination was driven with the following strategies:

- Inside the first Engineering Faculty:
  - o Teachers that employ and take advantage of AulaWeb facilities (students data access, web publishing, homework collect & deliver system, self-assessment tests…) act as a catalyst for encouraging other teachers to use the system.
  - o Students that use AulaWeb also persuade other *obstinate* teachers to publish online resources. Students are even more efficient than teachers as catalyst for introducing AulaWeb in the educational process.
  - o Introducing, *motu proprio*, all the courses, teachers and students in the AulaWeb system database. So, if a teacher decides to use AulaWeb, he can do it inmediately. The biggest problem, the students data (more than 3000), was solved by the implementation of a tool that imports the required students data from the academic management application (called AGORA) of the University.

- o Suppling all the academic staff with the AulaWeb teacher visual guide. The Engineering Faculty Director collaborated in this task taking charge of this delivery.
  - o Surveys were achieved to collect users feedback in order to get suggestions, ideas and proposals for system improvements.
- In other Faculties (considering that this University is practically a federation of two dozens of Technical faculties):
  - o Giving courses for teachers from other faculties about AulaWeb through the academic activities organized by the Education Sciences Institute of the UPM. For the present, a dozen of courses (more than 400 people were present), has been given. These courses are brief (between 4-6 hours) and very practical: the attendance could use a computer to practice with AulaWeb system during the course and took a very good impression of the e-learning environment.
  - o Installing AulaWeb server and introducing the system facilities to the teaching staff in the petitioner faculties (the courses attendance asks for it!).
  - o Providing to the system administrator facilities a students data importation tool from the academic management software application of the UPM: this task can become into the real problem since some Engineering faculties have more than 2000 students.
  - o Integration with other University services, i.e.: the library services (REBUIN plan).
- In all the faculties:
  - o Transmitting the following messages:
    - anyone can use AulaWeb without being an ICT expert and there is no need to learn HTML to publish online resorces, configure online assesment...
    - using of AulaWeb, designed and developed inside the UPM, is not compulsory (in a public University, this kind of compelling could be a reason for teachers rejection).
    - there is a secure access only for registered users (both, teachers and students) and different levels of access to the resources that can be configurated by the teachers.
    - the system has been tested since 1999.
  - o There is no need for the teacher to install and manage a web server for his/her subject or course: AulaWeb server is managed by the Computer Support Department in each faculty for all the subjects and academic courses they give.
  - o Implementing a information web server (no restriction access) that includes tutorials, reports, hyperlinks and articles about AulaWeb (`http://www.dii.etsii.upm.es/aulaweb`). Since november 2002, there are more than 6000 hits to this homepage.
  - o Giving complementary courses for UPM teachers to learn how to generate electronic resources (PDF, Microsoft Word, Microsoft PowerPoint, audio, video...) that subsequently can be publish in the AulaWeb server as online resources. These courses are also very practical and included in the academic activities of the Education Sciences Institute of the University.
  - o Winning the "New Applications for Internet 2002" first prize granted by the Telefónica Chair in the UPM.
  - o Organizing a Conference about Using New Technologies in Education in september 25th 2003. The contributions were edited and published in a proceedings book. The main outcomes are: users contributions are good for AulaWeb dissemination and teachers' works about ICT & education are recognized. This acknowlegdement is very important for the teachers since they are required to demonstrate some kind of activities and practices in education quality enhancement by the Government authorities. Since march 2003, the Conference homepage had more than 10.000 hits.

3. SUPPORT

In the beginning, the economical support was found in the INDUS-net projects call of in the first Engineering Faculty for the development of educational projects with new technologies and Internet. The funds were used to pay grant holders and computers. Later, a collaboration agreement between the development team and the first Engineering Faculty was achieved to extend AulaWeb facilities. And finally the University library services department also supported the development in order to integrate some library services for teachers

and students. Moreover, AulaWeb use licenses have already been sold to other institutions and companies with e-learning system needs.

4. RESULTS

Table 1 summarizes the results of this challenge and shows the list of Engineering faculties with AulaWeb servers.

Table 1. AulaWeb servers in the faculties of the UPM

Engineering faculty	Installation date	N° of students / academic staff (2003-04)
ETSI Industriales	December 1998	3122 / 305
F. Informática	October 2001	2480 / 165
EUIT Topográfica	July 2002	696 / 62
EUIT Aeronáutica	September 2002	1592 / 122
ETSI Aeronáuticos	November 2002	2021 / 161
ETS Arquitectura	February 2003	4302 / 421
ETSI Agrónomos	March 2003	2157 / 284
EUIT Agrícola	May 2003	1196 / 98
EUIT Telecomunicación	September 2003	1996 / 160
ETSI Navales	October 2003	656 / 83
EUTI Industrial	November 2003	2371 / 164
EU Arquitectura Técnica	January 2004	2772 / 146
EUIT Obras Públicas	January 2004	2128 / 100
EP Enseñanza Superior	February 2004	-- / --
EUIT Forestal	May 2002	974 / 67

5. CONCLUSIONS

A Web-based system with an easy-to-use graphic user interface has been developed by a Computer Science Department and disseminated to other Engineering faculties in the UPM. The system has been used since 1999 as a didactic support to the academic courses taught in these Engineering faculties. The main advantages are the system easiness and its adaptation to the users needs. Although the propagation was very laborious, the number of hits and the user feedback indicates that both, students and teachers, found it easy to use and a very useful learning tool.

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BENCHMARKING THE ICT INFRASTRUCTURE OF THE INFORMATION SYSTEMS IN THE INSTITUTUIONS OF HIGHER EDUCATION IN INDIA WITH SPECIAL REFERENCE TO TAMILNADU

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ABSTRACT

This study is an attempt to evaluate the level of implementation of ICT infrastructure in the libraries of the institutions of higher education in the state of Tamilnadu in India by taking into consideration the availabilities of their hardware, software and the network infrastructure. ICT infrastructure indices are computed to benchmark the status of the libraries.

KEYWORDS

assessment of library networked services, benchmarking, TQM, ICT infrastructure

1. INTRODUCTION

We are living in the 'knowledge-based economy (KBE)' and the KBE-development index takes into account variables like (a) info-structure, (ii) computer infrastructure, (iii) education & training and (iv) R&D to assess the development of a nation. Among the various components of the KBE, the info-structure has gained top priority because of its relevance in building the human capital requirements of the knowledge society. In the case of institutions of higher education, the knowledge productivity and the human capital development of a university depends to a great extent on the rich collection of the library coupled with appropriate technology and the ability to handle them speedily. The above factors clearly reinstated the fact that integration of ICT in the libraries is imperative for the successful execution of the various academic and research commitments of the institutions of higher education.

2. BENCHMARKING THE ICT INFRASTRUCTURE OF THE INFORMATION CENTERS IN THE STATE OF TAMILNADU IN INDIA

A plethora of studies have documented the impact of ICT revolution on the library environment in the recent years. (Lakos, Amos1997; Mc Clure, 1996; St.Clair, 1996). Some studies have insisted upon benchmarking the library infrastructure in order to evaluate the (i) status of library automation;(ii) volume and type of networking; (iii) users of library network services; (iv) types of services provided; (iv) cost and benefit of the networked activities and (v) the type of training required for the LIS professionals to achieve the target. The present study is an attempt to map the level of ICT applications in the areas of information retrieval activities in the libraries of higher educational institutions in the state of Tamilnadu in India . The focus of this study is to examine the following: (i) what is the strategic plan for ICT development of the libraries? (ii) what is the level of achievement of the libraries in building their ICT infrastructure (iii) what

methodologies or indicators are developed to measure the strength and weakness of the ICT capabilities of the individual libraries and (iv) what specific problems are encountered in the implementation of technology.

3. METHODOLOGY

This study was designed, developed and carried out in order to determine the existing position of ICT in the academic libraries in Tamilnadu. The survey was carried out using "Field Random Sample Survey Research" as a method of research. Questionnaire method has been used as the main instrument for the data collection. The regional coverage of the survey includes seven districts and the number of respondents are 61. To determine the level of penetration of ICT components in the libraries of the sample regions the following factors have been taken into consideration viz: (i) hardware infrastructure (ii) software infrastructure and (iii) network infrastructure and (iv) access infrastructure of the libraries. As far as the application of the statistical tools are concerned, score values are assigned to the data collected for the different categories of infrastructure and indices are calculated for each category from the cumulated score values.

4. BENCHMARKING THE HARDWARE INFRASTRUCTURE

The strength of hardware infrastructure of the libraries is measured by taking into consideration such parameters as the availability of the (i) servers; (ii) operating systems; (iii) processors; (iv) terminals; (v) input devices and (vi) back up devices etc. As far as the implementation of servers are concerned, it is noted that 'windows server' is installed in all the libraries while 'Novel-NT' (44.26%) and 'CD-NET (22.95%) servers' seemed to be common among a moderate percentage of libraries. On the contrary the availability of the 'internet and web servers' are found to be negligible, questing the possibilities of the Indian libraries to create digital libraries in the future. The reasons for such a lack of server infrastructure in the library environment is quite obvious. Most of the libraries are still in their initial stage of integrating technology into their library operations and there is no ICT task force or ICT planning committee to take forward the automation or digital process of the libraries in a phased manner. A review of the software application indicates that out of the 61 sample libraries, 42 libraries (68.85%) have used 'windows based operating system' while the remaining libraries have used other than windows operation systems like 'Unix (SCO); Linux; Ms SQL'. An analysis of the usage of 'Pentium and Non-Pentium family of Processors' shows that about 87% of the libraries (53 out of 61) have used Pentium family of computers while the other have used the non-Pentium family of computers. It is an indication that most of the libraries have started automation practices only in the recent years and that is an advantage in procuring the latest Pentium processors. The 'access facilities' are measured by means of the availability of 'terminals ' in the respective libraries. It is seen that a large number of libraries (67.21%) have less number of terminals (terminals ranging below 10) ; only a few libraries (18 %) have moderate number of terminals (between 11-20) ; and only a least number of libraries (14.75%) have large number of terminals (ranging above 20). It is observed that majority of the libraries are ill-equipped with terminals while comparing with the number of students visiting the libraries. The availability of **input devices** like the (a) scanners; (b) digital cameras and (c) video cameras that have been used for creating the digital content of the libraries is examined. It is observed that 32 libraries (52.46%) have only scanners; 8 libraries (13.11%) have digital cameras;only one library has video camera; and about 20 libraries (32.79%) have none of these digital input devices. The above details reinstate the fact that the practice of establishing digital libraries in the Indian environment is still in its infant stage. As far as the **back-up devices** are concerned, majority of the libraries have used devices such as DAT, CD-ROM, Hard-Disk and Floppy Disk for preserving their data. In short, the composite index for the hardware infrastructure reveals that only one fourth of the libraries in the academic institutions have built adequate hardware infrastructure; about half of the libraries have only a moderate level of infrastructure; and the remaining libraries have low level infrastructure. Unless the hardware infrastructure of the information systems or the libraries are strengthened, the possibilities for providing access to the world of information is limited. It is high time for the administrators of the institutions of higher education to take stock of the situation and make the necessary arrangements for improving their

hardware infrastructure in order to facilitate their academic and research community to take part in the knowledge based economy.

5. BENCHMARKING THE SOFTWARE INFRASTRUCTURE

The successful operation of any electronic library depends to a larger extent on the choice of appropriate library software to manage the library operations efficiently. The present study takes into consideration three major categories of activities like (i) software used for house-keeping operations; (ii) application software and (iii) support level software. The level of adaptation the of the library management software in the sample libraries shows that out of the 61 libraries taken for analysis, about 26 % of libraries have controlled their entire library operations using appropriate software of their choice; 56% of the libraries used the software to manage only a moderate level of their house-keeping operations and 18.% of the libraries have applied them to manage a few activities. It implies that the academic libraries are still in the threshold of library automation and they have to go a long way in building digital libraries which is the watch word of the present century. The survey report shows that the sample libraries have adopted both commercial and indigenous software for managing their library activities. For instance, 78.69% of libraries use the commercial software and 21.31% use in-house software. Majority of the libraries prefer Visual Basic (61%) and Foxpro (39%) as their front-end tools; and oracle (36.06%) and SQL server (63.04%) as their back end tools . As far as the supporting software is concerned, the sample libraries have made available DTP package, scanning software, and other presentation software for administrative and client service purposes. It is further noted from the above analysis that only the technical universities and engineering colleges could adopt library management software to a larger level than the arts and science institutions. It also indicates that the availability of technical manpower to design and handle the software is also higher in the technical institutions. Moreover, the financial support received from the above institutions for building electronic libraries are much higher than the other institutions.

6. BENCHMARKING THE NETWORK INFRASTRUCTURE

This study has analysed the network infrastructure of the libraries by taking into account such variables as (i) status of network; (ii) types of network; (iii) network interface; (iv) type of topology; (v) network components adopted; (vi) network technology used; (vii) level of connectivity and (viii) technology adopted for internet connections. The status of the network infrastructure indicates that among the 61 libraries taken for analysis, only one third of the libraries have their own independent network (33%) and rest have become a part of   their campus network. Regarding the type of network being adopted, it is noted that 67% of the libraries have developed local area network; 25% have developed wide area network and the remaining libraries have   developed neither LAN nor WAN.   As far as the application of network interface or connectivity, 66% of the libraries have adopted ISDN connectivity, 20% have dial-up connectivity and 7%have satellite connectivity.   An overview of the network topology shows that about 90.16 % of the libraries preferred to use bus topology in building their network. Besides, 34.43% of the libraries have used ring typology; and 26.63% have used star typology. It is disheartening to note that about 10% of the libraries have not gone for any type of network infrastructure. As far as the usage of network components are concerned, 36.07% of the libraries use routers, 29.51% use hubs and 27.86% use switches. This study review the type of network technology (viz: Ethernet, Fibre Optic, Fast Ethernet and Gigantic Ethernet) that are being use in the sample libraries. Nearly 25 libraries (44.64 %) preferred to use Fibre Optic cables, about 7 libraries (12.5%) use Ethernet technology, 13 libraries (23.21 %) preferred to use Fast Ethernet, 11 libraries (19.64%) preferred to use Gigantic Ethernet. Nearly one half of the libraries preferred to use the Fibre Optic Cables. This study also has examined the availability of the Web Technology infrastructure (viz Web server, Web Editor and Middle ware) of the sample libraries. It is observed that two thirds of the libraries (43 out of 61) posses web technology Infrastructure. Nearly one half of the libraries (51.16 %) use Web Server, 20.93 % of the libraries use Web Editor, 27.91 % of the libraries use Middle wares.

7. FINDINGS AND CONCLUSION

The composite index value of the ICT infrastructure (hardware, software and network) note that (vide Table) have shown that only 14 out of 61 libraries (23%) have built adequate level of ICT infrastructure while the others have built either a moderate (41out of 61) or low level (6 out of 61) of infrastructure. The factors contributing to this inadequate ICT infrastructure are plenty. Among these, special mention could be made about the lack of proper technological planning. Though each one of the libraries surveyed have a separate library committee or executive committee for planning, and budgeting, the ICT infrastructure building doesn't form their primary agenda. There is no forum in the sample libraries to build the ICT infrastructure in a phased manner by taking into consideration the strength of the academic community, the level of teaching and research programmes, the skill level of the users in handling the technology, the types of training programmes required, the means to cope with the changes in technology and the budgetary allocation to meet with these changes etc. It is observed from the sample libraries that only the technical and engineering libraries that have the advantage of getting huge grant and availability of technical manpower at their disposal (from other departments) have been able to build adequate level of infrastructure. This survey has brought to lime light the fact that a separate forum or a committee is essential in the library to take care of the development of the ICT technology suitable to the requirements of the academic community. Moreover, it is noticed that majority of the libraries do not have adequate number of technically trained manpower. This again is another factor attributed to the poor building of the ICT infrastructure in the sample libraries. What is required is that recruitment of technically trained personnel in larger percentage is felt imperative in the future years. Though the agencies like INFLIBNET, AICTE etc have come forward to offer training programmes to the existing library professionals, it is not sufficient to handle the fast growing technology.

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LEARNING WITH E'S: PUTTING TECHNOLOGY IN ITS PLACE

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ABSTRACT

The topic of e-learning is the focus of much current interest within education and industry. to decrease the use of computers within education made by Cordes and. Miller (2000), for example, we need to avoid the temptation to pay too much attention to the technology and too little attention to the learners, teachers and their context. The future design challenge we face is the development of interactive educational content that enables learners to bridge the gap between the operational and conceptual levels of their interactive experience and engage with the concepts of the discipline being studied. The technology challenge is building a platform for the delivery of this content through existing and emerging technology and in multiple contexts. The theoretical challenge and potential pedagogical benefits lay in the development of a central pedagogical framework. In order to address these challenges we need to reflect on our progress to date, to assess the evidence for the effectiveness of e-learning and to identify what works and why.

KEYWORDS

e-learning, socio-cultural psychology, systematic review, post-16 education sector

1. INTRODUCTION

A plethora of different artifacts and a constantly changing list of words for the latest trends in learning technology have emerged in the last decade or so. Digital technology is all around us, from fluffy parrots to mobile devices and flat screen TVs. But how can we tread through this digital landscape to inspire the young as well as meeting the training needs of busy professionals? Whether we are focusing upon e-Learning, m-Learning or designing a distance learning experience we need to ensure that the experience we offer our learners is integrated by something more certain than the latest gadgets and functionalities. Whatever the media and whatever the words used to describe the experience all of these efforts are about helping people learn about a particular topic using digital technology. There are of course differences between the type of learning experience that will work when this technology is a mobile phone and that which will work when the technology is a large screen television, for example. However at some level of abstraction there is a pedagogical framework about how people learn that is common to all these devices. Without question, that framework must put human learners and teachers at the centre of the design process. In order for learning technology to reap the potential rewards it promises much effort needs to be devoted to the specification of such a framework with the identification of how the framework needs to be adapted and varied to meet the needs of different devices and contexts. There has of course been much excellent work done on the development of underpinning pedagogies for various systems that have been developed. However, this work is scattered across a multiplicity of different disciplines. We now need to pull this work together into a coherent whole and make it accessible to policy makers, system builders and educators alike. We need to ensure that the dialogue between developers in business and researchers in academia is effective if we are to offer learners the quality of educational experience they deserve.

2. THE NEED FOR LEARNER CENTRED PEDAGOGY

The success of the use of any technology as an educational tool depends upon the extent to which it is integrated into a pedagogically grounded framework. The technology is merely a medium through which the learner can communicate with others. Those others may be the writers of course modules that the learner is reading on a screen, they may be fellow students with whom a discussion is being conducted through an on-line forum, or they might be a teacher who is offering some advice. Whatever the situation, the technology itself should not be the focus. There is a tendency to add a fresh letter to the start of the word 'learn' or 'learning' and to then assume that a new paradigm has been created. The words 'e-learning' and 'm-learning' are examples of this phenomenon. The fundamental feature is still, of course, the learning and that should always be the focus of any educational experience. If we wish to offer learners a particular technology such as a toy, a mobile PDA or a desktop PC in order to increase their access to the learning experience, the focus of attention should remain upon the concepts to be taught and learnt, not on the technology. We may have to make some changes to the packaging, to the size of the modules for example, but the concepts we want the learner to understand should remain our primary concern. One way to progress this endeavour is to address two key questions:

1. What kind of underpinning pedagogy can show us how we can use the most suitable resources to produce a motivating and coherent learning experience across multiple devices and contexts?

Constructivism has been influential within mainstream education and the design of educational technology alike. One brand of constructivism that is particularly appropriate to our current pursuit is the socio-cultural approach (Vygotsky, 1986), which relies upon social interaction, internalisation, the inseparability of teaching and learning, and targeting the to-be-learnt to each individual learners' point of learning readiness. We must therefore provide opportunities and support for individuals and groups of all ages to act as both learners and teachers. In the past we have also discussed the relationship that exists between the processes of Narrative Guidance and Narrative Construction and have suggested that developers of interactive multimedia learning resources need to confront this relationship and provide tools to ensure learners can create their own story from the resources and in this way construct meaning (Plowman, Luckin, Laurillard, Stratfold, & Taylor, 1999). The beauty of interactivity can be seen as offering learners a host of opportunities: pauses or gaps in the narrative (for example) for which they need to create personal bridges. The quality and contingency of these pauses and gaps is however a key design imperative; a design imperative that must be translated from current book, TV and film production traditions into the new tradition of interactive educational convergent media experiences. We need to create a sense of collusion between authors, teachers and learners so that they are both active participants in the creation of an educationally effective narrative construction experience.

2. What are the resources for learning that are at our disposal?

The glib answer to this question is "everything", however we can initially differentiate between people and artifacts. Central to the creation of an effective design framework is the need for us to recognise the specific aptitudes of digital technology and of human beings so that we use all our resources to best effect. Digital technology is excellent at storing, manipulating and displaying multiple media formats. Large memory capacity and fast processors permit detailed computation and the dynamic updating of descriptions of all learning resources both human and media. People are good at helping each other learn, at socialising and adapting sensitively to small nuances: changes in facial expression or behaviour. They are very flexible and can empathise in a way that machines never will. They are also capable of learning how to help themselves. Machines however allow us as humans to become connected and information about us to be distributed across the contexts in which we live and work. They also promote the reuse of media resources such as texts and videos that can be described using metadata, stored in a database and searched for by systems or people looking for particular sorts of content material. We need to keep technology in its place and use it for what it is good for.

In summary therefore, the future design challenge we face is the development of interactive educational content that enables learners to bridge the gap between the operational and conceptual levels of the interactive experience and engage with the concepts of the discipline being studied. The technology challenge is building a platform for the delivery of this content through existing and emerging technology and in multiple contexts. The theoretical challenge and potential pedagogical benefits lay in the development of a central pedagogical framework.

3. SEARCHING FOR ANSWERS IN THE POST-16 SECTOR

The preceding discussion has highlighted both the potential educational benefits offered by interactive digital media and the challenges it poses. Before we move too quickly ahead, we need to take stock and reflect upon what has worked in the past and ensure that we identify evidence for the effectiveness of e-learning. The discussion so far has encompassed all situations in which technology is being used to engender learning. This is a huge area and in order to make headway with this pursuit we need to focus on a smaller subsection. We now describe the way in which we are looking to others who have evaluated the use of digital educational technology in the post-16 sector and asking what worked and why. In this way we can start to explore the two questions identified in section 2 above: The nature of the underpinning pedagogy and the identification of resources.

Our methodology will be that of a modified systematic review. The question that will drive this review is: *How compelling is the evidence for the effectiveness of e-learning in the post-16 sector?* We hope that this methodology will ensure that we collect the most pertinent work from across a wide range of disciplines without being parochial with respect to our own discipline and area of expertise. Through consultation with a panel of experts, both through face to face seminars and on-line discussion we will identify key search terms, sources and criteria that can be used in our initial search for evidence. As we gather data the same group of experts will be asked to comment and advice on a regular basis. In this way our systematic review will be iteratively validated by a range of expertise to ensure both breadth and rigor. Our initial work is seeking to define the three concepts at the heart of this review through exploration of the following questions:

3.1 What is The Nature of Post 16 Learning?

Learning in instructional contexts is of interest to teachers, psychologists and researchers in education as well as to people who are interested in training, but is learning in the post-16 sector different to the learning that occurs in compulsory education? Laurillard (2002) suggests that a conversational framework model is needed in Higher Education. This entails a discursive, adaptive, interactive, and reflective approach by both the teacher and the learner. At the heart of Laurillard's model of learning is the notion that there needs to be an iterative dialogue between the teacher and the learner 'nurturing the ideas and skills that constitute understanding' (Laurillard, 2002). It necessitates recognition of the difference between interaction at an operational level of understanding and interaction at a conceptual level of understanding. Educators need to ensure that what happens at both levels is interlinked and that the interactions learners engage in at the operational level do not distract from the desired conceptual interactivity. This is particularly pertinent when we consider e-learning where the desire to use the power of technology to engage can lead to gratuitous operational complexity, leaving learners concentrating on the mechanics of the interface rather than the content to be learnt. Narrative, according to Laurillard, is a fundamental part of the learning process that allows for knowledge to grow and be negotiated over time. However there needs to be some flexibility in the system in order for adaptation, interaction and reflection to take place. We are currently asking a range of e-learning experts drawn from academia, industry and government a range of questions including: Are there differences between the pre and post 16 sectors in terms of how people learn? Are questions about the nature, growth, and self regulation of knowledge and the provision of more effective instruction also relevant to the post 16 sector?

3.2 What is the Nature of e-Learning?

Following on from our discussion of learning we now move on to the question of what is e-learning. E-learning has a plethora of definitions. The challenge is to combine, integrate and elaborate the definitions so that a satisfactory conception of what is meant by e-learning in the post 16 sector is achieved. Some example definitions will illustrate the issues here: The UK Department for Education and Skills consultation document 'Towards a Unified e-learning Strategy' presents us with a broad definition "*If someone is learning in a way that uses information and communications technologies (ICTs), they are using e-learning (DfES, 2003)*" Whereas , the UK Department for Health (2003) cite Rosenburg's (2001) definition and specify e-learning as being on-line learning: "e-learning refers to the use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance". In contrast again, the Australian National

Training Authority (ANTA) proposes that: "e-learning is a broader concept [than online learning], encompassing a wide set of applications and processes which use all available electronic media to deliver vocational education and training more flexibly…the general intent to support a broad range of electronic media (internet, intranets, extranets, satellite broadcast, audio/video tape, interactive TV and CD-ROM) to make vocational learning more flexible for clients."

3.3 What Counts as Evidence for Effectiveness?

Finally we need to consider what might count as the evidence for or against the effectiveness of e-learning. Evidence about how well e-learning is performing may be found in a whole host of different journals, websites, conference papers and presentations emanating from a wide range of disciplines. For each of these disciplines the nature of the evidence that will be seen as valid, and the data collection and analytical methodologies that will have been used to assess this evidence will likewise vary. There will be evidence of very different kinds and qualities ranging from large scale multi-institution studies looking at both process and outcomes, to well-conducted but small-scale laboratory experiments, to more impressionistic studies of individual class or college interventions. Gathering and then weighing this evidence are both not inconsiderable tasks. Specifying the nature of what will count as evidence for or against the effectiveness of e-learning in the post 16 sector is the third area that we are currently exploring with our panel of experts.

4. CONCLUDING REMARKS

In this paper we have identified key questions that need to be addressed by those involved in the development of e-learning. We have suggested that a learner centred approach that specifies an underpinning pedagogical framework is required and that technology should be used in a manner that recognizes both its weaknesses and its strengths. We have also proposed that in order to ensure that this approach is informed by past experience we need to pull together the growing body of evidence from the work conducted across a diverse range of disciplines and contexts from commerce to academia. We have described the way in which we are completing this type of review in the post-16 educational sector and look forward to reporting the results of our expert consultation at the e-society conference in July.

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A SERVICES ORIENTED APPROACH IN THE DESIGN OF LEARNING ASSESSMENT SYSTEMS

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ABSTRACT

A set of interrelated models is developed for the design and operation of an interactive learning assessment system. The proposed design methodology seeks for a balance between e-assessment content and activities standardization and pedagogical evaluation approaches diversity. The presented paper investigates an approach extending e-assessments interoperability adding to d ata structuring two new features: binding data locally with some functionality and developing a learning assessment scenario at a global level. The new enhancements are based on learning services abstraction. The main point is to have a standardized assessment content, which is handled trough an assessment scenario in a more or less generic mode of operation. A teacher proprietary evaluation strategy is considered as an instant of a generic assessment scenario. Two bindings for the assessment model have been explored – Python and Ch language environments. The both are implemented as interpreters and support an extended object-oriented paradigm. An experimental assessment environment – Virtual Assessment Blended Objects – has been designed and experimented.

1. INTRODUCTION

The assessment subsystem is one of the key components of a learning environment. The assessments can be viewed as a special kind of learning content for which we normally want to be highly interoperable and re-usable. On the other hand, as with other learning resources, the diversity of evaluation and examination approaches limits the common level of interoperability that could be reached.

The IMS Question & Test Interoperability Specification (2003a) is proposing a balance between the interoperability requirements and evaluation methodologies diversity through data structuring. The presented paper investigates an approach extending interoperability adding to data structuring two new features: binding data locally with some functionality and developing a learning assessment scenario at a global level. The new enhancements are based on learning services abstraction (see, for example, Bogdanov 2002; Bogdanov & Vries 1998; Learning and Web 2003; IMS 2003b; Java 2003). The main point is to have a standardized assessment content, which is handled trough an assessment scenario in a more or less generic mode of operation. A teacher proprietary evaluation strategy is considered as an instant of a generic assessment scenario.

2. CONCEPTUAL MODELS

The learning assessment is a twofold activity. Primarily, it is intended to evaluate the student's knowledge on the based of subject specific metrics. Secondly, the assessment is a different form of teaching. It seems that information&communication technologies are quite suitable to enhance this second role of computer-supported assessment. There are several perspectives for the conceptual assessment model. If you like they could be treated as several inter-related models. That is what is referred to as multi-modeling approach.

2.1 Educational Perspective

The learning assessment adds value to student's learning process so the assessment is an integral part of the learning – it deals with learning content although specific but to which apply all standards requirements that we relate with content like lectures, courses, etc. The assessment may be intended for self-evaluation or to serve educational organization regulations. In an assessment process the student acts in a distributed manner as an actor together with other participants in the assessment process. He/she works on standard and certificated learning materials. They are referred to as learning resources and may be located somewhere over the learning network to which the student has an authorization and authenticated access. The results from an assessment change the student's knowledge level or are used to register his/her progress. The mandatory assessments add new records to the student's knowledge certificated profile. The learning content that is used in an assessment should be transparent for the student in the context of origins and platform compatibility.

2.2 Functional Perspective

The learning assessment is viewed as a general nature process, which in turn is composed from a set of interrelated activities. The activities are running over the time and switched according to an Event model. The activities are wrapped in a learning scenario. A learning scenario may be activated by the student or offered to a student by a Learning Management System. The processing of a scenario may be carried out by a server based learning system to which the student is connected through a student's client. The student's client is an application for networking and act as a broker or agent. In some other cases the student's client could be responsible for scenario processing or a part of it.

2.3 System Perspective

Working on an assessment the student draws a trajectory that is a formal mapping of his/her behavior. The trajectory is an ordered collection of states, which are observable and some of them controllable. The student's trajectory generates proper feedbacks, which may be used to change the trajectory itself. The student's trajectory is pre-programmed in the sense it is one of preliminary known and desirable possible trajectories. Formally the system's outputs are records to student's knowledge profile and respective reports. The student interacts with the system. The data entered by student form the system's inputs.

2.4 Programmatic Perspective

The assessment is implemented as a computer application running in a distributed networked environment. The client/server model for networking is one of the options – in some cases prevailing. The other one is a peer-to-peer networking or some mixture of the both. The traditional programming paradigms are not suitable for implementation of an assessment application. Their main drawback is that they lead to proprietary solutions. To model the functionalities of an assessment system, the services approach is proposed. From the programmatic perspective the assessment system operates over four main layers: learning content modeled by objects, implementation of functionalities through services, composing a stream of services delivered to student, the layer of APIs mapping to specific hardware/software platforms. The programmatic architecture of a virtual e-assessment environment is illustrated in Fig. 1.

3. LEARNING SCENARIO MODEL

The assessment scenario comprises all activities, which are exercises to measure the student knowledge level, skills and understanding. The scenario is a dual abstraction. Firstly, it is the top-level representation of all models addressed in the assessment design. It is a programmatic construct that may be processed in a computer-supported learning environment. On the other hand, this is the place where the educational strategies could be mapped in a systematic and standard way. At the first look, the two perspectives of the assessment scenarios may seem conflicting. To have a good level of learning content standardization the

scenario should be pedagogically neutral. It is also required not to limit the teaching methodologies diversity in an electronic learning environment. On the other hand, the teachers need a template – rather a set of these ones – where to accommodate their visions about assessment as an educational process. The assessment scenario is that tool.
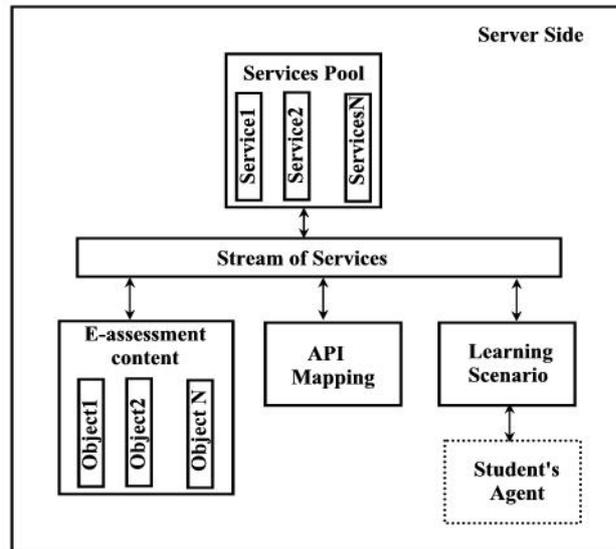
Figure 1. Virtual e-assessment environment programmatic architecture

The assessment scenario is built on the base of learning design primitives. These are the instruments to set up an assessment scenario. The set of these primitives could be extended by the teacher who may add new primitives descriptions. In the design stage of the assessment scenario the learning is viewed as a behavioral trajectory consisting of an ordered set of states, a sequencing plan over the states and an event table that may switch the sequencing in some states. A state is composed from services and learning resources. A resource has interface describing how it could be handled by a service.

The student's behavior in the assessment process is deterministic – he/she has to follow one of pre-determined trajectories, but it is not known in advance which one.

4. THE SERVICES ANATOMY

For the assessment process services are these small entities, which are used as building blocks to compose an assessment scenario.
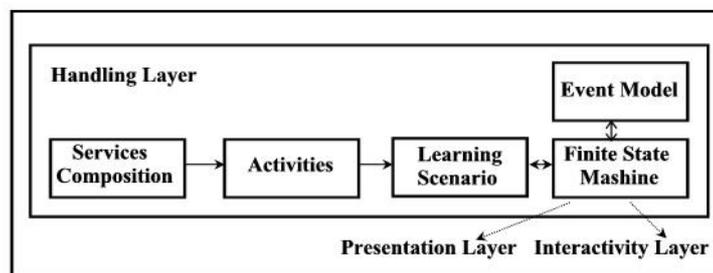
Figure 2. E-assessment environment structure

The service is an entity encapsulating a piece of functionality and which could be carried over the network (Bogdanov 2002; Bogdanov & Vries 1998). A service is described by means of class-like mechanism. It has:

- State attributes
- Methods to operate over them
- Packaged functionality
- Protocol section.
- May apply techniques like nesting, cooperation, inheriting to compose more complex services.
- A service is derived from a template that is referred to as an abstract class. A service is instantiated.
- A description section. It is a structured text description to reveal the service semantic.
- Service namespace – that means a service is identified by its name.

A diagram illustrating the utilization of services in the whole e-assessment process is depicted in Fig. 2.

5. BINDINGS FOR VIRTUAL ASSESSMENT MODEL

Two bindings for the assessment model have been explored – Python (2003) and Ch (2003) language environments. The both are implemented as interpreters and support an extended object-oriented paradigm. An experimental assessment environment VABO – that stands for Virtual Assessment Blended Objects – has been designed and experimented. VABO supports the following functionality: description of test resources, creation of an assessment scenario, exercising of a test, implementation of a grading strategy, reporting/recording of assessment results. In a particular case the tests generated on the base of VABO environment are IMS QTI compatible (2003a).

As binding instrument the emerging language YAML (2003) is used. In the case of learning assessment YAML is used for object serialization and messages passing over the Net.

6. CONCLUSIONS

A set of interrelated models for a generic description of learning assessment process has been investigated. The approach is subject-neutral and presents a high conformity to e-learning standardization requirements.

The assessment process is embedded in a scenario performed by students. This scenario is composed in a layering manner by small networked callable entities named services.

A flexible architecture of learning assessment systems that relies on open standards for interchanges and components composing is proposed.

On the based of assessment models a test framework is developed. It is a binding using Python and Ch languages. The ideas and approaches behind the framework are discussed.

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ONLINE ACADEMIC ADMINISTRATION SYSTEM TO SUPPORT DISTANCE LEARNING AT FACULTY OF COMPUTER SCIENCE UNIVERSITY OF INDONESIA

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ABSTRACT

Faculty of Computer Science (Fasilkom), University of Indonesia (UI) develops Web Based Distance Learning Systems for Graduate Program in Information Technology as part of Information and Communication Technology (ICT) based Distance Learning. The systems are developed using Enterprise Resources Planning approach that consist of student-centered e-Learning system, Digital Library and Online Academic Administration System. The latter manages online administration processes in academic activities such as: transcript, online registration, academic calendar, syllabus, news, and file management. This paper elaborates the on going development of Online Academic Administration System as a sub-system to support the Distance Learning at Fasilkom UI.

1. INTRODUCTION

Distance learning is often defined as *flexible* and *open*. *Flexible* means that learning options can be adjusted for both current and future learning needs and provides for the learner at any time, any place that suitable to his or her needs. On the other hand, *open* constitutes the removal of academic restrictions and privileges- that is, the elimination or reduction of the barriers between areas of knowledge, careers, institutions, the increasing and enriching of useful activities and experiences to complement the academic educational purposes [1].

Very often, the existing Distance Learning System offers services (such as courses) through internet but lack of other supporting systems such as online academic administration, electronic library materials and learning environment. The Distance Learning at Fasilkom UI attempts to develop integrated systems that comprise online academic administration system, digital library system, and student-centered e-Learning environment system [2]. The idea of developing such systems is to help us create new paradigm in education or academic field. Fasilkom UI also wants to share its long-term experience and accumulated knowledge to less fortunate institutions as well as to students who are less fortunate due to reasons such as disparity of available infrastructure, remote geographical distribution, and the digital divide in Indonesia.

The objectives of this distance learning systems are:
1. To minimize digital divide in Indonesia by providing larger opportunity to Indonesian people, especially IT professional and postgraduate students.
2. Introduce distance learning In Indonesia that is managed professionally and sustainable.
3. Improvement of human resource capacity in Information Technology, especially potential human resources from rural area.
4. To provide wider access to a better quality of higher education.
5. To develop strong professionals on IT who are ready to contribute in the related field.

In Indonesia, there are many institutions have offered distance education. Common problem on distance education is a minimum scientific atmosphere because most of the programs do not run on classroom or campus. According to Surahman in [3] there are common practices of distance education in Indonesia, such as:
1. Found a campus near the implementation of distance education program.
2. Run distance education using teleconference system that means lecturers are at main campus, students are at their place (home or anywhere). And learning system is done through telephone, video, or Internet. But, campus atmosphere still can not be presented as the ideal condition.
3. *Credit-earning activities* system that distance education process only part of all academic/learning process. Some courses and academic activities still offered at main campus.

The most popular academic institution in Indonesia which provides distance education since is The Indonesian Open Learning University or Universitas Terbuka (UT). UT implements distance and open learning system using media, both printed and non-printed (audio/video, computer/internet, radio, and television). Beside academic institution, companies in Indonesia also use distance education to improve their employees' ability and competency. For instance, PT Telekomunikasi Indonesia (Telkom) has developed e-learning system which is called Telkom E-Learning. Telkom E-Learning is web based training service which is own by PT Telkom Training Division.

Concerning to several attempts of implementation distance education in Indonesia, we named our system as distance learning instead of distance education. The rationale is we want to promote "e-learning environment" as a bases of developing distance education. In this paper, we focus on the development process of Online Academic Administration as a supporting system to the distance learning systems.

2. METHODOLOGY

In order to develop information system that take into consideration cultural diversity from various ethnic background Indonesia, careful steps had been taken.

Data Collection
Related data is collected from several sources such as:
1. Documentation
   Document of Fasilkom's Long-term Strategic Planning that consists of: vision and mission, human resources, infrastructure resources, SWOT analysis. Document of National Educational Ministry regulations on Distance Education.
2. Interview
   Interviews have done to staff of Computer Science Faculty and graduates of the program.
3. Survey
   Survey to several distance education system which is own by both academic institutions and companies.

System Development
The System Development Life Cycle methodology combined with Prototyping techniques are used for the development processes. From the data collection we captured functional and non-functional requirements.

These requirements are presented in Context Diagram, Decomposition Diagram, and Data Flow Diagram Level 1.

3. SYSTEM ANALYSIS

3.1 Requirement Analysis

There are two kinds of requirements, functional requirement and non functional requirement. Functional requirement of this system related to academic business processes that are:

- Delivering academic transcript, so that students can look at their grades in any specific semester of all course they have taken.
- Handling online course registration so that student can register courses they take for next semester.
- Handling user management so that academic administrator can add, edit, or delete student data.
- Handle learning materials management so that students can upload and download them. The learning environment itself is provided in the student-centered e-Learning system [4].

Non functional requirements for this system are:

- User friendly user interface, so users can use and navigate the system easily and effectively.
- Tracking activity mechanism, so we can evaluate the usage of this system
- High connection speed, because of this factor will influence users' durability in using this system and helps users download learning materials.

3.2 Process Modeling

According to Whitten and Bentley [5], process modeling is a "technique for organizing and documenting the structure and flow of data through a system's processes and/or the logic, policies, and procedures to be implemented in a system processes". In order to describe any process and flow of data through the system, we use Data Flow Diagram (DFD) technique. Figure 1 shows Context Diagram (DFD Level 0) which depicts global process in the system. There are four external agents in the Context Diagram: lecturer, student, secretariat staff, and administrator.
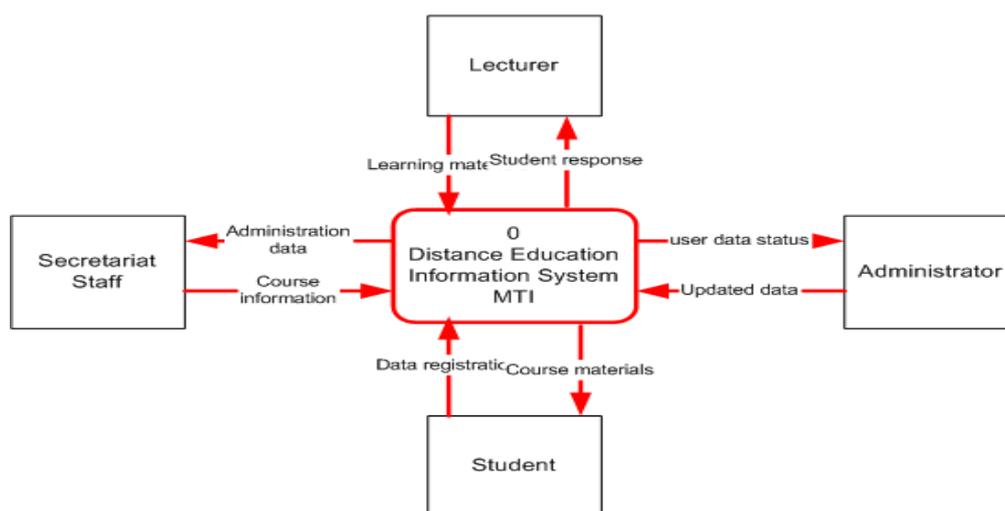
Figure 1. Context Diagram

Figure 2 describes decomposition diagram that shows all functional requirements of the system.
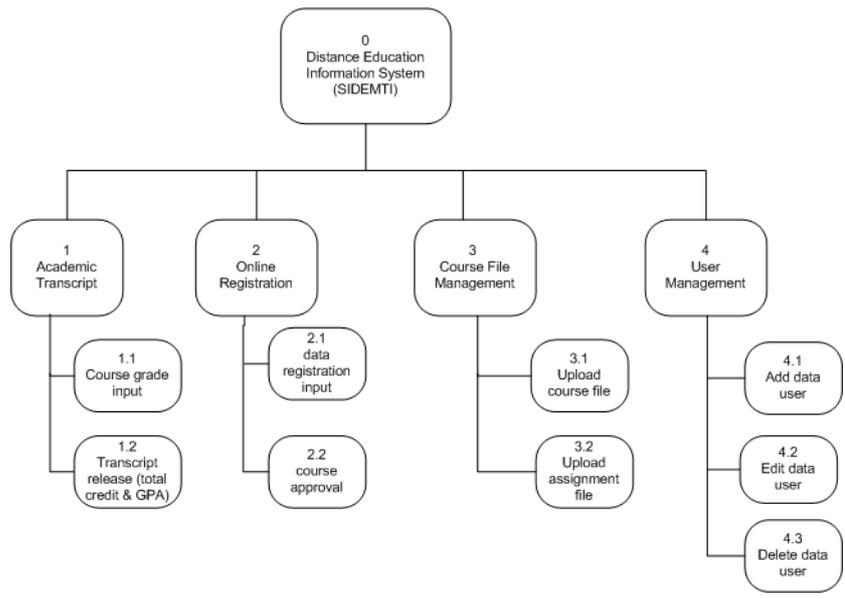
Figure 2. Decomposition Diagram

Figure 3 describes data flow diagram of level 1. In order to get access to this system, student must have an account that they apply to administration register. Lecturers can upload course files regularly. Academic staffs have authority to approve student academic plan, submit news, and submit student grade. Administrators have authority to maintain users' administration.
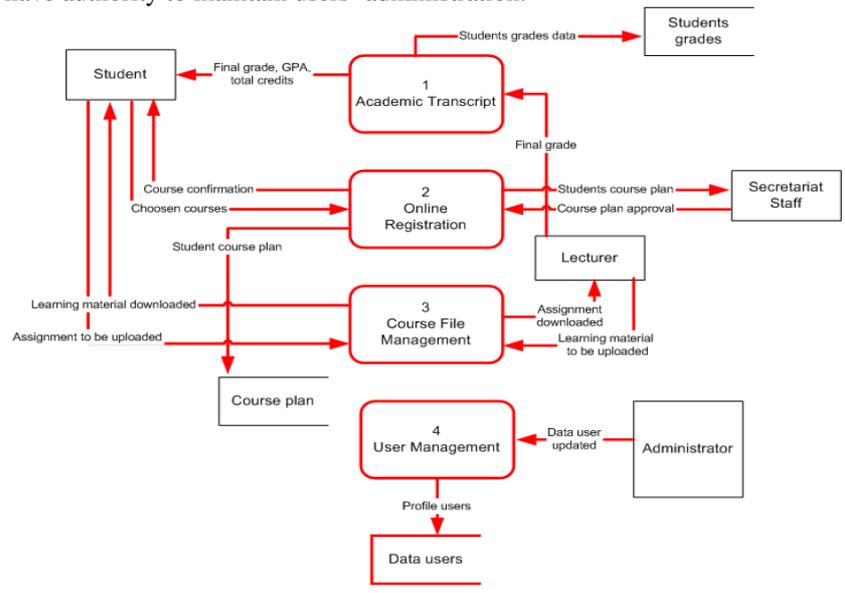
Figure 3. Data Flow Diagram Level 1

4. SYSTEM DESIGN

This system is a web-based Information System that uses 2-tiers architecture. Level 1 handle HTTP-request and give the response after the request is processed by web server and module program. Level 2 handle database, directory, mail server, and SNMP (Simple Network Management Protocol). Figure 4 describes the design of system architecture.
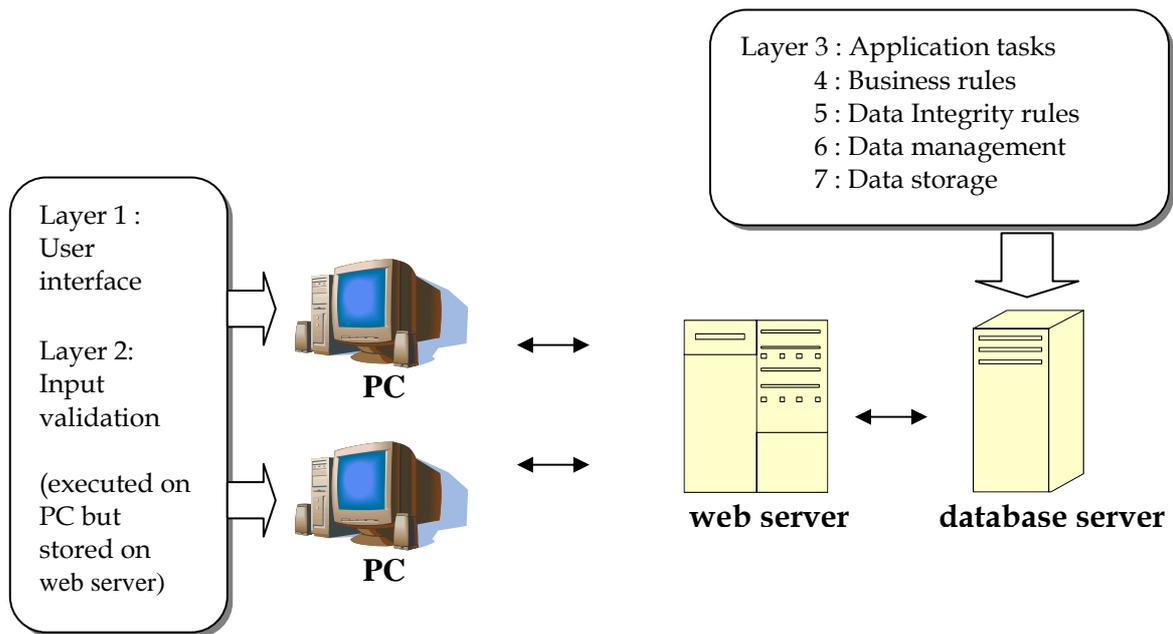
Figure 4. System Architecture Design [6]

Development tools which are used to implement this system is open source, such as PHP 4 as programming language, MySQL as database server, and Apache as web server.

Interface design is the design where colors, text fonts, font sizes, shapes and line thickness are strategically composed in an aesthetic manner to please the user and also set a hierarchy in the communication. This helps the user focus and attend to the information on the page sequentially [7].

- Academic Transcript Design.
  Figure 5 depict Academic Transcript Design where student can look their grades, total credits, GPA in specific semester or all semester they enroll. Lecturer can input grade for each student who enroll to specific course(s).
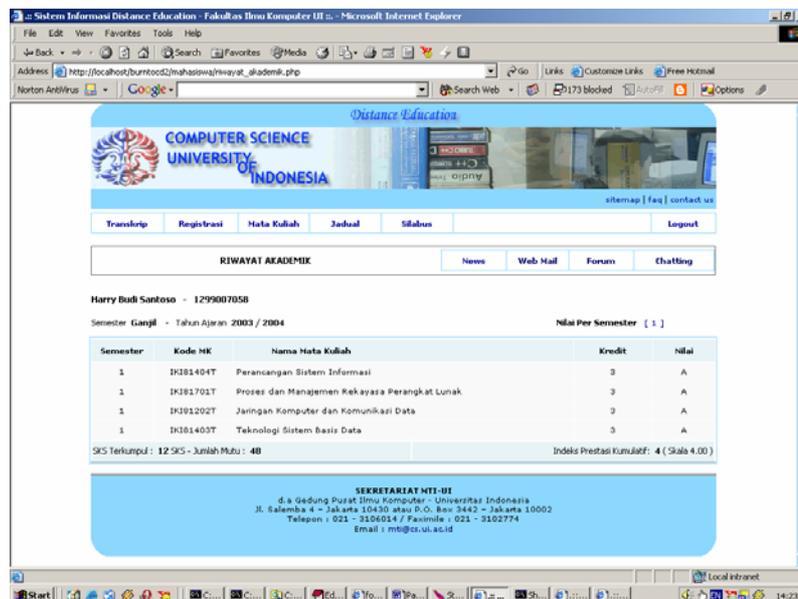
Figure 5. Academic transcript interface

- Registration Online
  Figure 6 shows Registration Online System that handles online course registration so that student can register for incoming semester.
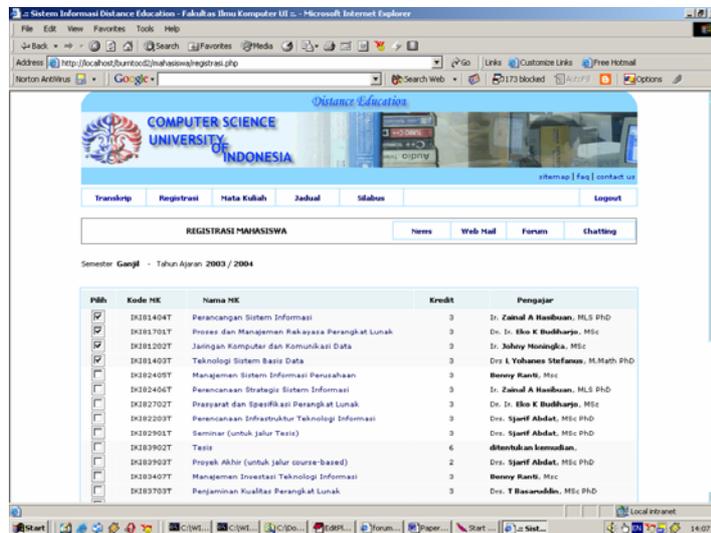
Figure 6. Registration Online interface

5. CONCLUSION

This web based online academic administration system is developed to support distance learning. The system manages several processes such as: academic transcript, calendar academic, online registration, syllabus, news, user management also file learning material management. It is a system that is part of enterprise resources planning in distance learning systems.

For future work consists of:
1. To extend the online academic administration into University of Indonesia wide program.
2. Wireless implementation by using WAP, so students can access transcript, calendar, register online, or download learning materials.

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ABC-NET: LITERACY TOOL FOR PAULO FREIRE´S METHOD

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ABSTRACT

Paulo Reglus Neves Freire was born in Recife in 1921, the capital of Brazil's northeast province. Through all his life, he developed the fundamentals of a teaching process with special characteristics. The fundamentals of his 'system' point to an educational process that focuses on the student environment. abcNet is a web-based application which seeks the goals of learning how to read and to write, following Paulo Freire's methodology.

KEYWORDS

abcNet, Paulo Freire, literacy, e-learning, tool

1. INTRODUCTION

The new technologies not only create excellent opportunities for the human development and fulfillment, but also enhance the challenge of making them accessible to all, including the ones away from the current information society. abcNet presents a structure based on the Web and has as its main aim putting at one's disposal contents to be used in the teaching of how to read and write. It is based on a method proposed by Paulo Freire and works with mechanisms used in the new communication technologies, such as active mechanisms for the interaction with users like buttons, hyperlinks, visual effects, etc, mechanisms of text, image and movie watching; mechanisms of listening. In the book "*Educação como Prática de Liberdade*" (Education as Freedom Practice), Paulo Freire presents the accomplishment of his method in five steps: 1) studying of the vocabulary used by the students; 2) selection of generating words; 3) recreating real scenarios; 4) programming the course; 5) creating tests with words broken apart in their syllables. At the present moment, abcNet focuses essentially on the last step. The development of abcNet is scheduled in two phases. The first one, which is in course, focuses on the developing the process associated with the learning of how to read and write. In the second phase, abcNet will deal with the following topics: a) continue the processes started in the first phase; b) develop a statistical study of the teaching moments; c) contents and tools to help understanding the contexts associated with generating words; d) digital libraries. The word is the fundamental unit of the teaching process. The selection of words is the key to the success of the teaching and learning process. Each of the selected words is called a generating word; the set of generating words is called the universe of the generating words.

2. PEDAGOGICAL ISSUES

At this phase, abcNet is only concerned with the learning of how to read and write. As it has been mentioned before, the word is the fundamental unit of the teaching process. Starting from the word, the teaching process follows a methodology based on syllables. It is through these syllables that the methodology will develop, by breaking up the word in syllables and also by grouping syllables into words.

2.1 Syllables

Syllables represent the basic division of every word. They are the minimum element of the learning process of how to read and write. Syllables can be grouped into sets sharing common features. These groups of syllables will provide extra flexibility in the planning of the learning process. We defined 4 groups of syllables: a) family: those obtained by the substitution of the vowel of one syllable for the other four vowels of the alphabet; b) homophonous: two syllables are said to be homophonous when they have the same pronunciation in spite of a different spelling; c) homographs: two syllables are said to be homographs when they have different pronunciation in spite of the same spelling; d) adjacent: syllables we obtain by adding or removing an accent or a nasalization mark from a syllable. All of these syllables are the basic elements used by the students to learn how to read and write.

2.2 Teaching Units

A teaching unit is the basic teaching structure in abcNet goals. A teaching unit consists of a set of forms with which the students interact and work to achieve certain goals in terms of how to read and write. Each teaching unit results from a configuration of a teaching template where the teacher may choose which words, syllables, sounds, images, etc, are required to achieve the goal. From each one of the teaching templates, configured by the teacher, abcNet will generate automatically all the necessary teaching units. We may say that a course planning requires the following stages: a) select which teaching templates to use; b) configure each teaching template to obtain the teaching units; c) ordering of the teaching units. We should notice that one teaching template may be configured as many times as necessary in order to generate as many teaching units as necessary. abcNet provides two types of teaching units: a) one to the learning of how to read (reading units); b); one to the learning of how to write (writing units).

2.3 Reading Units

The reading units are those specifically developed to the learning of how to read. At this moment, abcNet provides three reading units.

2.3.1 Reading Unit 1

Goal: reading unit 1 aims at learning how to read written syllables.

Methodology: The student must be able to select amongst some syllable pronunciations, the one that corresponds to the correct reading of a syllable shown on the form. Each one of the pronunciations can be heard as many times as the student wishes.

Configuration: In the configuration process, the teacher may define: a) the syllable to be presented of which the pronunciation must be given; b) the group of pronunciations from which the student will select the correct one.

2.3.2 Reading Unit 2

Goal: Reading unit 2 aims at learning how to read written syllables.

Methodology: The student must be able to select amongst some written syllables on the form, the ones which correspond to the pronunciation heard. The student may hear the pronunciation as often as he wishes.

Configuration: In the configuration process, the teacher may define: a) the pronunciation to be heard; b) the written syllables to be presented

2.3.3 Reading Unit 3

Goal: Reading unit 3 aims at learning how to read written words.

Methodology: The student must be able to select amongst some given pronunciations, the ones that correspond to the reading of a given word presented on the form. The student may hear the given pronunciations as often as he wishes.

Configuration: In the configuration process, the teacher may define: a) the word to be presented on the form; b) the pronunciations to be heard

2.4 Writing Units

The writing units are those specifically developed to the learning of how to write. At this moment, abcNet provides two writing units.

2.4.1 Writing Unit 1

Goal: Writing unit 1 aims at learning how to build words starting from a single generating word.

Methodology: From a generating word and its corresponding image, abcNet presents: a) the generating word; b) an image associated to the generating word; c) the generating word divided into its syllables; d) the
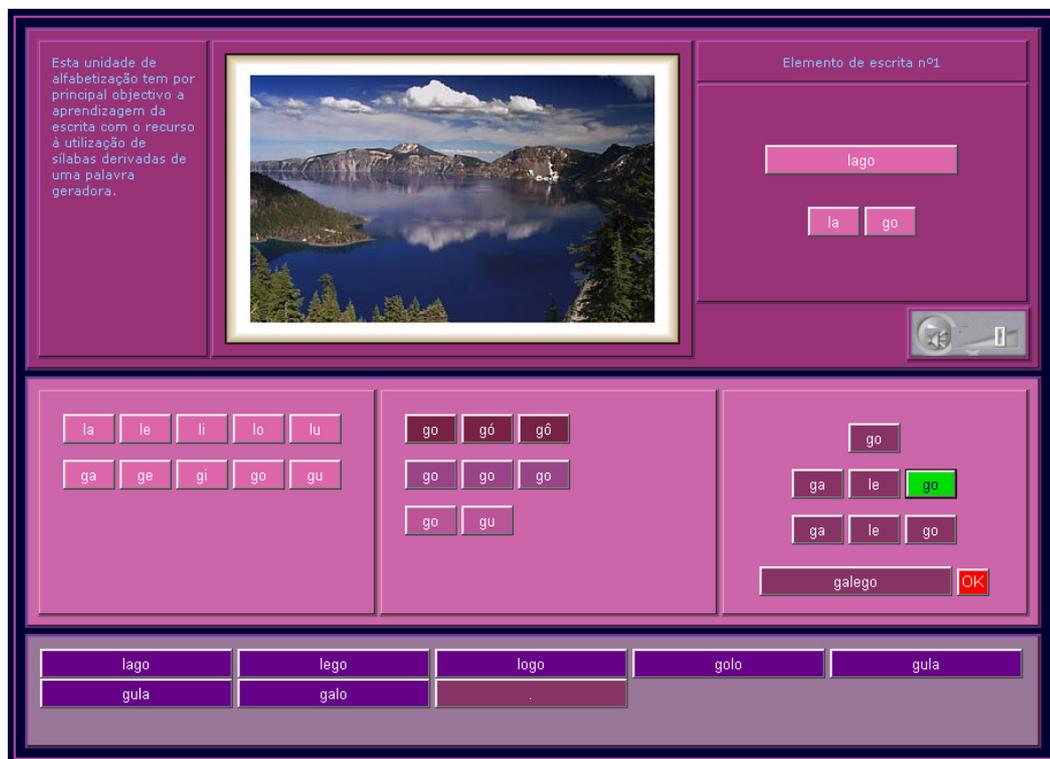
Figure 1. The Writing unit 1

family syllables of the generating word syllables; e) the other syllable groups (homophonous, homograph s and adjacent) for all presented syllables; f) a place where the student may build the proposed words which can be heard as often as necessary; g) a place to show all the already created words.

The student must build a series of words, one at a time. The student may hear the current word and each of its syllables. Then he must select from the available written syllables, the ones that match the pronunciation heard.

Configuration - In the configuration process, the teacher may select: a) a generating word; b) an image associated with the generating word; c) besides the group of the family syllables, other groups to present; d) words to be built and the order in which they appear.

Figure 1. shows an example of the writing unit 1. We can see: a) top left: a description of the teaching unit; b) top center: an image of a lake; c) top right: the generating word 'lago' (lake) and its syllables; d) center left: the family of all syllables from the generating word (syllable 'go' selected); e) center center: the adjacent, homograph and homophonous groups of syllables of the 'go' syllable; f) center right: the building of the word "ga-le-go"; the student has just selected the last correct syllable (go); g) down: all the words already built by the student and the one in the building process (not yet shown).

2.4.2 Writing Unit 2

Goal - Writing unit 2 aims at forming complete words starting from a group of syllables.

Methodology - The student is given a word divided into its syllables. One or more of these syllables may or may not be visible. The student must be able to build or complete the word by selecting the written syllables from the ones available.

Configuration - In the configuration process, the teacher may define: a) the word and the visible syllables; b) the range of syllables for the building process

3. TECHNOLOGICAL ISSUES

abcNet is an application based on the Web. In order to avoid problems associated with technological incompatibilities, some blocks of abcNet will only be built with standard technologies, such as: HTML, XML, SOAP, web services, Flash, etc. For the teaching purpose, abcNet will only require a web browser and some well known and free downloaded plug-ins.

4. CONCLUSION

abcNet has got many advantages if compared with traditional methods of teaching how to read and write. These advantages can be classified as follows: 1) planning – a) teachers have at their disposal templates that can be used in the planning of the teaching sessions; b) each template can be configured in order to achieve the aims defined by each teacher to a specific teaching session; 2) evaluating – a) in a near future, abcNet will provide mechanisms for statistical treatment; b) it works out learning profiles; 3) self-management: a) the online mechanisms provide the students with a greater degree of independence from the teacher; b) each student may have his own learning rhythm. abcNet may have the following disadvantages: 1) it requires a previous knowledge and training on how to use the application; 2) it requires an information platform prepared to fulfill the application needs. We may also present some restrictions of abcNet which come from the fact that it is at the beginning of its developing process, so it does not yet include the following features: a) context understanding; b) statistics; c) digital libraries; d) other languages than Portuguese. The flexibility of abcNet makes it suitable for students of any age. abcNet can be used to teach adults, teenagers or children by providing specific interfaces for each group. It is the teacher who chooses the resources to be used (words, syllables, images, teaching units, interface, etc) and the way these resources are going to be handled by the students.

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PRACTICAL PRINCIPLES OF E-LITERACY FOR THE E-SOCIETY

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ABSTRACT

It is necessary to re-define eliteracy_ in ways that are of practical use. In the early days, we distinguished between print literacy and computer literacy. But in fact we should separate *operational* computer literacy and *cognitive* computer literacy. The former ranges from adequate to very advanced skills in computer commands and processes. *Cognitive* computer literacy refers to an intellectual grasp of how to exploit what the computer [including the WWW] offers, whether this be to find or record information, share information with others, or interact with other individuals. The paper will refer to this as e-literacy and will explore some of its key principles.

KEYWORDS

e-literacy, information literacy, computer literacy, media literacy.

1. WHAT IS ELITERACY?

It has been proposed "that we are living now in an eWorld, a world permeated by the effects and products of electronic technology. The notion of e-literacy is based on the assumption that there are skills, awarenesses and understandings which will enable individuals firstly, to survive, and secondly, to be more effective in, e-encounters. eLiteracy may therefore extend beyond the basic skills of survival in e-encounters, and include also what is needed to prosper and to excel in them" (ITEU). I suggest that e-literacy is a combination of computer literacy, information literacy, and ethical literacy.

Computer literacy includes:

- the specific features of the computer, e.g.typing conventions, icons, menu bars, pop-up windows, hyperlinks, etc.
- how meaning is conveyed differently on the computer, e.g. moving text, flashing text, text with sound, text appearing in response to speech, etc.
- how sound, moving image, or the special conventions in journalism and film convey their meanings, and how, again, these are different on a computer, e.g. the flowing of text around images, the juxtaposition of movie with PowerPoint slides, etc.

Information literacy is the subject of the next section. The last, ethical literacy, refers to aspects of computer communications involving intellectual copyright, data protection, netiquette, and so forth. This paper will not deal with these issues.

2. WHAT IS INFORMATION LITERACY?

One clear, early clear definition was based on the concept of what we now call the learning society: "To be information literate an individual must recognise when information is needed and have the ability to locate, evaluate and use effectively the information needed. …Ultimately information literate people are those who have learned how to learn. They know how to learn because they know how information is organised, how to find information, and how to use information in such a way that others can learn from them" (ALA 1989)

A more comprehensive approach was proposed by SCONUL (SCONUL 1999) in 7 competencies needed:

1. The ability to recognise a need for information

2. The ability to distinguish ways in which the information 'gap' may be addressed, which includes

- knowledge of appropriate kinds of resources
- selection of 'best fit' resources
- understanding accessibility

3. The ability to construct strategies for locating information, which includes

- matching information need against resources
- systematic methods appropriate for the need

principles of construction and generation of databases
4. The ability to locate and access information, which includes

- appropriate searching techniques
- indexing and abstracting services,
- citation indexes
- databases

5. The ability to compare and evaluate information obtained from different sources, including

- awareness of bias and authority issues
- awareness of scholarly publishing processes
- appropriate extraction of information   6. The ability to organise, apply and communicate information to others in ways appropriate to the situation, which includes

- bibliographic references in project reports and theses
- constructing a personal bibliographic system
- applying information to the problem at hand
- communicating in an appropriate medium
- issues of copyright and plagiarism 7. The ability to synthesise and build upon existing information, contributing to the creation of new knowledge – this being seen as the true value of information literacy, without which it would have little purpose.

A slightly simpler version of such an approach is from the TFPL's report (TFPL 1999) which emphasises that all staff need to be able to find, appraise and use information, requiring the following skills:
1.   take a structured approach to defining questions;
2.   navigate through information sources;
3.   evaluate the relevance, reliability and quality of information obtained;
4.   filter out irrelevant and superfluous information;
5.   synthesise and apply to the decision making process;
6.   record conclusions and reasoning.

A quick snapshot of the situation in my own institution, Institute of Education of the University of London, shows that we are on the way to becoming an information literate universityA recent survey indicates [provided by Gwyneth Price, Institute of Education Library] that at Easter 2004 our beginning teachers signalled that they were confident or very confident in ICT skills (86%) and information skills (67%), but at a lower level for the use of electronic resources since 38% used themdaily, while 19% did so less than once a month.

As to which resources they were exploiting, the library catalogue and search engines came first at over 90%, with awareness of the ATHENS Access Management System surprisingly lower (75%) and disappointing results for use of E journals (48%), journal indexes (16%) and internet gateways (15%).

3. E-LITERACY IN LARNING & TACHING – WHO NEEDS IT?

For our e-society - the network society - and its needs for just-in-time and lifelong learning, we thus have to extend our traditional concepts of print literacy to embrace computing skills and a wider range of information skills than we did before computing and the WWW. All contemporary courses or knowledge providers, need to develop resources so that they are justified in feeling confident that they have equipped their teachers, students, and above all librarians with full e-literacy skills for their tasks.The role of the librarian has now become as crucial for these developments as that of the technician. And both of them are in professions that, today, require a comprehensive understanding of the needs of teachers and learners. We cannot expect those who design computer interfaces for education, nor those who assist educators and learners to manage information, to do so without a proper regard for the processes involved in teaching and studying.

In the Online Education and Training certificate – an e-learning course that I have been running internationally since 1992 (OET) - there has been a significant change in the background of the participants. Whereas early groups were exclusively college teachers, we now have technical and library staff as well as administrators and other support staff.

Such professional development is today essential for people involved in education and training who may never have been trained to teach and/or have never conducted online courses, but who seek understanding of key educational issues. In my view, an integral part of such training lies in the value of becoming an online learner for a period. After such training, people who manage, administer or assist e-learning teams [e.g. librarians or technical specialists, corporate trainers, educational administrators, instructional designers, and online content & course authors] will be able to feel greatly more confident of their own e-literacy and therefore better able to develop training materials and resources for their own learners.

We should not forget our concerns to remove barriers access and the inclusion issues raised by members of our society who have visual or hearing difficulties, or for whom ICT skills are a very expensive undertaking. This year, for the first time, I was able to accommodate a deaf student in our online course.

All multimedia that included the spoken voice were transcribed for her, and I believe that she was fully able to participate.

4. HOW DOES E-LITERACY RELATE TO LITERACY IN GENERAL?

Literacy has always been the barrier between people and the knowledge they aspire to. In pre-literate societies, children are not sent to school because they are part of the adult world, without too many secrets kept from them. In literate societies, children become a separate community in schools, and we see features of this separation, like toys, different clothing and foods (Postman 1994).

Now, the pervasive accessibility of radio, film, and TV has meant that a very large part of the knowledge that had been concealed in books, can be openly shared with children. In the West at least, we have had a period in which childhood and adulthood have re-converged. TV programmes and films address both groups, clothing and food have again become almost indistinguishable, as have leisure activities.

But at the same time, most significantly, the new convergence of adults and children is different from the earlier one chiefly because information is now sought as much by the WWW as from print. Today, everyone needs to develop e-literacy. For educators, the interesting question is what we are going to do with these skills when we all have them.

One fear that has been expressed, was that the cognitive demands of print literacy – requiring, it was said, linear and logical ordering of thought – would be down-graded in favour of highly simplistic elementary thinking. This view sees the printed page as a highly value medium leading readers to pure conceptual thought unmediated by images, so that readers are *compelled* to interpret meaning through their own thought processes.

By contrast, on a computer, words now are more and more frequently side by side with *concrete realisations of their meanings* through pictures and sounds. The danger was that we would no longer interpret for ourselves. Richard Lanham (Lanham 1992) responded to such anxieties by arguing that there was great value in the convergence of words, images and sounds. He indeed anticipated a complete renegotiation of the relationship between verbal and visual thinking. Because in a digital universe, words, images, and sounds are, at a fundamental level, convertible into one another, and because our minds have the power to organize experience, we would make use of computer graphics not merely to illustrate what we use words to say, but we will develop new styles of thinking.

Although it is perhaps to early to reach agreement on such a new type of literacy, nevertheless, we can almost certainly assume that most of us are now "media literate" in ways we are unaware of. People who watch contemporary films – especially advertisements - are very alive to the iconic logic in them, such as the angle from which the pictures are taken, the cutting from one scene to another, the juxtaposition of images - all these are meaningful and logical.

Another example is the use of icons to replace verbal commands on the menu bars of word processing packages. Here, the icon is actually functioning like a word. They lead further and further into a new semiotic which will incorporate not only the old rhetorical traditions, but also visual and sound arts, and thus we are facing what Lanham calls a new organisation of humanistic knowledge, where we are beyond simple linear, verbal thinking processes here.

Moreover, the fact that computers are digital and have hypertext, introduces another fundamentally different process into literacy. The writer and the reader are no longer limited to a fixed reading order. Beginnings, middles, and ends can be a set of user-selected variations. Taking this together with the reader's options to amend, rewrite, reformat, change colours, make text "flow" around pictures, add or change sound, etc., the whole system of cultural authority enshrined in the text has evaporated. We might see this as a desecration of "cultural authority", or as a democratization of knowledge.

Surrounding all these changes are other developments. A major one is the increasingly multi- or pluri-cultural make-up of all societies, involving new configurations of communities of practice and thus presenting educators with the need to prepare a multi-lingual e-society whose members are open to cultural thought patterns different from their own. These present serious pedagogic dilemmas that we will not solve simply by the assuming everyone will become e-literate and also a proficient autonomous, lifelong learner!

In addition, information literacy is developing in many new directions. Search engines like Google, sweeping right across the internet, have broken down the boundaries between established disciplines, primarily because they find items by keywords rather than by discipline boundaries. Multimedia developments mean that the digital world can now link, and search, not only authors, but also conversations, lectures, television programmes, films, or any of the many aspects of our lives. Hence the need mentioned above to compare and evaluate information obtained from different sources.

As a consequence, e-literacy is changing the role relationships between laymen and specialists, e.g students and educators, or doctors and patients, who are now more in a position to control - or at least influence - their own studies or healthcare. Some might fear the danger that this will be exploited if anyone can use available the knowledge towards their own goals and purposes [indeed the re-usable objects movement is working towards just this].

5.   CONCLUSIONS

Our training programmes for e-litaracy need to take account of all the factors I have briefly outlined, with priorities evaluated on a case by case basis. This is an exciting and challenging one that is being constantly made simpler by the on-going spread of computer use alongside traditional literacy.

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THE FACTORY: A MULTIMEDIA TOOL TO MINIMIZE THE DEVELOPMENT TIME OF ELECTRONIC TRAINING COURSES

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ABSTRACT

This paper describes the e-factory project and the obtained results applying the tool factory. The tool factory was developed by the SINTONIA group of the Computer Science department at Carlos III University of Madrid and a Spanish financial institution.
The main goal of the tool factory is the development of e-learning courses minimizing the cost and time gathering and integrating the course contents. This paper compares the results obtained (in time and cost) by the financial entity, in the development of e-learning courses without and with the factory tool.

KEYWORDS

E-learning, software tools, case study.

1. INTRODUCTION

e-learning is the use of technology to manage, design, deliver, select, transact, coach, support and extend learning, but actually the e-learning process is not only for educational institutions, many institutions have an e-learning systems to train their employees.

This is the case of the financial institutions that have specific necessities for employees training, but which business is not the education. The greatest priority in employee training arises when the bank launches a new financial product or service. The department responsive for developing the new financial product keeps it in secret during the development phase. Therefore the technical details, tax treatment and other issues related to the product are known only after it has been designed and is ready to be launched. Consequently, it is impossible to train employees until the new product has been completely developed.

There are many tools for courseware in the commerce, but all tools compete to cover in a general way the learning necessities in different contexts and they add many functions and transform the material development process in an complex process one.

In a financial institutions there are particular necessities for e-learning process with their employees. In these institutions de speed in the development of multimedia material, is a critical factor for the success in the new product and service delivery.

For this reason to have an appropriate tool for development e-learning courses, is an important way for simplify and speed up theirs e-learning process. This paper present the factory tool as example for e-learning tool appropriate for the financial institutions training process.

2. THE E-FACTORY PROJECT

The financial institution in order to continuously update offered products and services, made continuous training of their employees and took steps to facilitate distance learning for their staff beginning with the development of a virtual campus.

Once the virtual c@mpus was installed, different courses were added: computer studies, management skills, banking products and the new economy. On average, it takes three months to develop and implement each course, although some were developed simultaneously.

However, the problem was provided with the contents in a reasonably short time and within the budget appropriate for each course. After subcontracting the training of these courses to some service companies, and as a result of the high level of cost and time until the requested courses were ready, they decided that it was necessary to look into the possibility to develop a tool to solve this problem.

They contacted the SINTONIA group of the Computer Science Department of Carlos III University in Madrid and a contract was signed with the goal to develop a tool for the development of e-learning courses. The pilot project was called e-factory and the tool factory

2.1 Theoretical Context

In general way the e-learning term referring broadly to technology-based learning, but actually it seems to focus on web-based delivery methods but often used in a broader context.

There are many kinds of e-learning tools use in different context and platforms, but the web-based training is the tread for training process in many institutions. Software tools used in web-based learning is rank by function:

1) Authoring Tools: essentially, multimedia creation tools.

2) Real-time Virtual Classrooms: a software product or suite that facilitates the synchronous, real-time delivery of content or interaction by the web.

3) Learning Management Systems (LMS): enterprise software used to manage learning activities through the ability to catalog, register, deliver, and track learners and learning.

Many web applications include groups of tools to present on-line courses. These are known as virtual learning environments (VLE) or virtual campus, have appeared and some case studies published has focused on the use of e-learning in field like e-commerce or in the introduction of this technology in academic institutions (Ahmad, 2001), (Hodgkinson, 2002), (Presby, 2002), (Seufert, 2002).

There are well know standards for e-learning such as AICC Aviation Industry CBT Committee (AICC, 1997); IEEE Learning Technologies Standards Committee-LTSC, IEEE 1484.x (IEEE, 2003); IMS Global Learning Consortium, Inc.(IMS, 2003); and ADL SCORM Advanced Distributed Learning, Shareable Content Object Reference Model. (Foix et al., 2002).

In the same way, actually there are many platforms for e-learning (Foix et al., 2002), for example: TEDS (http://www.teds.com/), Docent Enterprise Learning Management Server, Training Partner (http://www.docent.com/), LearningSpace (www.learningspace.org), Training partners (http://www.training-partners.com) CLIX (Corporate Learning and Information eXchange), WBT Manager (http://www.ielearning.com/), IntraLearn (http://www.intralearn.com/), KPLearning Management System (http://www.knowledgeplanet.com/), Pinnacle Learning Management system (http://www.learnframe.com/), Pathlore Learning Management System (http://www.pathlore.com), Enterprise Learning Management System(ELMS) (http://www.plateau.com), Saba Enterprise Learning Suite (http://www.saba.com/), TopClass (http://www.wbtsystems.com) Sigal (http://www.technomedia.ca/), WebCT Campus Edition (http://www.webct.com/), and many others.

2.2 The Pilot Project e-Factory

The pilot project e-factory started in 1999 and finished in 2001. In Figure 1, we summarize the pilot project main phases as well as the previous steps achieved by the financial institution and related with this case study.

1. Subcontract courses: from 1998 to 2000, the financial institution has been subcontracting the development of electronic courses under the project c@mpus to train their employees.

2. Gather subcontracted courses data: from 1998 to 2000 the financial institution has been gathering data related to the time, measured in hours, and cost of subcontracted courses.

3. Factory development: Gather the requirements and software development. The tool price, €24.100.

4. Courses development using factory: to begin the use of the factory the financial institution developed twice some of the courses which were previously subcontracted.

5. Gather courses data, using factory: from 2000 to 2001 the financial institution has been gathering data related to the time measured in hours, and cost of courses developed using the factory. The cost of each course has been calculated taking into account the people involved in the development (usually composed by experts in the course subject and experts in the tool use), and the proportional part of the factory development project, (calculated dividing the factory cost among the number of courses development with factory tool).
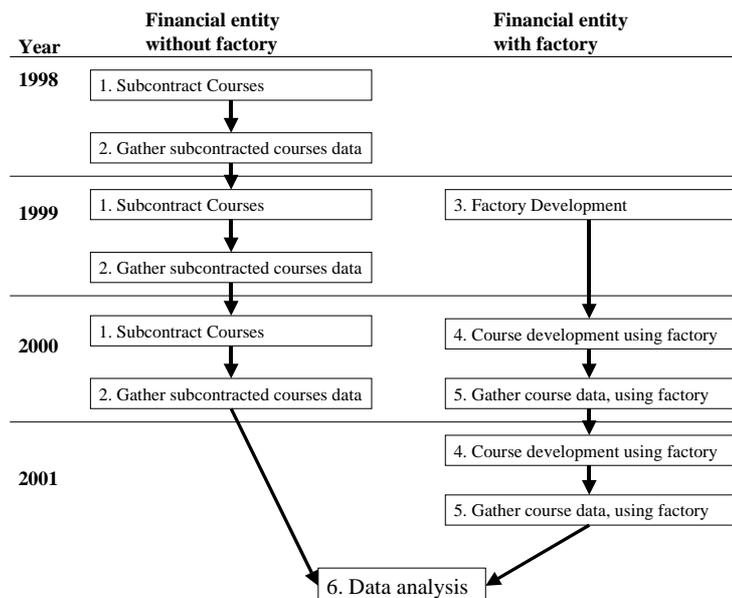
Figure 1. e-factory main phases

6. Data analysis: The data obtained during the development of the training courses with and without the use of factory are compared in Table 1.

Table 1. Data cost and time comparison

Course name	Without Factory			With Factory		
	Course Hours	Development Time (Hours)	Cost (euros)	Course Hours	Development Time (Hours)	Cost (euros)
Leasing	15	560	14300	15	210	12000
House Credit	12	420	13300	15	210	12000
Credit Cards	15	560	15000	15	280	16000
Business on line	25	350	36100	20	210	12000
Oral Communication	9	280	12110	15	70	4000
Time Management	9	280	12110	15	70	4000
Meeting Management	8	280	12000	15	70	4000
Advanced Excel	15	350	12500	20	140	8000
EURO	10	280	12000	10	70	4000
Internet	10	280	12000	20	140	8000

As can be seen in Table 1, the tool factory has been successfully applied and has solved the proposed goals. Development time is significant reduced for all the courses. Being this problem, the necessary time to

have a course ready, one of the problems due to the employers must learn the new product features as quickly as possible.

As can be observed, the cost of the course using the factory was more inferior than the one of the same courses developed without the factory, for the most part of the courses and this was an important goal for the institution. In most cases the cost is significant inferior except in the case of Credit Cards course where the cost using the factory is major. The reason for this is that in some courses more than one expert in the subject was involved in the selection and elaboration of the contents and theirs salary does the course more expensive.

2.3 The Tool Factory

Factory is an authoring tool, which simplifies the development courses on WWW for e-learning in the financial institutions, and it was development with JAVA technology and used SQL server as database and the communication with the database was implemented using the bridge JDBC-ODBC. The course generate is in HTML or XML format.

The main factory features give answer to the following goals:

1) The factory should be portable so could be easily installed in any personal computer of the financial institution. We decided the use of JAVA code because the virtual Java machine can be executed in any personal computer.

2) The factory should facilitate the development of the course minimizing the courses time and cost of development. To achieve this goal the factory was endowed with a set of modules which covers all the course necessities and only this. The factory users can easily and quickly select not only the contents of the course, but also its structure, style and exercises. The structure for instance the course must be structured in lessons, sections, and paragraphs. The style for instance the background must be unified. The tool must have the exercises for traced the training.

3) The factory should generate courses absolutely ready to be published in the selected internet virtual campus. To achieve this goal it was decided the factory generates HTML and XML courses.

As a result of the above mentioned goals, in Figure 2 can be seen an architectural view of the factory tool. Where P1, P2, P3, and P4 represents the sub-systems corresponding to Structures generator, Styles generator, Exercises generator respectively. This architecture solution allows:

*   The easy inclusion of tracking sentences.
*   The visualization of the courses using navigators than understand HTML and also has a module able to generate the same course in XML code, which can be interpreted by new generation navigators.
*   The endowing of semantic content to the courses using XML, we mean, the same course can be used to different students and depending on their levels the contents showed will be different.
*   The easy inclusion of new packages
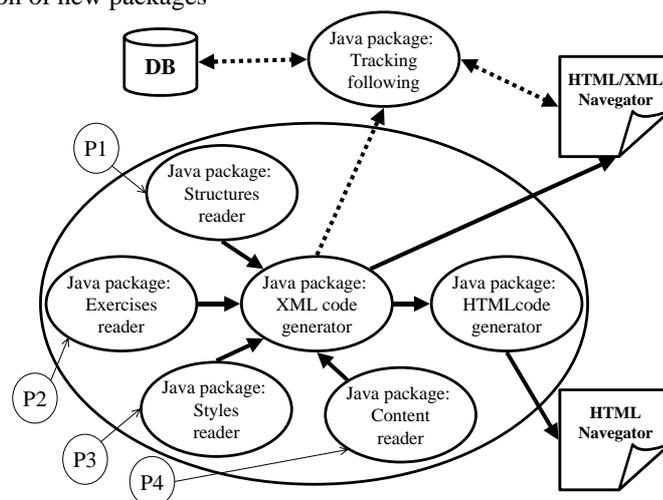
Figure 2. Factory main packages

3. CONCLUSION AND FUTURE TRENDS

Virtual c@mpus takes advantage of e-learning and was developed so that all the employees could be trained at the same time, at a lower cost and without having to leave their offices.

The main problem for training employees in a financial institutions arises when developing the course for a new financial product for the virtual c@mpus since, if three months were needed, the urgent training these courses demanded was lost. To solve this problem the factory tool allowed the development of new courses within few weeks.

The e-factory project has obtained excellent results in many aspects:

- Factory tool assists the rapid gathering and integration of contents in the courses. This requirement is necessary for launch a new product or service in a financial institutions.
- Factory tool is designed for a particular context and this tool only implements the functionality required in this context.
- The factory tool is able to develop courses in HTML and XML format of different levels of complexity. Can be easily enhanced, is portable because is written in Java, and can be used by people with little computer science knowledge.
- By other hand, the whole project e-factory has achieved all the proposed goals. From the gathered data can be seen the financial institution has reduced notably the cost in training its employee.

The financial institution should compare the benefits obtained before the use of factory to develop courses for specific financial products with the ones obtained using the factory. The experience should be repeated using the factory but in other financial institutions.

Although the factory was developed to solve the problems of training in financial institutions, but in fact would be a useful tool for teachers in any kind of institutions with teaching necessities. Usually the contents of the courses are ready and using factory the teacher can easily prepare the lessons for the students in HTML or XML format without any knowledge about specific web tools.

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MiULPGC, ULPGC'S PERSONALIZED WEBSITE: A TOOL TO MEET THE TECHNOLOGICAL CHALLENGE

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ABSTRACT

The University is usually defined as an institution characterized by teaching, research and service to society. These activities are undergoing changes brought about by the influence of information and communications technologies (ICT), which are used more and more in the educational environment. These changes create difficulties and uncertainties but also new spaces for opportunities.

The purpose of this work is to present a tool designed by the University of Las Palmas de Gran Canaria (ULPGC) that is user friendly and enables information to be administered and managed more efficiently for the different user profiles found in a University setting.

KEYWORDS

Internet, Contents management tool, e-administration, Higher education, Information and communications technology.

1. INTRODUCTION

In recent decades, man has been able to produce a true technological revolution. This scenario has made qualitative leaps, not only by molding customs but by shaping our way of life.

The digital revolution plays a key role in the construction of knowledge and development of teaching models. The challenge of this new age is to combine education, culture and technology rationally. In that way, this creative capability of man has been able to eliminate distance, time and frontiers and even bring geographically scattered cultures closer together.

We are players in an age where the learning communities are organized and managed in increasingly larger virtual spaces. This new form of interaction enables us to submerge ourselves in a multicultural world that promotes the richness of our learning.

These new educational and management spaces generate new relationships and give rise to concepts like the virtual campus or electronic campus. Kurshan (1991) characterizes it as the use of varied communication technologies to achieve effective learning and the interaction of the students and teachers.

Telecommunications bring the user closer, and institutions must contribute to that; to the different services that can be grouped into four categories (Romiszowski, 1994): communication (the service informs people, information is exchanged), entertainment (people enjoy the material and using it), motivation (people are influenced, persuaded to participate) and education (people learn and are taught by means of the material).

For Bartolomé (1998), the new communication channels are developing new words (technopolis, cyberculture, hypertext, global village, virtual community, etc.), new languages and new ways of knowing, bringing about much deeper changes than we could imagine.

The vast amount of information available does not guarantee its rational exploitation; it can even represent an obstacle. That is why information and communications technology (henceforth ITC) are not a means in themselves. Organizations must seek ways of creating flexible structures, new forms of management and administration capable of rapid response to the continuous and spectacular changes in the environment.

Society does not always evolve culturally at the same speed as the technological transformations take place. Our capacity to assimilate the developments requires on tools that channel and screen the vast quantities of information that we absorb every day.

The aim of this work is to give information about a simple-to-use tool designed by the University of Las Palmas de Gran Canaria (henceforth ULPGC) that permits information to be managed more efficiently and in line with the three profiles present in the university environment: students, faculty and research staff (FRS) and services and administration staff (SAS). It also optimizes the handling of contents and helps access knowledge through the publications prepared by the teaching and research staff. These tasks are performed using a management tool with one single access, thus permitting easy handling that makes more efficient use of time and information.

2. METHODOLOGY

This project was launched in June 2003 as a result of the attempt to continuously improve the ITC of the ULPGC by developing a tool that contributes to providing education and managing and administering the university content while taking the different profiles into account.

The service offered by this University through **MiULPGC** aims to link, promote and facilitate interaction between the different players in the university community. For this synergy to become a reality, it was first necessary to define the various profiles and the relationships between them. The interaction and connections of the human resources was achieved through a series of participation mechanisms, which made it possible to know the role of each actor, their needs, limitations, strengths and expectations. These activities led to a clear definition of services in broad terms taking the different categories into account. Figure 1 shows how interaction between the key factors supported by technology determined the main actions to be taken by **MiULPGC**.
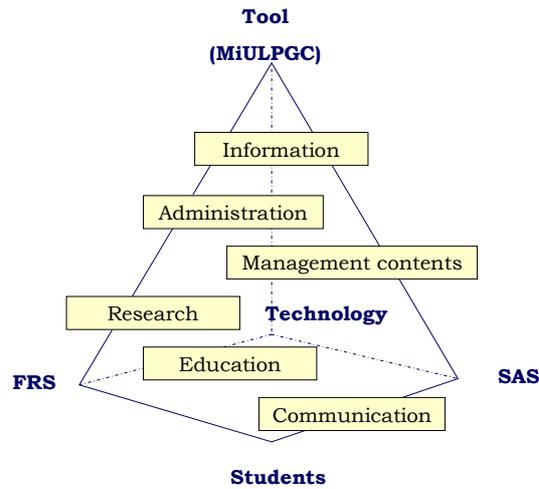
Figure 1. Interaction between the different profiles

To reduce both resistance to change and the fears generated by new technologies, this tool was developed in a network, with the active participation of the players involved, by means of special continuous courses to promote and demonstrate its benefits.

2.1 MiULPGC. Management Tool

Based on the definition of a design, the contents to be addressed more specifically and the objectives of the tool, the services needed (see Figure 2) to administer the information and enable the creation and interaction of knowledge were defined. The special feature of this tool is that it permits the management of a series of services through a single, personalized access attending the needs of each profile.

	PDI	PAS	Estudiante
MisDATOS PERSONALES	●	●	●
MiPERFIL	●	●	●
MisDATOS ELECTORALES	●	●	●
MisASIGNATURAS			●
MisPROFESORES			●
MiEXPEDIENTE	●	●	●
MiDOCTORADO	●	●	●
MiFORMACION	●	●	
MiEVALUACION	●		
MiGESTION	●	●	
MisARCHIVOS	●	●	
MisFAVORITOS ULPGC	●	●	●

Figure 2. MiULPGC services

MiULPGC enables users to access the facilities offered in **www.ulpgc.es.** by means of a single password. When the name and password are given, the system opens a personalized welcome page. From that point, the user can access the following services:

- **My Personal Data.** (MisDATOS PERSONALES). This permits the registered user to consult his/her identification data.
- **My Profile.** (MiPERFIL). This includes data about his/her official registration in ULPGC or about membership of groups of Web users.
- **My Electoral Data.** (MisDATOS ELECTORALES). This gives access to ULPGC census information that permits the user to exercise his/her right to vote in the different university electoral processes.
- **My Subjects.** (MisASIGNATURAS). If the user is a student at the University, he/she will find direct access during the current academic year to the Web pages of the subjects included in his/her registration.
- **My Professors.** (MisPROFESORES). This gives direct access to the lecturer files and to the Web pages of the subjects included in the official registration.
- **My Record.** (MiEXPEDIENTE). If the user has been a ULPGC student, he/she can find the details of his/her academic record.
- **My Doctorate.** (MiDOCTORADO). Doctorate students can find all their marks for their Doctorate courses.
- **My Training.** (MiFORMACIÓN). This contains the complete offer of courses available to workers at ULPGC.
- **My Evaluation.** (MiEVALUACIÓN. This permits ULPGC lecturers to consult the results of the surveys of Evaluation of Faculty Staff of the University of Las Palmas de Gran Canaria.
- **My Management.** (MiGESTIÓN). Those in charge of managing the Web pages of any ULPGC area will find centralized access to the management area of those pages.
- **My Files.** (MisARCHIVOS). This permits the storage and administration of the files and images for later inclusion in the web pages.
- **My ULPGC Favorites.** (MisFAVORITOS ULPGC). This offers the possibility of adding links to favorite sites within the ULPGC. These links will be shown on the user's welcome page.

With **MiULPGC,** we can see how the transformation of administrative processes to electronic formats, e-administration and management, is tackled. As a way to facilitate and streamline operations, by using this tool, the users, based on the defined characteristics, can enroll and register for the subjects and courses in the relevant periods. The special feature of enrolment in courses through My Training is that it covers the available places in their entirety and, if any user confirms the intention of not attending, the system automatically fills the place with another applicant.

It is an intuitively used tool that, by means of the various options, permits the easy creation of Web pages, storage of files and images in a structure of folders in the University server in such a way that they can easily be shared by other users.

This new virtual-social space permits the sharing of knowledge, experiences and research with the university community, provision of class notes to students and modification of Web page content within the departmental group.

Hence, each student and group of players has unique characteristics that determine their reaction and interaction when faced with the technology and scenarios that are developing. The important thing about this tool is that it helps to organize, classify, screen, store and synthesize knowledge, thus facilitating logical and critical thinking.

2.2 Evaluation and Control

The development of this type of project has a social, cultural and technological dimension. It is not enough simply to start it; what we plan or intend is one thing while what happens in reality and how the players respond to the project is something very different.

Although the project, as previously mentioned, was launched in June 2003 the tool had a six-month simulation period that provided information predating that month. This section shows some of the statistics that were calculated in order to evaluate the tool and so improve its practices, strengths and experiences.

Figure 3 shows the percentage of users registered per profile in MiULPGC. It can be seen that there was a simulation period prior to the launch of the tool, hence the low values indicated. The trend reveals that, by January 2004, approximately 60% of registered users corresponded to each profile.

	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04
Accum.Percent. FRS	0,00%	0,81%	0,88%	0,88%	0,94%	25,75%	31,75%	32,63%	36,31%	57,81%	60,44%	61,56%	66,88%
Accum.Percent.SAS	0,14%	0,71%	0,71%	1,00%	1,71%	33,14%	36,71%	38,71%	41,14%	43,86%	49,00%	51,00%	55,86%
Accum.Percent.Students	0,02%	0,06%	0,06%	0,06%	0,10%	1,52%	21,84%	28,91%	39,56%	45,37%	47,60%	65,34%	67,19%
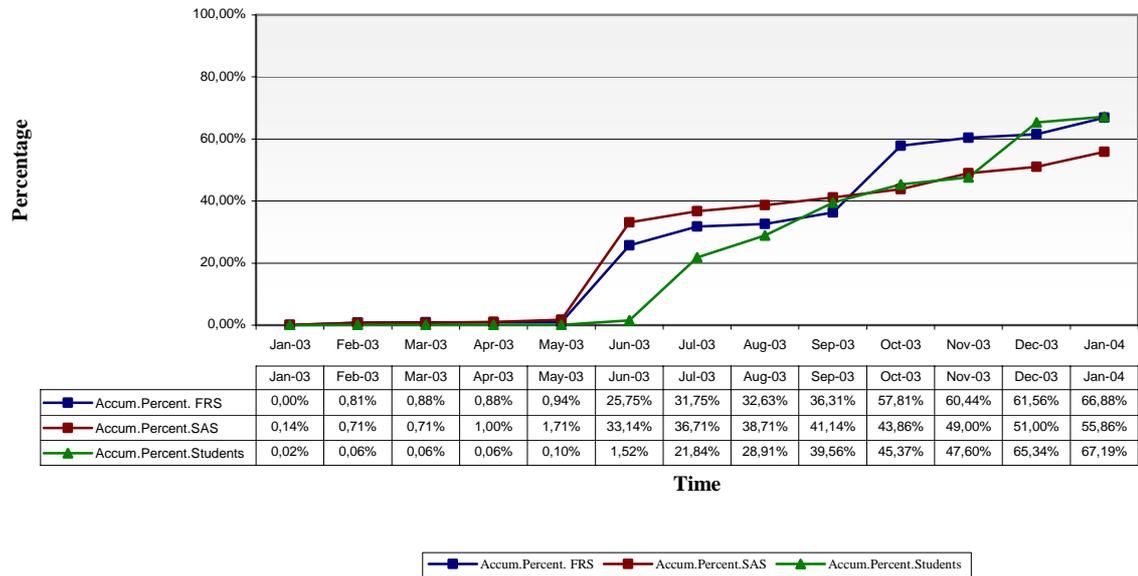
Figure 3. Accumulated percentage of registered users

Figure 4 shows the number of pages requested by registered users per profile in MiULPGC. In June 2003 the highest demand was from students while the surge in October for the FRS is explained by the beginning of the academic year as well as strong promotion of the tool to develop and facilitate teaching material.
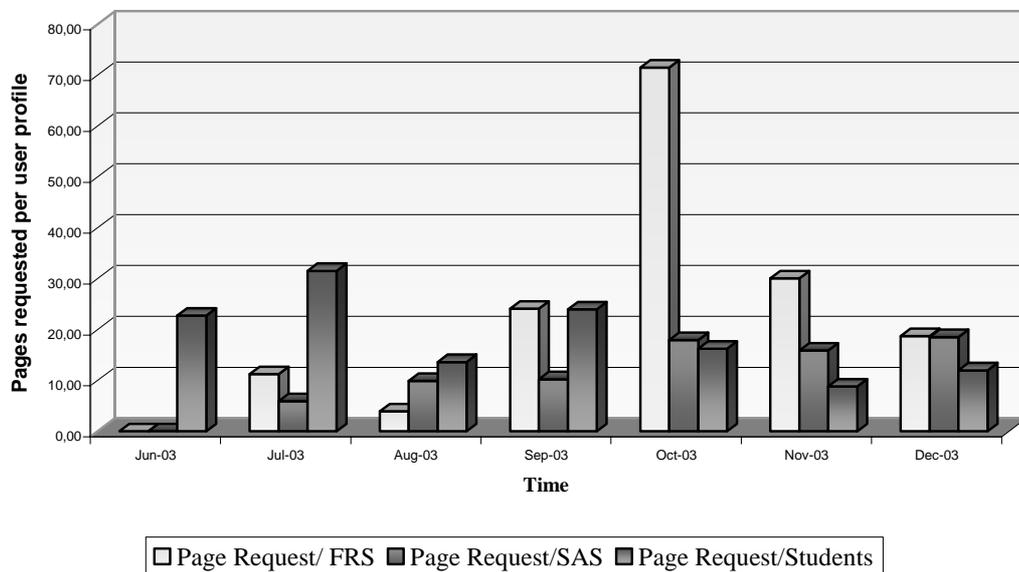
Figure 4. Average number of pages requested per user profile

This type of periodical evaluation and measurement of the acceptance of **MiULPGC** in key periods enables us to detect its faults and limitations.

3. CONCLUSION

MiULPGC is a tool that facilitates the design and development of learning experiences while streamlining the administrative and management tasks. It highlights the fact that the new services continuously being offered by the ULPGC are being integrated in a single application in a way that permits fast, personalized use in line with the needs of each profile.

This instrument makes interaction possible between the various players by means of the common use of technology as a support for virtual tools. This permits a series of activities to be combined and visible advantages to be obtained:

For the **Faculty and Research Staff (FRS):**

- It improves the teaching and research work since through **MyManagement** (MiGESTIÓN), FRS can provide students materials that allow them to follow the classes easier.
- It facilitates interaction by means of communication and instant response spaces while motivating participation.
- Collaboration is another important characteristic. By means of **MyFiles** (MisARCHIVOS), documents and images to create the pages Web must be in the University server, thus making it also possible to share them with other users.

For the **Service and Administration Staff (SAS):**

- SAS can register themselves in different courses through the **MyTraining** (MiFORMACIÓN) option. This way management and administration are improved considerably.

For the **STUDENTS:**

- The tool allows students to enrol themselves in different activities (sports, cultural, etc.) as well as in all the courses available.
- It facilitates the obtaining of notes and documents that teachers place in their web pages.
- Students and even former members of the University community can access their academic record, diminishing therefore the times of management.

Among other advantages it improves feedback since it is more rapid, fluid and timely between all the members of the University community.

Nowadays, ICT and its instruments are evolving rapidly and we still find ourselves in the experimental stage of its applications. The scenarios and the players are more and more demanding, which means designing and developing simple-to-use tools like **MiULPGC** that enable dynamic management and administration of contents and integration of information without overwhelming the users, while offering a space that enables them to act and be players.

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THE N-@BLE INITIATIVE: A BLENDED INSTRUCTIONAL PROGRAM FOR TEACHER TRAINING IN ICT-BASED SETTINGS

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ABSTRACT

The continuous transformations undergone in the educational field justify the need to include technology in the teaching and learning of a foreign language, since it is truly modifying the traditional educational methods and requires a technology-literate teacher eager to face the hardnesses of change. In this context, teacher training is key to reach success in the implementation of ICT in the teaching of foreign languages. The aim of this paper is to present the "N-@ble Initiative" a blended program carried out with the support of the ICE (Instituto de Ciencias de la Educación – Universitat Rovira i Virgili) aimed at training English language teachers (Secondary and Primary Education) in ICT-based settings in order to help them to reach success in the acceptance and implementation of technology into their teaching practices. This paper will focus on the following streamlines: 1.- Training in digital environments 2.- ICT competencies for English language teachers. Specific Teacher training needs. 3.- The N-@ble Initiative: traits and implementation. 4.- Conclusion. Results of the investigation will show that the use of a collaborative training environment together with other web-based training tools become key to enhance the quality of teacher training standards.

KEYWORDS

Web-based training, English Language Teachers, ICT Competencies.

1. INTRODUCTION

The educational use of ICT promotes a new culture of teaching and learning in which the pluralisation of learning spaces enables new open and flexible teaching and learning models to emerge. Interaction and collaboration play an outstanding role in the new technology-based settings and allow unlimited access to information in virtual environments. The World Wide Web fosters new means of communication and interaction both in real and asynchronous time and provides authentic material and resources that can be easily exploited. These transformations justify the need to include technology in the teaching and learning of a foreign language and requires at the same time a technology-literate teacher , familiar with the new teaching and learning scenarios eager to face the hardnesses of change. Teacher Training thus, becomes essential and key for the development of the Knowledge Society and -in a more restricted area- to reach success in the acceptance and implementation of ICT in the teaching of foreign languages. Many teachers have shown their willingness to defy difficulties and integrate ICT into their teaching procedures, although the use and deployment of ICT in foreign language teaching is far from being satisfactory. The main objective of this paper is that of offering an overview of the creation and implementation of a blended instructional program exclusively dedicated to English Language Teachers, in which collaboration and cooperation play an outstanding role. The main project, known as "The N-@ble Initiative", intends to use an instructional web-based tool in order to fill in the gap of the specific needs that digital age teachers require

and to contribute in an effective way to enhance quality standards in the practices of English Teaching using technology.

2. TRAINING IN DIGITAL ENVIRONMENTS

The traditional teaching and learning methods together with the most reccurrent means of communication have been substituted by other modalities that facilitate interaction and provide at the same time other communication strategies, basically due to two key factors: time and space flexibilization and pluralisation of learning spaces. The need to include ICT-based learning methodologies into teaching procesoes is determined by international organizations which claim for their usefulness. In 2001, the European Comission launched the E-Learning Initiative and Action Plan to promote the adaptation of the European Union´s education and training systems to the Knowledge Society, through the effective and relevant use of information and communication technologies and the Internet for learning. This action Plan defines E-learning as "the use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services a s well as remote exchanges and collaboration"[1]. Two of the main components of the action plan to promote the development of E-learning are teacher training and the establishment of cooperation and interconnection strategies among the members of the educational context. Another of the plan´s main points is the aim at engaging all the participants in training procsses in acknowledging the importance and potential of e-learning to develop a lifelong and life-wide learning.

3. ICT COMPETENCIES FOR ENGLISH LANGUAGE TEACHERS. SPECIFIC TRAINING NEEDS

The new role of the teacher is that of acting as guide and instrument in order to assure a comprehensive learning process via the Internet, managing the student´s learning process by creating - at the same time-new instructional models set in newly-created virtual environments. The teacher will have to develop skill related to the learning contexts that changes in teaching and learning paradigms require. It is crucial that they acquire instruction regarding the design and implementation on on-line courses, the orquestration of ICT/Web-based instructional processses and the development of management skills.

The European eLearning Summit manifests and develops proposals and recommendations to accelerate the program of innovation and implementation of the use of ICT in education. Among other proposals, the Summit´s fifth recommendation stresses the necessity to "Increase investment to continuous professional development of educators. Enhance their status. Help them develop an understanding of a pedagogy for e-Learning"[2]. The detailed and complete report elaborated by ICC suggests different proposals in order to maximise the benefits and minimise the disadvantages of integrating ICT . Among these proposals, we would like to put the emphasis on those which have certain relevance and are directly linked to the practical development of our project: creation of workshops to promote exchange of experiences among colleages, Teacher Training initiatives in order to "provide a principled, meaningful approach to the development and hardnessing of new literacies (mainly digital, critical and cultural) such as the creation of dedicated websites, Creation of platforms which offer links to providers and users of online language classes and learning materials, Development of new training modules whose contents should be updated and revisited periodically.

4. THE N-@BLE INITIATIVE: TRAITS AND IMPLEMENTATION

The " N-@ble Initiative" is an instructional proposal aimed at training English language teachers (Secondary and Higher Education) in ICT-based settings in order to help them to reach success in the acceptance and implementation of technology into their teaching practices and to achieve, at the same time, quality

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[1] COM (2001) 172 final, 28.3.2001 "The eLearning Action Plan – Designing Tomorrow´s Education"
[2] ICC (2002:53)

standards in the new teaching processes related to ICT. The initiative aims at promoting exchange of experiences among teachers via collaborative work, as well.

This initiative emerged to provide response to an increasing training demand by a collective of teachers of English as a second language belonging to both Primary and Secondary Education. From the School of Education of the Universitat Rovira i Virgili in Tarragona a pilot implementation of this training programme has been carried out from February 2004 to May 2004 upon 25 teachers of English as a foreign language, whose common trait was their eagerness to learn and acquire both pedagogical and technical ICT skills to be implemented in their classes. The whole course had a total length of 30 hours of blended training (40% online and 60% on-site training) .

The "N-@ble Initiative" seeks to accomplish the following main objectives:

4.1 General Objectives

- Analise the educational potencialities of ICT in the teaching of English as a foreign language
- Create a virtual instructional platform dedicated to teachers of English and facilitating tools, resources and strategies to integrate ICT and to encourage collaboration and cooperation among them via a collaborative environment.
- Analise the effectiveness of this instructional platform through its contribution to improve the quality of teaching English through the use of new technologies.

Among the specific objectives we stress the following : - Use of Blended Learning (Web-based Training and in-site training) as specific methodology to train foreign language teachers . - Define and classify those telematic tools and resources useful for the teaching of English as a foreign language and the inclusion of didactic strategies to contribute to its development. - Research on the latest trends in technology related to ELT. - Create elements of communication and cooperation to enhance collaboration and experience exchanges among teachers. - Facilitate to teachers an attractive means to familiarise with, which will enable future research in this context.

4.2 Methodology

The framework of research of this project is shaped within the context of the teaching of English as a foreign language through the use of ICT in Catalan Primary and Secondary Education -both compulsory and post-compulsory-. By means of combining research tools belonging to both qualitative (training platform, BSCW) and quantitative (survey) the main aim of this project is that of creating an appropriate instructional platform addressed to those teachers in order to contribute in an effective way to widely spread good practice not yet established but tremendously useful from the viewpoint of ICT implementation in teaching processes.

In order to provide teachers with specific training for the acquisition of ICT skill , the assessment model of this project includes two different instruments for data collection: a questionnaire passed both at the beginning of implementation and post-implementation, and the use of the collaborative environment BSCW. The questionnaire posed open and close questions related to the training needs of teachers of English as a foreign language and put special emphasis on both the technical and the pedagogical competencies. At the beginning of the teacher training programme teachers were given access to BSCW and to the web-based instructional platform, whose main aim is that offering online support and training during the course. Thus, the platform includes the following sections: Training modules, Communication, ICT tools and resources, multimedia and users.   The use of the collaborative environment employed on the programme enhanced the development of the ability to collaborate and co-operate by means of a process which involved experience sharing among other important factors.

The already mentioned assessment instruments were created to answer the following assessment needs: Design, development and implementation of the instructional platform, Creation of a learning community of teachers set in ICT-based environment, Detection of specific training needs of teachers of English in ICT-based settings, Analyse the effectiveness of the training modules created specifically for this course as well

as the whole of the collaborative and instructional tools and its contribution to enhance quality degrees in teacher training.

4. 3 Implementation

The different instruments were implemented from February to May 2004. Throughout his period teachers were introduced to basic notions on how to use a workshared space and received both technical and pedagogical instruction related to the use of ICT in the teaching of English as a foreign language. On the whole, teachers attended six on-site sessions with a length of three hours which took place weekly whereas the remaining hours (12) were devoted to online training. The different training modules were monographic and teachers were acquainted with aspects which ranged form the search for information in the Internet to a brief introduction on how to create electronic materials to be carried out in class. Special emphasis was put upon training those pedagogical aspects which would enable teachers to incorporate the mentioned tools and resources into their day-to-day classes, since that was their main concern. Thus, as a final activity of each on-site training they were required to develop some online research on the given topic and share it with the course members and the trainers, bearing in mind always the pedagogical part of it and the way in which a determined activity or resource could be exploited in class. The collaborative element provided extremely useful in order to assure communication and foster continuous feedback and help among the members who participated in the training course.

5. CONCLUSION

The collaborative learning model employed in this programme enhanced the development of the ability to collaborate and co-operate. By means of its reccurrent use we tried to promote active learning as key to enhance the quality of teacher training standards. During the process of implementation, instruction has been given in order that teachers acquire the necessary skills, competencies and tools to be able to manage at the time pedagogical requirements. Training appears as vital to ensure the correct acquisition of such pedagogical competencies. Results seem to show how this instructional programme is useful to train teachers with instructional needs related to the acquisition of ICT skills, fosters communication and collaboration among them and allows them to reach success in the acceptance and implementation of ICT into their everyday teaching practices. Promoted by a University Department, the design and implementation of the program is being carried out and developed throughout the academic year 2003-2004 among 25 English language teachers belonging to both Secondary and Primary Education levels. Results will show how this blended program is useful to train teachers with instructional needs related to the acquisition of ICT skills, fosters communication and collaboration among them and allows them to reach success in the acceptance and implementation of ICT into their everyday teaching practices. Furthermore, the positive results obtained account for a possible implementation of this program as a Formative Action Plan addressed to the whole community of teachers in the near future.

The assertion of the importance of the integration of ICT in the renewal of traditional teaching and learning systems, the use of WBT as an innovative method of distributing knowledge and instruction via web together with the use of telematic tools and resources based upon collaboration and cooperation for training teachers of English as a foreign language in the Catalan educational system (Secondary and Primary Education constituted the departing point of this project. Results of this investigation highlight that ongoing teacher training together with the creation of suitable instructional spaces, become fundamental to enable teachers to implement successfully ICT in their teaching and become -at the same time- essential to reach a high degree of quality in the near future teaching processes. At the same time, teachers should have to accept to radically change their traditional role in the teaching/learning processes and become instructed to be acquainted with the educational and pedagogical possibilities that ICT-rich learning environments require.

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COLLABORATIVE LEARNING IN VIRTUAL LABORATORIES

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ABSTRACT

The use of Information and Communication Technologies (ICT) has gained its prominence in the building of educational collaborative environments providing new ways of knowledge acquisition. With the aim of obtaining a system which fits with the educational purposes, it is necessary to join pedagogical and technical efforts.

In this paper we are going to deal with the design and implementation of a platform for supporting collaborative learning in virtual laboratories using tools such as whiteboard, chat, posting tools, modeling experiments, simulation tools and remote laboratories.

Regarding the design of this platform it is has been used J2EE technologies for supporting the asynchronous communication and Elvin notification servers to support the synchronous communication.

KEYWORDS

CSCL, Virtual Laboratories, J2EE, notification server.

1. INTRODUCTION

The use of Information and Communication Technologies (ICT) has gained its prominence in the educational field providing new ways of producing learning.

More concretely, our developments are focused on Computer Supported Collaborative Learning (CSCL) system in which the ground of the knowledge building is the user collaboration. Therefore the use of tools such as whiteboards, posting tools, chat and modeling collaborative tools play a vital role in the learning process.

In this paper we are going to deal with the development of a CSCL educational platform which will be one of the result of the European project COLAB "Collaborative Laboratories for Europe" (IST-2000-25035).What is more this system does not pretend to replace traditional education in fact it is shown as a system used to enrich the learning process encouraging students to learn Physics theories by collaborating using experiments. This environment does not pretend to be a Virtual Campus. On the contrary it will be used to enhance collaborative communication between users of the same group, allowing to store the results of their experiences as well as supporting their interaction in an online session.

This paper is structured as follow. In section 2 we are going to tackle the technical aspects of the development of this platform, the section 3 deals with the collaborative tools introduced in the system and section 4 show the conclusions and future work.

2. COLAB SYSTEM

2.1 Colab Architecture

This environment has been designed to offer different areas in which users can collaborate in order to coordinate the task (Meeting), to consolidate theoretical aspects (Theory room) or to run experiments (Laboratory room). In order to support asynchronous and synchronous communication we have designed the core of the platforms as follow.

With the aim of storing the information in the educational platform (including initial configuration files) the asynchronous part has been developed based on J2EE technology (Java 2 Enterprise Edition) using the JBOSS server in our development. The major benefits of using these technologies are:

- Its three layers design which allows the separation between the graphic interface, business methods and the database. Allow to develop portable code, so it can be run in any platform.
- This technology is based on well-known standards which help in the system configuration and management.

However, the use of this technology is not enough to solve synchronous collaboration between tools and users. Due to its high performance, efficiency and the good results in previous research, it has been selected the Elvin notification server as the core of the synchronous system. So it is responsible for managing the subscription events from tools, groups and theirs location. So the abstraction of a collaborative session will be built over this technology managing the relations between users, groups and collaborative areas.

The JBOSS server stores all the COLAB structure, including the visual tools, which allows the collaboration between users and experiments (simulators and remote laboratories), users information, relations of groups, buildings, floors and rooms, as well as sessions files.

In the figure 1 is shown the general schema of the COLAB architecture. So all clients will establish a connection with the J2EE server in order to be introduced in the COLAB structure as well as another one with the "Elvin Bus" to send and receive events to or from other clients or tools or experiments (sending events to start, stop the running of an experiment or receiving events with the results obtained in the experiment).
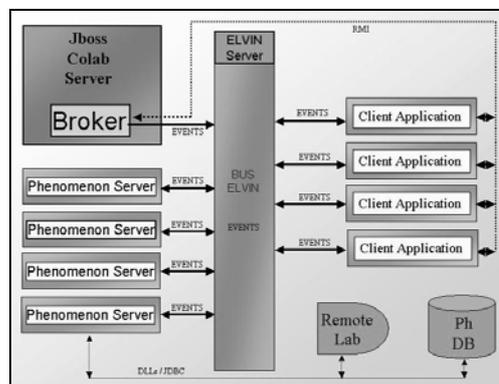
Figure 1. COLAB schema, reflecting the different elements like JBOSS, Elvin server, clients and Phenomena

In order to build a flexible and adaptable tools all of them are configured using XML files.

2.2 Synchronous Communication Features

Dealing with synchronous communication it is necessary to take into account the following features:

- Users in the same session manage the same information (Workspace Awareness)
- All the resources in the system has to be accessed in a coordinate way which implies concurrency policies.

- The user connection in the session will be possible at different points in the time. (Late Coming).
- All the users need to be conscious of the online users in their same session. (Presence Awareness)

To solve the first aspect all client tools are subscribed to receive some events inside a session depending on the kind of tool, so all the users in a session can view the same information.

About the second point, it has been introduced the term of "leader" inside each room, so the first user who enters in a room will be the responsible for directing the activity progress in this room. This role can change in the collaboration, therefore others users can ask for control of the session and the actual leader can give it to anyone of them or well ignore these requests. What is more, when the leader leave a room, there is an automatic leadership transfer to another user in the room.

Furthermore, it is necessary to define a mechanism to establish critical sections which should be executed by only one user in order to obtain a coherent control in the change of some parameters. This mechanism will allow to synchronize the use of some sections and it will be modeled using a Token implementation, represented in our system like an EntityBean with grab and release methods.

As in the traditional education, the collaboration is held with a reduced number of students in the group, so it is unusual to have more than five users in the system. Taking into account this fact and searching the less delay to send the actual status to the late coming users we have solved this issue supporting on the leader. Due to the fact that the leader will be the application with all the status of the collaboration, the leader will be the responsible for sending this information when he notices that a new user has come into the room.

To cover the Presence Awareness feature, the application shows the members list in the left, lighting the online users and showing their location in the session.

3. COLLABORATIVE TOOLS INSIDE THE SYSTEM

One of the basis which help in the collaborative knowledge building are the tools used by the group for sharing the knowledge of each participant. In this way the result from these interactions is the ground for the knowledge building process.

With the purpose of covering the previous aspect it has been implemented a Chat, a Whiteboard, a Process Coordinator which helps users to follow some goals added by teachers or by users in the same group and Model Editor which allows designing simulations introducing different kind of elements and configuring them with values or parameters according to the group decision.

There are others tools which help in the learning process and are the basis for the discussion and the knowledge building of the group, such as simulators visual tools, graph and table tools and html viewer, which give general concept to students for starting to work in the collaborative area.
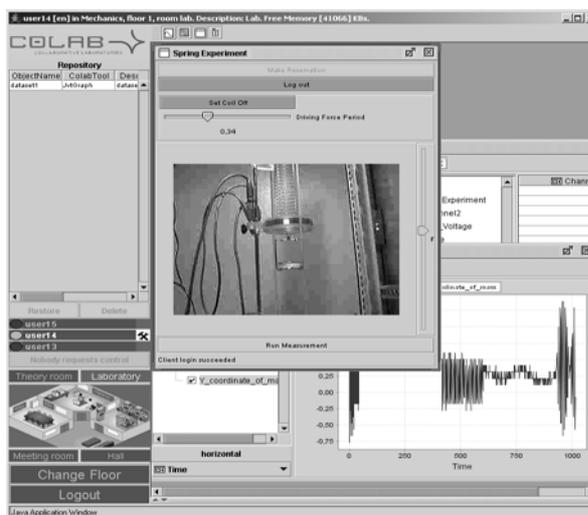

Figure 2. Colab application showing a remote laboratories and tables and graph tools with the result of the experiment

4. CONCLUSIONS AND FUTURE WORK

One of the result of the Colab project obtained at this moment has been this platform for the collaborative learning in the physics theories by using virtual laboratories. As it has been explained before, this platform offers different collaboration areas where users can share their experiences and build new concepts or models by using tools such as whiteboard, chat, process coordinator and model editors. Each collaborative area is designed by teachers according to the learning purpose of this area.

The development of this architecture has been based on application server architecture in which the integration of new tools could be performed easily using packed jars and following the J2EE specifications. In addition to support synchronous communication it has been used notification servers to receive and deliver the events in the system.

With the aim of encouraging students in the use of this platform it has been elaborated a intuitive interface which allow a friendly collaboration in the platform and in each one of the collaborative areas. In this way we pretend to encourage users to learn Physic by the use of this system. In the next months the pedagogical test will be held in different school from different countries.

In addition this system provides a way of catch and save important events from the collaboration in the system, and in this way teachers will be able to trace them.

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TOWARDS BEST PRACTICES IN CONTINUING EDUCATION AT THE IVPV – GHENT UNIVERSITY (BELGIUM)

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ABSTRACT

The Institute for Continuing Education at the Ghent University (IVPV) offers courses in the framework of Life Long Learning. Courses include exercises, homework and projects. Through examinations/projects a certificate issued by the Ghent University can be obtained.
Combining Life Long Learning with a full time job in an environment where accessibility to courses due to traffic congestion is severely hindered, posed a challenge to the IVPV. Since 5 years now, the search for best practices for offering course content is constantly continuously going on.
The success of the large scale inter-university IT1 course in 1998-2000, using live ISDN-videoconferencing, persuaded the IVPV to organize other courses taking into account the remarks of students and industrial partners.
Taking up current 'best practices', a renewed course framework was set up for a new IT course (IT2) based on streaming video lessons on CDs where participants were tightly kept into a study rhythm in order to avoid 'free lunch' behaviour, ("guided" streaming video courses). An in-house system for streaming video, with emphasis on animation and interaction, has been developed. In 2003, the IVPV started a new type of e-learning course based on IT2 but with maximum flexibility/freedom for participants ("free" streaming video courses). The search for best practices continues Some courses are therefore given through "blended learning".

KEYWORDS

Life Long Learning, e-learning, blended learning, best practices, streaming video

1. INTRODUCTION

The basic mission of the IVPV is to provide 'delta'-learning: i.e. to bridge the gap between the knowledge of employees in industry and young graduates, by providing courses on demand of the industry.

One of the early continuing education programmes, coordinated by the IVPV, was a large-scale programme in Information Technology (IT1), jointly presented by the 4 main Flemish universities (Ghent, Leuven, Brussels and Antwerp) from 1998 to 2000, using massive ISDN-videoconferencing at 384 kbps (6 ISDN channels) [1, 2]. The target of this programme was to train a new generation of IT-professionals by the year 2000. In twelve sites, for 417 hours, two times a week, 3 hours of interactive videoconferencing were set up in the evening, completed by 87 hours of hands-on exercises for 1145 participants in Flanders and abroad. IT1 can be seen as a first attempt of the IVPV to bring education by distant learning. The positive evaluation of the IT1course stimulated the IVPV to continuously search for best practices in offering education by distant learning.

2. SEARCH FOR BEST PRACTICES IN CONTINUING EDUCATION

2.1 Video-conferencing?

In the follow-up of the IT1 course, a scientifically based evaluation of the complete educational programme among the participants was carried out to gather information about the effects of the videoconferencing framework as such. More detailed data can be found in [4], but the main results were as follows:
- well known obstacles of videoconferencing remain: too static, little interaction, no 'classroom feeling',..
- limited quality of the image together with a good sound quality was not seen as a real problem;
- real-live animation of the videoconferencing (animated PowerPoint slides + mouse interaction) was considered as highly beneficial to enhance the learning behaviour;
- possibility of bridging time and space was seen as a main advantage;
- accompanying electronic discussion forum (Majordomo) was highly appreciated.
  All this resulted in an overall satisfaction degree of 79%.

Following those assessment results, a fundamental discussion took place with representatives from industry in Flanders in order to define the framework for the second issue of the programme (IT2, 2000-2001). The conclusion was that the main idea of the videoconferencing was all right, but that the necessity for people, working in industry under high pressure, to be lively present at fixed times was impracticable, and that a swing to more asynchronous learning was highly desirable.

2.2 "Guided" Streaming Video on CD?

The modified framework for the IT2 course was designed as follows:
- the lessons have been recorded digitally on CD or DVD in a "streaming video" format which:
    o keeps in any case the animation of the slides (building up slides / mouse movements);
    o enhances possibly the image quality (audio quality was satisfactory);
    o maximizes the amount of lectures per disc;
- the interactive electronic discussion lists have been extended with more features;
- a minimal live interaction with teachers / assistants was safeguarded;
- participants were tightly kept into a study rhythm in order to avoid 'free lunch' behaviour, therefore we speak about "*guided*" streaming video lessons.

In the Streaming Video framework, the lecturer prepares the lecture in PowerPoint, and cuts it into 'paragraphs' of 5 to 15 minutes. Animations (slide transitions…) are used, following some basic rules about fonts, picture sizes… The lecture is recorded in a multimedia studio, mouse/cursor movements are freely used to clarify the lecture. The 'paragraph' is captured from the computer output (vga…) together with an image of the lecturer's face, picked up by a professional video camera. The studio technician mixes the computer output with the teacher's image in real-time, resulting in one digital signal recorded onto a digital Dvcam tape.

An important aspect of this recording system is that – starting from slides used in old-style lectures – the extra workload is kept to a very strict and acceptable minimum. We postulated that the time spent for the preparation should not exceed the lectures time.

The IT2-course was composed of 5 modules with identical layout:
- preliminary videoconference for first contact with the lecturer and distribution of the relevant CD's
- 'home study': a number of weeks for asynchronous learning by the student;
- lab exercises on Saturdays at the university to perform guided hands-on training on PCs
- one live feedback session: where students could forward final questions / remarks to the professors;
- time for project work and final preparation time for the examination;
- the examination: written exams, PC-exercises, projects depending on the content of each module.

Table1. summary of the calculated course load of 34 weeks at 11 hrs/week

	Theory		Lab exercises	Feedback	Project / study	Total hours	Number of weeks
	Videoconf.	Home					
Hours	18	95	51	15	202	381	34 (11 hrs/week)

As in the IT1-course, the department of communication sciences of the Ghent University carried out an evaluation [5]. The inquiry dealt with all aspects of the course (including content and teaching skills of the lecturers). Only the results on the course format as such are presented below.

Table 2. summary of evaluation of CD supported education

(Legend: ++ Fully agree /+ Agree /0 Neutral/- Disagree/ -- Fully disagree)

Attitude towards CD supported education.	
This kind of education bridges distance as well as time. It's a solution for the mobility problem.	++
This kind of education gives me enough opportunities to ask questions in a direct and interactive way	+
This kind of education stimulates interactivity and contacts among the students of the course	0
This kind of education stimulates interactivity and contacts with the teachers	-
This kind of education implies a very isolated situation for the students of the course	0
The personal freedom as far as time management is concerned (following own rhythm to study, and choosing moments which fit you the most) is definitely a strong advantage of this kind of education	++
This kind of education is a weak substitute for the traditional way of 'live contact'-education	--
I would prefer a 'live teacher' to CD-supported education	-
The CD has no added value as compared to a videotape	--
One needs a high dose of self-discipline to finish a course given in a CD-supported way	+
CD supported education is only interesting when it goes together with a sufficient degree of and possibility to interactivity and asking questions (discussion fora, short term-answered e-mails)	++

The evaluation shows an overall satisfaction degree, which was also confirmed for the other aspects. The course format is an ideal way for people with a busy professional job: to bridge time and distance; to keep the liberty to follow his/her own rhythm and to determine his/her own study moments; to have interaction possibilities among each other and with the teachers.

Participants commented on some aspects as follows:
- although a rhythm has been imposed, one needs a good dose of self discipline;
- interactive exercises on the CDs would be desirable in future;
- although many contact moments were foreseen, there was some feeling of isolation, also because the step to go onto the discussion forum is too high for some people;
- freedom to study the CDs when and how you want, but you have to study them nevertheless…;

One respondent summarized: "*The advantage of personal time management and the solution for the mobility problem is more important then the lack of personal live contact with the teacher. There are still the lab sessions to communicate with experienced people*".

2.3."Free" Streaming Video Lessons on CD and Electronic Learning Platform?

In May 2003 the IVPV started a course "Environmental Management", based on the structure of IT2 but with more freedom for the participants. They can start at any moment and in min. 6 month to max. 3 years the certificate can be obtained. Contact days and exams are organised twice a year. There is an electronic learning platform on Internet for discussion and communication and for the compulsory exercises. Actualisation of content is performed on the learning platform. Because of this greater degree of freedom for participants and teachers we speak of "*free*" streaming video lessons.

The first evaluation results are positive but all students state they underestimated the workload and the necessary self-discipline.

In view of future courses, we screened the market for new commercial streaming video products. Communication specialists evaluated these products and our in-house streaming video system was pointed out as being the best one. Although the other products consume the available bandwidth economically and

provide a better image quality, they all used static images (e.g. jpeg encoded PowerPoint slides) as learning material. The animations and cursor movements, especially in technical courses (with many figures and schemes), is very important to catch the attention of the students. Recently we tested a commercial product (Screenwatch) that meets our needs and results in a better screen quality (less loss) and lower production cost.

2.4 Blended Learning?

Depending on the content, some courses require a more direct contact between teacher and students (ex. Classes where managerial aspects are discussed). We came to the conclusion that for some courses specific parts (with high technical content) can be offered through streaming video on CD or on the electronic learning platform, whereas other parts are better given in the classical way with direct interaction between teacher and student (blended learning). The practical exercises on PC are given in PC-classes at the university, mostly on Saturday. In all courses an electronic discussion board should be available.

3. CONCLUSION

At the IVPV, distant learning is part of a "larger" "learning" experience. In the search for best practices in continuing education, the IVPV tested and improved different methods for distant learning. Efforts were made to adapt the delivery system to best motivate and meet the needs of the participant, in terms of both content and preferred learning styles. E-learning, as major part of distant learning, makes use of a network for delivery, interaction, or facilitation. Even if the bandwidth is still far from ideal, E-learning provides a new set of tools that adds value to all the traditional teaching and learning experiences and processes.

Distant learning is not the magic bullet and it certainly is not a "*one size fits all*" approach and will never replace "live" group dynamics. The added value consists in the extra "personal" guidance of the students.

The objective is to reach a fully integrated, easily transferable and adaptable system that contains the complete cycle of an electronic learning process: registration, monitoring, coaching, evaluation, discussion forums, documents, workbooks, self-tests, referrals, streaming 'live' courses, contacts with the teachers, practice sessions, … i.e. an ideal environment for asynchronous learning within the framework of continuing education programmes.

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TRACKING FUNCTIONALITY CHANGES IN IRI: A DISTANCE EDUCATION SOFTWARE SYSTEM

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ABSTRACT

IRI-Easy is the current version of version of a synchronous distance learning system developed at Old Dominion University and used there for several years to teach a variety of classes. System functionality has evolved not only in response to rapid changes of computing and networking technologies but also due to our experiences in using the system to teach many university-level classes. Our purpose in this paper is to discuss changes in functionality due to our experiences in using the several versions that we have implemented. We describe functionality that we have omitted or modified significantly in newer versions and the reasons for those changes.

KEYWORDS

Distance education, distributed systems, multimedia, group collaboration

1. INTRODUCTION

For roughly ten years we have been using a system we developed for the delivery of synchronous university courses, Maly et al, 1993, originally called IRI (for Interactive Remote Instruction). Over time we have completely redesigned and re-implemented the system twice as our understanding improved and as the technologies on which the system relies changed. In this paper, we describe changes we have made over the years of use with a focus on these made in response to use of the system with real instructors and students in real classes. Section 2 gives a brief description of the system. Section 3 describes the changes we have made to the functionality of the software and section 4 provides a brief summary and conclusions.

2. BACKGROUND ON IRI

The IRI project started in 1993 and was first used to teach a semester-long for-credit university class in 1995, Maly, et al. 1995. With the experience obtained from actual classroom use and technology changes (cheaper and faster processors, storage, memory and networks), the functionality of the initial version has changed significantly in some aspects. In this paper, we discuss those changes and the reasons for them with particular emphasis on those based on use of the system. Fig. 1 provides an image of an IRI classroom in 1995 (a) and two screenshots from that system in (b) and (c). Fig. 2 contains images from the current version (now called IRI-Easy). While the images differ, they are quite similar in the basic functionality they provide for synchronous interactive instruction.

Fig. 1 provides several views of the 1995 IRI. At that time, the system consisted of several similarly equipped classrooms in different locations. Each location contained several multimedia workstations, one for each participant and these were connected by a 10Mb Ethernet connection. The goal of this system is to provide a "virtual distributed classroom" that allows instructors and students to interact much as they might if they were together in a real classroom. As can be seen in Fig. 1(a), each classroom consisted of several high-performance networked workstations, each with its own camera and microphone. Fig. 1(b) shows the use of several shared tools including a presentation tool with an pointer, an animation window and a regular UNIX

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command window (which anyone in the class could use to run software for classroom demonstrations). The four videos on the right show the instructor (top image), two class members and in the lower right, a room view of one of the IRI classrooms; this video switches among each of the IRI classrooms to give views of what is happening at each site. Fig. 1(c) shows use of the system in "presentation mode": the large central video image is an instructor using a whiteboard; the two video images on the right show two students participating in a class discussion as before. Feedback to a presenter is an important consideration; this image also shows a list of class participants with status information about the IRI software components running on each person's workstation. All class members share this same view of the virtual classroom.

a.
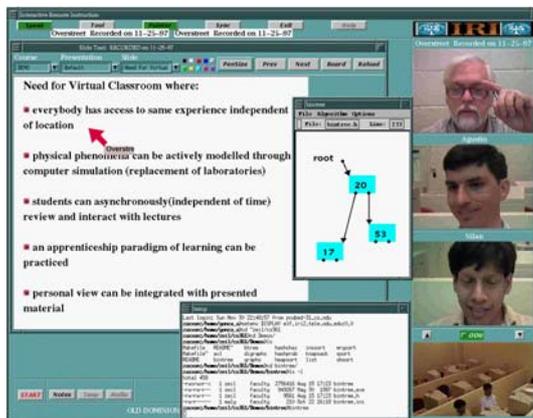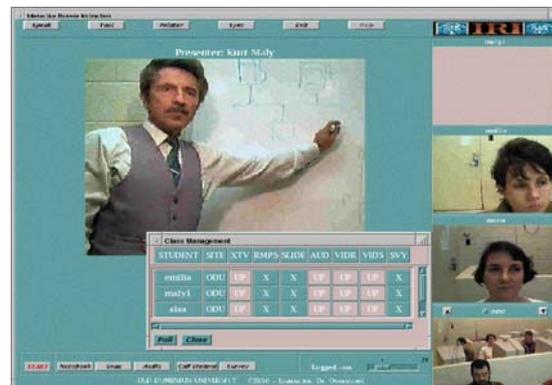
b.   c.

Figure 1. a) IRI classroom, 1995, consisting of Sun workstations with special video cards for large presenter's image. b. Screen shot from 1995 version of IRI showing use of shared tools and videos of class participants. c) Presenter using large video image, along with a class list, videos of two class members, and a site video of one IRI classroom

Rapid changes in technology for networked multimedia systems have lead to significant changes in implementation details of IRI. For example, in the original version, the large video image was analog carried on a separate bi-directional video link to/from each workstation and did not share the network used for software control and for the much smaller video images on the screen. The current version, IRI-Easy, is implemented completely in Java (rather than the C implementation of the original), uses inexpensive audio and video components and runs in both Windows and UNIX environments, and adjusts to different network bandwidths for different participants (by use of a Gateway), see Abdel-Hamid et al. 2001 and Maly et al. 2001 for a discussion of this system.

The older version of IRI required several configuration files that were used to facilitate starting several machines along with the video and audio servers required at each site. A configuration file was also used to download any files that the instructor planned to use during a session to a server at each classroom site. This made the system more responsive by reducing network traffic during actual class sessions. In contrast, IRI-Easy does not rely on these configuration files; sessions can be started with a couple of button clicks (if all defaults are acceptable) then people can join the session with a simple button click.

a.   b.

Figure 2. a. The IRI-Easy interface in discussion mode. b. The IRI-Easy interface sharing a tool and providing status information

Figure 2. shows the current version of IRI-Easy. The menus of the interface have changed, but much of the basic functionality is unchanged. In fig. 2(a), the presenter can be seen in the large video image along with two smaller student videos. In fig. 2(b), a shared presentation is partially covered by a list of participants along with status of the IRI-Easy software running on their machines. The system includes many features not discussed here.

3. FUNCTIONALITY ANALYSIS

Table 1 lists the basic functionalities that we believe are particularly useful for synchronous distributed instruction along with how these key capabilities are addressed by IRI-Easy.

Table 1. Analysis of IRI-Easy support of useful capabilities for classroom instruction

Desirable Characteristics	IRI-Easy Support
Present prepared material	Shared tools for slides, simulations, graphics, pointers, annotations Because of the tool sharing engine used, IRI-Easy may not perform well with rapidly changing presentation images
Presenter audio and video:	Presenter video; audio only if speaker not is same room Audience audio and video Multiple audience videos and audios, but no audio from other people in same room
Attendance records:	Not available
Audience list & location:	Participant list and locations
Autostart for large group:	If machine and participant list is provided, IRI-Easy can be started for all uses by a single user
Identification of speakers and questioners:	Names displayed on videos and pointers
Recorded sessions:	Available for replay during a regular class or privately outside of class
Notebooks:	Private on-line notes available after class
Feedback to presenters:	1. Video of remote classrooms 2. Instantly tabulated surveys & quizzes 3. Participant initiated direct feedback tool

Table 2 lists functionality that was present in some previous version of IRI-Easy but which was removed, along with a brief justification for its removal. Our primary use of IRI-Easy has been for teaching of for-

credit, semester-long, computer science classes to undergraduate and graduate students. Thus support for activities such as allowing class members to spontaneously examine, modify, compile and execute software is particularly useful, while the playing videos seemed much less important. Clearly, use of IRI-Easy for other audiences would likely change some of these decisions.

Table 2. Functionalities significantly modified from older versions of IRI-Easy and reasons

Functionality Description	Reason for Change
Participant clicked hand icon for attention; instructor then could respond by turning on that student's audio and video	Inhibited classroom discussion; better controlled verbally by instructor
Instructor controlled all student audio & video	Delayed interactive exchange; better controlled verbally than electronically; made quick relevant student comments difficult
Instructor had to explicitly give control of a shared tool to a student	Slows down change of control; quicker and more natural to tell a particular student to take control with audio channel.
Machine Lists, Room Configurations	Earlier versions used in established classrooms; these facilitated automatic start-up. Now participating machine not dedicated.
Participation Lists	Inhibited spontaneous use of different groups

4. LESSONS LEARNED

Due to excessive instructor control, our initial versions of IRI inhibited free-flowing discussions or even short useful comments from students during presentations. We found that since students are familiar with norms of classroom social interaction, they respond well to familiar classroom management techniques for participating in and contributing to discussions. We realize that in some situations, the ability of any participant to interject comments freely or to take control of a shared tool at will may not be appropriate. We also learned that students are resourceful in using the system. For example, IRI-Easy only supports four simultaneous video streams; when many students want to talk, they often "queue up" by starting their video while someone else is talking, thereby letting other class members know they wish to contribute while still waiting their turn to speak. As social creatures we are used to participating in groups; it is desirable for a system to provide us many of the clues we are used to

Other fundamental functionality changes resulting for the change in costs of computing equipment and networks: as these components dropped in price, specially equipped machines provided by the university or other organization are no longer needed. Thus the special configuration files are not as useful as earlier.

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INSTRUCTIONAL METHODOLOGY FOR E-LEARNING CONTENT DEVELOPMENT

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ABSTRACT

Some of the most important requirements to be taken into account when implementing an e-learning system are the teaching principles in the learning process within this new technological environment. However, this aspect is often overlooked when implementing technological learning models or learning management systems. Web-based e-learning education research mainly focuses on the inclusion of new technological features. This paper proposes a new instructional development methodology based on the latest research into pedagogical techniques for teaching or instructing in e-learning environments. It also defines a blended approach to the learning process. The proposed instructional model is supported by learning objects, a concept inherited from the object-oriented paradigm that is widely employed to implement recent technological e-learning processes.

KEYWORDS

E-learning, learning objects, psychopedagogy, instructional model, blended learning.

1. INTRODUCTION

The conventional education system has focused on transmitting the knowledge from the teacher to the students. However, it has paid less attention to the other aspect of education, namely, *learning*. Learning implies decision making on the basis of experience, which elevates "doing" as a basis for achieving an effective understanding of the knowledge (Pazos *et al*, 2002).

The learning process is optimum when it is assisted and personalised (Gell-Man, 1996). Computers are the potential saviours of the education system, because they can be used to personalise learning. They can design our learning according to our knowledge and needs, record the progress we make and tell us if any thought process is wrong so it can be corrected (Ismail, 2002). With the development of the Internet, computerised learning, known as *e-learning,* has attracted the attention of educators. E-learning is defined as "the use of network technologies to create, deliver, and facilitate learning, anytime and anywhere." (Line Zine, 2000).

E-learning is another way of teaching and learning. It is a recent phenomenon, which has not yet incorporated the pedagogical principles of teaching (Govindasamy, 2002). There is a serious dysfunction between the profusion of technological features that are put forward and the shortage or non-existence of teaching principles for e-learning (Weisburg, 2001). There are no guidelines for analysing, designing, developing, supplying and managing e-learning materials pedagogically. Evidently, e-learning cannot continue without pedagogical techniques, and these should, if possible, be aimed at personalised teaching, which, as mentioned above, is the best. Psychopedagogical principles are theories that govern good educational practice, and, as far as e-learning is concerned, good educational or instructional practice is represented by the instructional technology.

Orthogonally to this instructional view is the learner's perspective, in the sense of how the learning should take place to optimally acquire the knowledge. A series of specialists in the subject advocate a blended learning solution (Davies, 2003). Blended learning is used to describe learning that mixes various event-based activities: self-paced learning, live e-learning and face-to-face classrooms. *Self-paced learning* is

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what the learner does by executing the e-learning process. Self-paced activities can be taken at the learner's leisure; that is, can be taken anytime and anywhere.

In this paper, we outline an instructional e-learning methodology, whose goal is to achieve assisted and personalised teaching, adopting a blended approach to the learning process. The model includes prescriptions and methods borrowed from different fields of knowledge. For the design and implementation of the educational contents, we have used multimedia principles based on the content performance matrix (Merrill, 1997), derived from the latest research on information processing psychology within the field of cognitive psychology (Clark, 2003). Accordingly, the targeted learning objectives are linked with the underlying contents, knowledge and skills, employing a structure that depends on their class: facts, concepts, processes, procedures and principles.

2. LEARNING AND LEVELS OF KNOWLEDGE

It is not enough to understand and learn a subject. When a subject has been learned, it should be used, practised and tuned until it is used effortlessly. Learning does not stop at comprehension; the underlying fundaments need to be completely automated. These are the reasons why learning is not a single activity. It includes at least three different stages: accretion, restructuring and tuning (Rumelhart and Norman, 1978). *Accretion* is the insertion of knowledge into established structures. *Restructuring* is the formation of new conceptual structures suited to the knowledge. *Tuning* involves making this knowledge efficient, that is, progressing from the unsure and anxious state of the learner to the serene and experienced skill of the expert.

During learning, learners acquire levels of knowledge, which Bloom defined within a taxonomy of educational objectives that are still widely accepted today: knowledge, comprehension, application, analysis, synthesis and evaluation (Bloom, 1956). These objectives describe several knowledge levels, intellectual capabilities and skills that a learner can achieve through learning and which, briefly, are:

- *Syntactic level.* Where the learner acquires the *knowledge and understands* its fundaments and the underlying reasoning processes.
- *Semantic level.* Learners are able to successfully tackle *analysis and synthesis* processes in new or complex situations. They have the ability to decide what method, knowledge and instruments to use in each case.
- *Pragmatic level.* Learners are able to *apply* the knowledge acquired and to *evaluate* the methods, processes and tools to be used. They can judge both qualitatively and quantitatively.

3. E-LEARNING INSTRUCTIONAL APPROACH

The proposed instructional approach is based on the fact that the training should enable learners to *apply* the concepts learned at their workplace and *evaluate* the results. That is, it should provide the *pragmatic level* and the practical tools for the learners to be able to put into practice what they have learned. This approach establishes a systematic instructional methodology, which assures that the e-learning content development and evaluation processes meet certain stipulated standards.

The instructional methodology is based on the systematic development of instruction and learning and is composed of six phases: analysis, design, development, execution, evaluation and review. Table 1 summarizes, for each phase, its purpose and deliverables.

1. *Analysis*: This phase defines *what* to teach. The learner and the educational contents to be taught are analysed. Its purpose is to detect the learner's learning characteristics and needs, and ascertain the environment in which the learning is to take place and the available resources. It outputs three documents:
   - *Learner profile*, defines personal, social and specific characteristics of learners.
   - *Learning objectives*, which define the primary and secondary objectives, as well as their hierarchical structure.
   - *Educational contents*, which defines the knowledge and skills to be learned and the tasks to be developed to acquire this knowledge.

Table 1. Methodology for e-learning content development

Phase	Purpose	Deliverables
Analysis	Defines what to teach. Identifies learner's learning needs and characteristics. Establishes the learning environment. Available resources.	Learner profile Learning objectives Educational contents
Design	Defines how to teach to achieve instructional objectives. Specifies the learner's learning process. Defines the level of detail and depth of content. Selects instructional and media elements. Standards to be used. Execution criteria. Achievement expected of the learner.	Theoretical self-paced learning process
Development	Defines the practical learning process Sorts events sequence and selects learning tools. Constructs (implements) the learning process.	Practical self-paced learning process E-course
Execution	Learner runs instructional learning process.	Learner log
Evaluation	Gathers information from learner log and analyses it.	List of amendments
Review	Refines and improves the learning process.	Modifications in analysis, design, development and / or implementation.

2. *Design*: This phase defines *how* to teach. It specifies the learner's learning process, defining the learning approach, the structure and granularity of the information to be delivered (facts, concepts, processes, procedures and principles), standards to be used, execution criteria and achievement expected of the learner. The content to be learned is structured by means of *learning objects*. More complex structures —*e-lessons* and the *e-course*— will be formed from the learning objects in the subsequent phases.
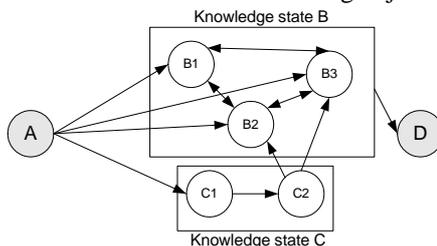
Figure 1. Road map of a learning process

The presentation of information depends on the type of contents to be taught and should differ depending on whether the aim is to teach facts, concepts, procedures or principles. The method includes setting activities and exercises to evaluate the knowledge acquired. This phase outputs the *Theoretical Self-Paced Learning Process*, which describes the process of learning the educational contents by means of a structured presentation of the information, using an information diagram or *road map*. The road map is the set of Hamiltonian paths that go from the initial state to the goal state of a connected, directed acyclical graph, whose nodes represent the *learning objects*.

Figure 1 shows the road map for acquiring four knowledge states: A, B, C and D. The arrows indicate the possible alternative educational processes that can be implemented to reach the knowledge state D. For example, B1, B2 and B3 can all be accessed from A. The arrows start from either a road map node or a rectangle that groups several nodes (a knowledge state). In the second case, the arrows indicate that all the nodes grouped in the rectangle have to have been correctly completed before accessing the next node. This applies, for example, for accessing D, where B1, B2 and B3 all have to be completed.

3. *Development*: This phase describes the real learning process, including the tools that are to be used to teach. The materials, strategies, event sequences and necessary resources are prepared. This phase involves building the software of the e-learning process using an authoring tool, and its location in a LMS (learning management system) platform.

This phase outputs the *Practical Self-Paced Learning Process*, which includes a *learning tree* containing the structure and contents (learning objects) of each e-lesson. The learning tree is built by selecting the best of all the possible Hamiltonian paths for reaching the target knowledge state set out in the road map. Figure 2 shows the route selected within the roadmap illustrated in Figure 1. Each node (learning object) reflected in the road map matches a section of an e-lesson. A series of exercises or activities, defined as tasks in the knowledge graph, would be added to build the learning tree from Figure 1.
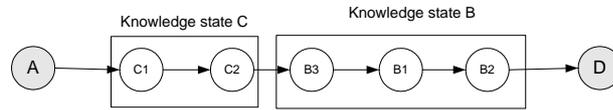

Figure 2. Selected route from the road map

4. *Execution*: This phase involves the learner using the learning process. This execution provides information on the problems encountered and the knowledge acquired. This phase outputs information that is stored in the learner log. Table 2 shows a log of a learner who started the course on 15 January, studied for a total of 3 hours 23 minutes, completed four tasks, attained an average grade so far of 55 and is now working on the fifth task (B1).

Table 2. Learner log

Learning object	Start Date	Time to study	Qualification out of 100	Progress
A	15/01/04	0 h. 53 min.	80	Finished
C1	20/01/04	0 h. 42 min.	**40**	**Not passed**
C2	23/01/04	0 h. 38 min.	**30**	**Not passed**
B3	27/01/04	0 h. 45 min.	70	Finished
B1	31/01/04	0 h. 25 min.		Learning
B2				Not started

5. *Evaluation*: Information stored in the learner log is gathered, and the results are analysed on the basis of the learning objectives. Analysing the learner log shown in Table 2, we find that the learner received a good grade for learning A. Then, he got two poor grades and, again, another good grade. This can occur when the route selected in the road map for reaching the target knowledge state is not optimum. The self-adapting learning system detects such situations and dynamically (during execution) generates *amendments* to modify the contents tree of the e-course, so that students can redo the tasks they failed and gives a different view of the contents to be learned to assure that they get good grades in all the sections of which the e-course is composed. The log can be also used for monitoring purposes to determine successes and ascertain the learning product quality

6. *Review*: This serves to refine the learning process by analysing the results of the evaluation. Any instructional model phases can undergo review. Modifications can be made to analysis, design, development and / or implementatrion.

E-learning content must be designed and developed in smaller manageable items known as learning objects. Our instructional approach employs the learning object as the minimum self-contained unit of instruction. Learning objects can be stored and have shareability and reusability properties. The proposed instructional methodology embeds learning objects within large structures of content: the *e-lesson*.

An e-lesson is composed of a set of facts, concepts, processes, procedures and principles that can be learned on the basis of the current knowledge of the learner. The e-lesson is divided into six sections:

- *Presentation:* describes (in an introductory manner) the subject that will be dealt with. It is responsible for motivating and providing guidance to learners about the knowledge they are to acquire.
- *Objectives:* indicate what the result of the learning will be, briefly describing the tasks that learners will be able to perform.
- *Necessary knowledge:* provides the information and instructions associated with the steps required to perform the task to be learned in the e-lesson.
- *Learning tasks:* teach the skills and tasks to be learned.
- *Practice:* consolidates what was taught by putting it into practice on a real case.

- *Conclusion:* reinforces and recalls the key points learned throughout the e-lesson. Its objective is to focus the learners' attention and get them to think about whether or not they have achieved the proposed objectives with regard to certain key issues.

These six sections of which an e-lesson is composed within the instructional model are divided into two categories: *content sections* and *context sections*. The content sections are composed of the necessary knowledge and tasks to be learned, which make up the body of the e-lesson. The presentation, objectives, practice and conclusion are context sections, which serve to provide the learner with guidance about the content of the e-lesson.

An e-course is a set of e-lessons that take the learner through to achieve the learning objectives defined in the analysis phase. This structure provides a consistent framework that covers the needs of the instructional method for learning.

4. BLENDED LEARNING

As mentioned in the introduction, blended learning is used to describe learning that mixes various event-based activities: self-paced learning, live e-learning and face-to-face classrooms. An efficient blended learning solution includes a mixture of the three learning types with the following ingredients:

1. An instructor that directs learning.
2. Email and telephone assistance for personalised learner support.
3. Virtual classes by means of computerised videoconference, in which the instructor explains specific learning subjects to the group and learners raise questions.
4. Interaction between learners and the instructor and between the learners themselves through the chat to stimulate group learning.
5. Support and query line for subjects related to learning management (enrolment, LMS platform problems).
6. Assessment examinations, certificate and diploma that certifies having taken or passed the course.

Table 3. Blended learning employed to train computer specialists

Phase	Who take the actions?	Activities
Course definition	Instructor	Defines what to teach.
		Selects learning objectives and educational contents.
Self-paced learning	Learner	Enrols for the course.
		Fills in a form stating previous knowledge skills.
	Instructor	Supervises the automatically built learning process:
		• Specific e-lessons tree is generated for the learner.
		• Contents already known by learner will be appendixed.
Course execution	Instructor and learners	The course kicks off with a one-day face-to-face class.
		Two one-hour chat interactions are informally held per week.
		Two planned and structured videoconferences are broadcast.
		Permanent email support, answered within 24 hours.
		Telephone support for one hour a day.
		Face-to-face assessment examination is set for all learners.
		A diploma is issued to accredit having passed the course.
Review	Instructor	Depending on knowledge acquired and objectives achieved:
		• E-lessons tree is modified during course execution.
		Care must be taken not to destabilise the learning process.

These learning instruments are combined differently depending on whether the personalised teaching targets a group or an individual. In personalised group teaching, a *self-paced learning process* is created for each learner applying the learning instruments described above and taking into account the core objectives of the course. If the group does not have computerised videoconference support, activity 3 is dropped and activities 2 and 4 are reinforced. In individual personalised learning, a *self-paced learning* process is created for the learner, and the learner executes the process following the instructor's instructions. The interaction

takes place through activities 2 and 4. Activity 6 depends on whether or not a certificate or diploma needs to be issued.

From our experience, we can establish that a blended learning process as described in Table 3 is very adequate for an eight-week course of 20 teaching hours. Note from phase 2 in Table 3 (self-paced learning) that, although all the learners have the same course documentation, their instructional method is different.

We have been training Spanish central and local administration computing specialists for over 10 years through the Master in Information and Communications Technologies Management, where first we applied classroom learning, which was later combined with live e-learning. We have recently implemented self-paced learning with a blended learning process to train this personnel (Alonso *et al*., 2001, 2002, 2003).

5. CONCLUSION

This paper presents the pedagogical foundations and an instructional model for successfully managing and implementing e-learning content. E-learning implementation will be unsuccessful if it is concerned exclusively with e-content logistics and delivery technology and overlooks the underlying pedagogical principles. It will result in resistance to change: learners staying away from e-courses, poor performance of learners and poor quality of content.

The instructional methodology proposed here is based on seven phases that enable learners to apply concepts and evaluate results. It presents pedagogical principles and theories for good teaching practice using the new technologies that the Internet offers. Each of the phases generates deliverables that can keep track of e-content development, detect deviations from the initial established learning objectives during the learning process and apply amendments to any of the phases to correct them.

Our experience over several years has backed the hypothesis that the most efficient teaching model is a blended approach, which combines self-paced learning, live e-learning and face-to-face classroom learning.

At the moment, we are working on the development of a technology model to construct a learning management system that has fully integrated pedagogy, not just innovative technological features. This model is a perfect match for the instructional approach presented in this paper and also makes an attempt to solve the problem of generating dynamically adapted e-courses to specific learners.

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NIGARI SYSTEM – STAIRWAY TO JAVA

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ABSTRACT

We design a language named "Nigari" with its environment "Nigari System" for beginners in programming. It is designed to encourage learners to continue their learning of programming, which is necessary in some way for everyone in e-Society. Nigari is simple in syntax and borrows most of it from Java. Nigari System is an integrated environment with automatic visualization and ease of use. The experiment in a university course shows that most students approve the visualization features, and some students also support the simplicity of the language.

KEYWORDS

Programming Learning, Educational System, Course Design, Programming Language, Programming Environment, Program Visualization.

1. INTRODUCTION

Programming is one of the significant base technologies of computing. Everyone in e-Society should learn programming in some way. Learning programming brings profit: good comprehension of principles of computing to participate in e-Society, and ability to script something actually to make e-Life better.

Programming is hard to learn in its nature. Many tend to drop out, because their lessons look dull and strict in trivial details and they lose their will to learn.

We have developed a language named "Nigari" with its environment "Nigari System"[1] for beginners in programming. It is designed for university freshman classes to encourage students to learn programming and proceed to practical programming in Java in advanced classes. It would also help learners who study programming by themselves, since Nigari System is sure to let its users find "programming is fun."

Nigari is **a language easy to start up and step up:** In Nigari, a program is, in most cases, a sequence of executable statements. Neither class declarations nor method declarations are necessary to write. Students can understand everything down to concrete language elements of their programs even in the first class, and teachers can explain everything in detail to students without any "spells" kind of stuff. Despite its simplicity, the language Nigari has **affinities with widely used languages:** Nigari borrows its syntax mostly from Java, and students getting accustomed to programming language essentials in Nigari can easily proceed to Java language without difficulties.

Nigari System is **an environment that produces attractive outputs:** Nigari System produces animated graphics by reflecting internal state of a program. No special statements for drawing graphics are needed in programs. This feature does not only encourage and motivate students for learning but also supports l**earning fundamentals of OO:** objects are the natural units of existence that have their own states and are controlled by "associated" programs. In Nigari, these states and their changes can be well observed through animated outputs.

2. NIGARI IN SHORT

We introduce you to Nigari System, the programming environment, and then to Nigari, the language itself, through examples.

2.1 Nigari System

Nigari System behaves in two phases: the design phase and the execution phase. In the **design phase**, students can locate graphical objects on the screen and write programs to be associated with them. In the **execution phase**, Nigari System runs programs and displays objects associated with them. Students can turn Nigari System into either phase by clicking specific buttons.

You see a typical snapshot of Nigari System in Figure 1.

The main window is where objects show themselves. In the design phase, objects are created and placed in this window by the user to set up the initial state of execution. Each object is associated with its program, or its class, on its creation time. In the execution phase, objects are moving around on the main window according to their program's state. Values of the variables, among others, x and y of an object determine where the object appears in the window and p determines its graphical figure.

Figure 1. Screenshot of Nigari System

The editor window opens when an object is double-clicked in the design phase. It shows the program that the object is associated with and lets it be edited by the user.

The inspector window displays values of the object variables of selected object. Objects can be selected by single-clicking on the main window. Displayed values are automatically updated according to the state of that object even in the execution phase.

2.2 Nigari, the Language

We present 5 example programs. You could grasp the all of Nigari with them and see how simple but powerful Nigari is.

```
while(x<300) {
  x=x+5;
  wait(10);
}
```

Figure 2. Moving to the right

2.2.1 Simple to Write a Program to See the Result

Figure 2 shows a simple program that makes the object run to the right and then stop. Remember that the value of x determines the x-coordinate of the object in the main window. The method `wait(n)` is predefined in Nigari to wait for roughly n milliseconds.

You see that the basic syntax of Nigari is similar to that of Java. But it is much simpler. Neither variable declarations nor class and method declarations are necessary.

2.2.2 Predefined Methods

Figure 3 shows another simple program that makes the object track the mouse in x-direction. Nigari provides several predefined methods, such as `getMouseX()` that returns the x-coordinate of the current mouse position.

```
while(true){
  if(x<getMouseX()) x=x+1;
  if(x>getMouseX()) x=x-1;
  wait(10);
}
```

Figure 3. Tracking the mouse in x-direction

Other predefined methods are shown in Figure 4. Students can retrieve information of mouse and key without notions of event handling.

2.2.3 Referring to another Object and its Variables

Figure 5 shows a program of an object that tracks another object horizontally.

```
getMouseX/getMouseY: Retrieve mouse position
getKey: Retrieves key and mouse button state
wait: suspends execution and draw the object
die: erases the object and stop its execution
drawString/drawLine/drawRect/fillRect/fillOval:
 Draw or paint graphics on Main Window
sin/cos/sqrt/rnd/abs: Mathematical functions
array: creates an array object
```

Figure 4. Predefined methods

You shall create two objects, one at the center of the bottom edge (named $player) and another at the center of the top edge in the main window (named $ball) and associate the object $ball with the program in Figure 5.

Figure 5 illustrates that an object can be referred to by its name and any variable of the object can be referred to with appending that variable name preceded by a period. This way of reference is called **indirect reference**. "$player.x" in the program, as an example, refers to the *x*-coordinate of the object $player.

A variable having a name headed by a "$" is a **global variable**, which is common to all the objects, and accessible from any program without declaration. A variable without a "$" is an **object variable**, which belongs to one specific object.

```
while (y<180) {
  if (x>$player.x) x=x-1;
  if (x<$player.x) x=x+1;
  y=y+1;
  wait(10);
}
```

Figure 5. Falling onto another object

```
while(true) {
  if (x>$player.x) x=x-1;
  if (x<$player.x) x=x+1;
  y=y+1;
  if (diff(x,$player.x)<20
  && diff(y,$player.y)<20) {
    die();
  }
  wait(10);
}
function diff(a,b) {
  var c=a-b;
  if (c>0) return c;
  return -c;
}
```

Figure 6. Disappearing when collides

2.2.4 Defining a Function

Figure 6 shows a program for the $ball, that disappears when collides to $player.

Figure 6 illustrates how we may use a user-defined function in a program. Note that the program uses a predefined method die() to make the object kill itself to disappear from the window.

The function diff receives caller's arguments into **dummy arguments** a and b. They are local to the function diff and can be referred to only in it.

A function may have its own **local variables**, the variable c is declared as a local variable in the function diff. Any function can be called from another object by referring to the function with indirect reference.

There are four kinds of variables in Nigari: object variables, global variables, local variables and dummy arguments.

2.2.5 Creating an Object Dynamically

An object can be created dynamically in a program. An object shall be of a specific class, which, at least, specifies the behavior of that object. In Nigari System, a class is a file containing the program for objects of that class. A class is given a name when an object of that class is created in the design phase.

```
while (true) {
  if(getKey(1)==1){
    t=new Ball();
    t.x=$Player.x;
    t.y=0; t.p=1;
  }
  wait(10);
}
```

Figure 7. Creating an object

Figure 7 shows a program of a persistent object that creates a new Ball object every time when the mouse button is clicked. An object will appear and fall down onto the $player just like the $ball, provided that Ball is the class name of the $ball.

As you see in Figure 7 "t" is an object variable and assigned to the created object. A variable in Nigari is type-free and any value or object is assignable to it.

3. EXPERIMENT

We applied Nigari System to a university course.

3.1 Overview of the Course

Figure 8 shows overview of the course. The learning objective of the course is to acquire fundamentals of programming by using Java.

- Course: Programming A
- Students: Freshmen of the Department of Computer Science, Waseda University.
- Terms, Times of Lessons: April 14 to July 7, 2003. 12 Lessons.
- Class hour for one lesson: 2 units (about 3 hours)
- Number of students: 240 approx.
- Classrooms: 3 classrooms. Each classroom, its size is about 80

Figure 8. Course overview

Students were divided into three classrooms randomly regardless of their knowledge or ability of programming. Each Classroom was managed by a teacher with help of several teaching assistants.

Students brought their notebook PC to their classroom to write and run programs. Network connections are available on any desk in the classrooms.

Each teacher taught by his own way with the textbook *Java gengo programming lesson jyou* (Java Language Programming Lesson 1)[7] common to all classrooms.

There were two examinations for each classroom: one is common to all classrooms, the other is specific to each classroom. The common one took place with our own Web-based answering system.

4/14,4/21,4/28 Preparations
5/12 Variables / while statements
5/19 while statements (Cnt'd) / if statements
5/26 if statements (Cnt'd)/Mouse cursor detections
6/02 Referring other object / Multithreading
6/09 Methods / Dynamic Object Instantiation
(Starts to use Java In 6/16)
6/16 Java Overview/Variable declaration/Data types
6/23 Control structures /Methods /Strings
6/30 Arrays / Command-line arguments/ Sorting
7/07 Sorting (Cnt'd) / Input
7/14 Examination for classroom 1

Figure 9. Lessons for classroom 1

3.2 Procedure of Experiment

Nigari System was used as materials in classroom 1. It was not used in other classrooms (classroom 2 and 3). Figure 9 shows details of lessons in classroom 1. Nigari System was used from April 28 to June 9. In June 16, Java was introduced to the classroom. Figure 10 shows some example of practices in the lessons.

3.3 Questionnaires and Results

We investigated students' skills or opinions by Web-based questionnaires.

3.3.1 The Advantages/Disadvantages of the Class Applied Nigari

In July 7, we performed final questionnaire asking students' total opinions for this classroom. The opinions and the number of each opinion are shown in Figure 11.

Q1 is the question for answering their opinions in free styles. Some students stated favor for Nigari System: "Program visualization is interesting, easy to understand." "Easy to use for beginners" and "It supports understanding OO paradigm or multithreading", etc.

On the other hand, some said, "Nigari wasted my time to learn Java". This opinion was especially from those who had been experienced programming before this class, according to the questionnaires at the first lesson of the class. And others wondered about using Nigari because Nigari doesn't support some features like arrays (in fact, Nigari supports array data type, but no visualization feature for arrays, we taught the concepts of arrays only in Java, but not in Nigari) or input from console or files.

Figure 10. Practices

3.3.2 Whether We should use Nigari on Java Lesson

Q2 in Figure 11 shows the result of the question asking whether Nigari had supported their learning of Java. More than half of the students answered Yes for this, and about 15% answered that Nigari disturbed their learning of Java.

The questionnaire proved that most students approved Nigari, but some students opposed to using Nigari. The main reasons were that Nigari has some Nigari-specific rules especially for method declarations, which make confusions with Java.

4. FUTURE WORKS

4.1 System Improvement

The experiment has shown following effectiveness of Nigari:

- **The language Nigari, with simple language specification, makes programming learning easy.**
- **Nigari System fascinates the learner with the visualization feature.**
- **Nigari System supports learning basic concepts of Java, especially variables, control structures and OO paradigms. Those concepts can be applied also after students shift to Java.**

On the other hand, some problems found on Nigari:

- **For those who are eager to learn Java, Nigari robbed them of their time to learn Java.**

   This problem is especially for skilled students, who are already learned programming before the class. One of the good solutions is dividing classrooms by skill and using Nigari only in novice students' classrooms.

- **Language specification is different especially in class or method declarations. These differences may confuse students.**

   Some students felt that Java is too complicated compared with Nigari. To bridge the gap between Java and Nigari, we are now developing some features that auto-generates Java programs by just writing small segments of programs.

- **Visualization feature is still poor, especially in showing sophisticated data types like arrays and object references.**

   At the time of the experiment, Nigari already supported array data types, but no visualization feature was prepared. Now we have already developed new visualize features: showing all elements of arrays by texts or bar graph, drawing arrows that represent reference between two objects. The visualized objects are shown in Figure 12.

- **When the lesson shifts to Java, all programs have to be text-based, no graphics can be used.**

   As stated in Section 1, handling graphics in Java is too complicated to novice students. In the lesson, we could not help using boring text-based programs as examples in Java. We are now developing visualization feature on Java, which has almost same look-and-feels with that of Nigari.

4.2 Application to Earlier Stage of Education

After the experiment, we had a chance to apply Nigari System to junior high school students in the exhibition of the university. We taught them essence of programming through making simple game with Nigari System. Most students had no trouble with operating environment and understanding programs. It implies Nigari System can be applied to younger students than university students. We are planning to introduce Nigari System to lessons in junior high school or high school.

5. RELATED WORKS

There are some prior researches about language environments for programming education. We note some of them in comparison to Nigari.

Squeak[2] is the environment in which students can draw pictures and make them move by programming by drag-and-drop operations. But it is difficult to apply the skills obtained from Squeak to practical

Q1: Write your free opinions for this Class	
Opinions for Nigari	21
Opinions against Nigari	11
Opinions for Nigari (Details):	
Easy to use	7
Fascinating visualization	7
Supports understanding of OO paradigm	2
Others	5
Opinions against Nigari (Details):	
Introduce Java earlier	6
Nigari lacks some features that Java has.	3
Too different from Java	1
Too simple	1

Q2: Did Nigari support understandings of Java?	
Yes, it supported	45
It had no influence with Java	27
It disturbed learning Java	13

Figure 11. Result of final questionnaire

languages like Java, because their programming styles are different.

Dolittle[3] is Logo-based language for programming learning. Students write programs to operate "turtles" and make them draw graphics. Programs are created and modified in text form. It still differs from Java in syntax and remains in Logo flavor in spite of its design aims. A report[4] says studying Logo did not contribute to support understanding of other languages like C.

According to our questionnaire, visualization or animation features are helpful to encourage students and support understandings of programming. Other environments for learning Java such as DrJava[5] or BlueJ[6] don't have enough visualization and animation features. For example, It is true that BlueJ can visualize objects and invoke methods interactively. But it is difficult to make animated objects.

6. CONCLUSION

This paper introduced Nigari System, the language and Nigari System, the programming and its learning environment. Nigari is Java-like and much simpler than Java. Nigari System is the integrated environment for programming in Nigari, with visualization feature. The experiment has shown that the way starting programming lesson with Nigari System and shifting to Java had contributed to reduce students' burden for learning and encourage students' motivations. Most students approved the visualization feature. However, the simplicities of the language Nigari did not fully have good effects on the learning of Java. To solve this, we also proposed visualization feature on

Figure 12. Enhanced visualization feature

Java and the method accessing restricted parts of Java not to bother students and teachers with "spells". We are going to enhance the system as "the gentle stairway to Java, the big language".
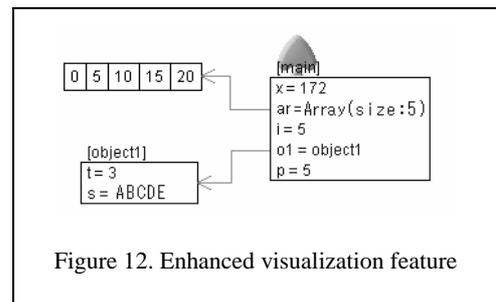
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CONSTRUCTING ADAPTED E-LEARNING COURSES ON DEMAND

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ABSTRACT

This paper presents a new e-learning methodology that addresses the issue of reusability and aims to facilitate the definition of adaptive education, allowing personalized web-based learning environments on demand. Two repositories have been designed allow the definition of e-learning courses adapted to each learner: a learning objects repository and a subject-related educational objectives repository. These repositories follow the Sharable Content Object Reference Model (SCORM, www.adlnet.org) philosophy. This methodology outputs the self-paced learning process with the structure and contents of each e-lesson of which the full e-course is composed. This technology is now deployed at the Spanish Ministry of Public Administrations for training computing and communications specialists (INAP, 2004).

KEYWORDS

Learning object, adapted e-learning, learning objective, e-course, e-learning methodology, self-paced learning.

1. INTRODUCTION

Communications technology development has made a variety of distributed multimedia applications, including e-learning, feasible. More people can now produce and distribute e-learning content (e-content). However, educational technology has not yet realized the full potential of deploying the existing vast digital learning resources (Atif, 2003). The main reason is that a genuine teaching system should not focus on the transmission of knowledge from teacher to student (Govindasamy, 2002), it should be concerned with the fundamental aspect of education, namely, learning (Pazos, 2002). It is important to assist learning rather than to deliver knowledge. The learning process is optimal when it is assisted and tailored (Gell-Mann, 1996).

Some e-learning systems tend to focus exclusively on the management and measurement of training processes. They do not provide any means to support content production processes, e-content management or even maintenance (Ismael, 2002). Other e-learning systems address the issue of reusability of educational e-content (Muzio, 2002). This provides for the production of different e-learning courses via the Internet using reusable contents. The main weakness of these approaches is that they are not able to generate adaptive e-learning content on demand, that is, generate an e-course depending that is adapted to the background knowledge of a given learner. To get round this problem, systems have been developed to construct individual learning structures that are adjusted to learners' profiles (Sampson, 2002). Nevertheless, they do not take into account the course learning *objectives*, which means that the ongoing course cannot be modified when it is found that the objectives are not being achieved.

This paper presents a new e-learning methodology that aims to facilitate the definition of *adaptive* education based on *learning objectives* (Sharable Content Objects - SCOs). This methodology allows personalized learning on demand, and an ongoing course can be modified when the learning objectives are

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not being achieved. To achieve these goals, an *IMS-XML repository file of learning objects* (SCOs), which can be reused for different learner profiles, and a *learning objectives repository* have been developed. Also, an *e-course* has been defined *as a set of e-lessons* for a specific learner that takes this learner through to achieve the learning objectives.

2. LEARNING OBJECTS REPOSITORY

A learning objects repository is a warehouse of subject-specific and interrelated SCOs. Such a repository allows the teaching material to be reused in different e-courses. Also, the e-lessons making up a learner e-course can be automatically constructed on demand.

IMS (www.imsglobal.org) provides a standardized way for different systems or tools to exchange digital learning resources through Content Packaging (Anderson, 2001), but does not specify how to define a SCO learning objects repository. Therefore, following the IMS Content Packaging philosophy, we have specified the SCO repository by means of a Repository Manifest and its physical files, as shown in Figure 1.

The Repository Manifest is a special XML file describing meta-data on the learning objects of which it is composed, their interrelationships and the assets (resources) that each SCO contains. The physical files implement the contents of the assets that form the SCOs contained in the repository.

| Repository manifest	Physical files		
Metadata	Audio	Video	Image
Resources	html	xml	jscript

Figure 1. Learning objects repository

Modifications have been made to adapt the standard IMS Content Packaging XML, which describes the meta-data of the SCOs in a package, to the description of the learning objects repository involved describing the meta-data and resources of each SCO specified in the repository manifest. This description is enclosed within the labels <sco> and </sco>. Additionally, the labels <metadatanode> and </metadatanode>, which are used to delimit the information about the meta-data of each SCO in the repository, have been added for each SCO. This improves the search for SCO meta-data and resources when the XML search engine constructs an e-lesson, employing, for example, .NET Xpath library.

Table 1. SCO repository manifest schema

```
<SCORepository … > <sco>                      <questionnaire>
      <identifier>  </identifier>                 <question>
      <identifierref>  </identifierref>               <statement></statement>
      <metadatanode>                                  <answer1></answer1>
            ...                                       <answer2></answer2>
      </metadatanode>                                 <answer3></answer3>
      <resources>                                 <correctAnswer></correctAnswer>
            <file href="file.html" />             </question>
      </resources>                            ……..
</sco> </SCORepository>                       </questionnaire>
```

Unlike IMS Content Packaging, the <resources> label is associated with a SCO. That is, there is no one label that describes all the package resources, but each <sco> includes a label <resources>. Therefore, there is no need for the *identifierref* attribute that appears in the IMS Content Packaging manifest. Additionally, it means that each SCO is *self-contained*, with respect to both its meta-data description and the identification of the files that implement the assets of which it is composed. On the left-hand side of Table 1, there is a list containing a fragment of the XML repository manifest schema with the described changes.

The learning objectives of an e-course will specify what learning objects from the repository should generally be part of the e-course in question. Nevertheless, these learning objects will differ depending on each learner's background knowledge. To build an e-course tailored to the needs of a particular learner, each SCO will have an associated *questionnaire* containing questions and tests. These questions and tests can be used to determine how knowledgeable the learner is about the concepts described in the learning object in question. Taking the learner's questionnaire responses, the SCOs that the learner knows and does not need learn are removed from the general e-course, leading to an learner-adapted e-course.

The XML labels <questionnaire> </ questionnaire > have been added to build this functionality into the repository SCOs. These labels define a questionnaire for each SCO. The right-hand side of Table 1 shows its XML schema. The questionnaire is located in the repository manifest between the <sco> </sco> labels, after <metadatanode> and before <resources>.

3. LEARNING OBJECTIVES REPOSITORY

A learning objective is the specific knowledge about a concept or skill that the learner has to develop. This knowledge generally includes several learning objects. The instructor plans an e-course, defining the learning process for a set of educational objectives to be achieved by the learner. The result, the learner e-course, consists of a set of e-lessons, each of which is generally composed of an educational objective.

The instructor defines the educational objectives from the learning objects repository, including the objects of which each objective is composed. Therefore, each learning objective is defined by a set of interrelated SCOs that deal with a very specific item of knowledge.

The methodology described in this paper includes a Learning Objectives Repository, which is implemented by an XML objectives manifest. This manifest describes the educational objectives covered by the learning objects repository and relates the learning objectives to SCOs. This repository contains the identifiers that define each learning objective and not the physical SCOs (which are located in the SCO Repository). Table 2 shows the XML objectives manifest schema.

Table 2. Learning objectives repository manifest schema

```
<OBJRepository...>    <objectives>
    <objective>
        <identifier></identifier>
        <title></title>
        <scoDependences>
                <sco>
                <identifer></identifier>
                <identifierref></identifierref>
                </sco>
        <scoDependences>
    </objective>
</objectives> </OBJRepository...>
```

4. E-COURSES CONSTRUCTION METHODOLOGY

Based on the learning objects and learning objectives repositories described earlier, we present a methodology for constructing e-courses that are adapted to the theoretical background of each individual learner on demand. This methodology is composed of the following processes:

a. Learning objects creation: SCO creation is performed by the content expert interacting with the system. A Dependencies Graph is derived from the dependencies between SCOs in the repository.

b. Learning objectives creation: the instructor selects the Dependencies Graph subgraphs that are labelled as specific learning objectives. Each objective defines or is part of an e-lesson. These objectives are stored in the Objectives Repository and are represented by means of a General Knowledge Graph.

c. E-course objectives definition: the instructor selects the specific learning objectives of the e-course to be imparted from the Learning Objectives Repository. As a result, the system outputs an E-Course Objectives List that it represents by means of the E-Course Knowledge Graph.

d. Learner knowledge elicitation: the system elicits what knowledge the learner has on each SCO in the E-Course Knowledge Graph. As a result, it produces the Learner Knowledge Graph. This graph will be a subset of the E-Course Knowledge Graph, if the learner already knows any of the SCOs.

e. Learner objectives definition: the instructor reviews the Learner Knowledge Graph for inconsistencies. From this reviewed graph and the E-Course Objectives List, the system outputs: the Learner Objectives List and the Learner Road Map. The Learner Road Map is the set of Hamiltonian paths that go from the start state to the goal state of the Learner Knowledge Graph.

f.   Learner learning route definition: the learning route is built by the instructor who selects the best of all the possible Hamiltonian paths for reaching the target knowledge state set out in the road map.
g.   E-course development: this process depends on the authoring tool used to develop the e-course. It outputs the Self-Paced Learning Process applicable to the real structure of each teaching unit, which includes a learning tree containing the structure and contents of each e-lesson.
h.   E-course execution: this activity involves the learner executing e-lessons. This execution provides information on the problems encountered and the knowledge acquired. Information output during execution is stored in the learner log within the LMS platform..
i.   E-course revision: this serves to refine the learning process by analysing the results of the execution. The system analyses the Learner Log and the Learner Learning Route, and, depending on the learner learning results, modifies the learner learning process and executes the e-course development process.

5.   CONCLUSION

This paper presents an e-learning methodology in response to the demand for self-adaptive e-learning systems that serve e-courses on demand, taking into account the theoretical background of individual learners. The proposed methodology is based on two new technological resources that are also introduced in this paper: the learning objects and the learning objectives repositories. XML manifest schemas based on IMS content packaging have been developed to describe both the learning objects, plus their relationships, and the learning objectives.

This methodology is being implemented to train Spanish central and local administration computing specialists. We have over 10 years' training experience through the Master in Information and Communications Technologies Management, where first we applied classroom learning, which was later combined with live e-learning and has now been enhanced with self-paced learning (Alonso et al., 2001).

We have implemented a CASE tool, called Adaptive Learning System, based on the proposed methodology. The self-adaptive e-learning capability of the tool is an important qualitative and quantitative added value in the field of e-learning. By using the standards proposed by IMS and SCORM, this tool is conceived as an open system that provides two additional advantages: firstly, the e-courses generated can be deployed on any Learning Management System, which contributes to diversifying available learning web material. Secondly, existing learning resources can be used.

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TEACHING MANAGEMENT INFORMATION SYSTEMS: AN EXPERIENCE WITH WEBCT

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ABSTRACT

In order to improve teaching quality, web tools are becoming more important. Modern multimedia tools include a wide range of technologies to improve on-line education. At *Universidad de Cantabria*, several courses are given in a digital teaching web, named *Aula Virtual*, using state-of-the-art technologies. These new tools approach our students to a new environment, where they can obtain complementary material in the Internet that is not available in classroom or on the *Aula Virtual*. Nowadays, our group of Business Computer Science offers several subjects in *Aula Virtual* environment of our university: "Introduction to Management Information Systems", "Business Computer Science", "Management Information Systems" and "Introduction to E-Organisation". This paper explains our experience in using the e-learning platform WebCT to offer digital teaching in our subject "Introduction to Management Information Systems".

KEYWORDS

Information systems teaching, Digital teaching web, WebCT

1. INTRODUCTION

Our goal in "Introduction to Management Information Systems" subject is teaching the fundamentals of actual information systems. To achieve this aim, we teach the relational database model. Likewise, we learn NIAM methodology for the databases design and SQL standard language, for so the definition and manipulation databases. Finally, we include some lessons about distributed databases and transactional process. This subject introduces students in the theoretical knowledge of information systems: databases design, SQL standard language and interfaces, as relation tools for the users, with the development of examples in every topic and in the laboratory classes.

The classes in the computer room try to apply, in a practical way, the acquired knowledge in the theoretical lessons, making use of the Microsoft SQL Server 2000-database management system (DBMS). Students are distributed in working groups. Every group must develop the design, creation and manipulation of a Database for a specific type of business. Tools used during this project are based in NIAM methodology for the database design and the obtaining of the conceptual diagram that allows creating the database over the designed DBMS. During the three last years, teaching on this subject is complemented with the inclusion of the subject in the Aula Virtual environment of Universidad de Cantabria.

The aim of this integration is to provide our students with new working tools, offering them the possibility of reinforcing their acquired knowledge and their auto-evaluation with test resolution on the Aula Virtual environment. Nevertheless, the participation on this environment is rewarded with recognition in the final student mark as seen in the Figure 1 about the evaluation method. It may be necessary to pass the theoretical exam in June or September for passing the subject, regardless the mark obtained in the different evaluable parts.

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2. VIRTUAL ENVIRONMENT STRUCTURE

The *Aula Virtual* home page offers access to all the subjects of the faculties. This page maintained for the *CeFoNT* (*Centro de Formación en Nuevas Tecnologías*) (IT Formation Centre) also offers news of this service and statistics of use. First step, a student chose his / her studies, then he / she can find the different subjects for these studies. Students are provided with a username and a password for entering this environment.

The Aula Virtual is supported over an e-learning platform -WebCT- and contents actually 205 courses in which take part 193 teachers and more than 7.900 students. The new server, built-in at the beginning of 2000 year, allows the continuous use of the system, 24 hours a day, seven days a week.

Table 1. Evaluation method

♦ Theoretical Exam – June or September	**60 %**
♦ Practical project	**30 %**
Data bases design with NIAM methodology and Data bases creation and operation and SQL Server 2000	(20 %)
Data bases creation and operation with Microsoft Access	(10 %)
♦ *Aula Virtual* tests	**10 %**

Once the student has passed the subject page with his / her username and password, he enters in the environment shown in Table 2, which components we discuss below. The page offers eight icons distributed in two lines. The more important sections are situated in the first line and include: *Objetivos -Metodología*, *Programa - Bibliografía*, *Contenidos* and Test. The second line of the page shows other icons with useful information for following the lectures in this course.

Table 2.

Objetivos - Metodología	*Programa - Bibliografía*	*Contenidos*	*Test*
Objectives and methodology	Syllabus and references	Lectures	Test
Trabajos	*Exámenes*	*Calendario de exámenes*	*Foro*
Practical projects	Exams	Exams' calendar	Forum
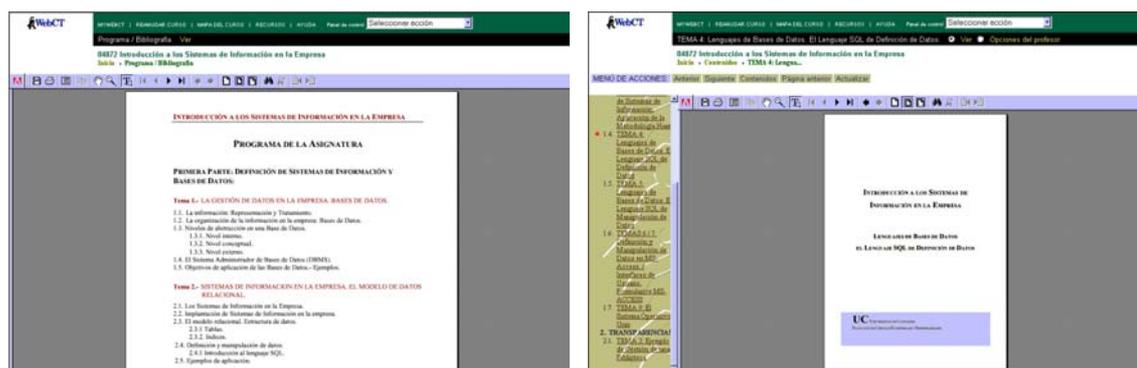
Figure 1. Programa and Contenidos

In *Objetivos - Metodologia* section, students can find the high lines for the subject, in order to deepen in the following sections (*Programa* and *Bibliografia* and *Contenidos*), the theoretical part of the subject. In Figure 1, we show at left side, the syllabus and at right side, one of the topics of the subject. Students can get this material in PDF format. In *Trabajos* section, are specified the practical requirements of the projects, that students must carry out during this course. Likewise, they can find the date line for the presentation of these projects. Finally, in other page sections as *Calendario de Examenes* o *Foro*, students also can find useful

information relative to write-text dates and the possibility of contact with teachers and other registered students in the same subject, using a chat.

2.1 Self-evaluation material

Inside Test and *Examenes* sections, students can find support material for studding and checking the acquired knowledge. In the *Examenes* section, we publish the last three years' exams, both for June and September periods. (Students that fail the final exam in June can pass the same subject in September.) In Figure 2, we can see one of the exam exercises of last courses. The *Test* icon offers several one-question-tests about every topic learnt during the course. This possibility of self-evaluation is also an easy way of improving the student's marks.
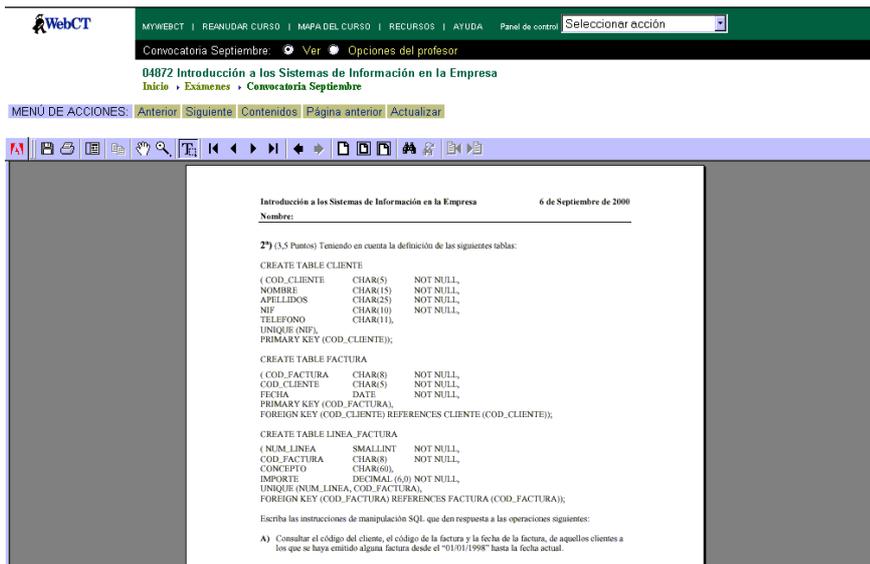

Figure 2. Exam exercises.

3. CONCLUSION

A growing number of teaching professionals use modern multimedia tools to innovate traditional lectures, making them more graphical and didactic. Widespread access to personal computers and Internet has helped to crate new work areas, such as the European Higher Education Area or environments that improve students and teachers' mobility. Internet can be used to reinforce on-site education with continuos training, which is essentially distance learning. Within this framework, the *Universidad de Cantabria* began to create the *Aula Virtual* in 1999, where students and teacher can meet in a virtual environment. Solutions are provided in many different situations, ranging form long distance education, folders for different teaching material, evaluation tools, calendars, image and video database, communication tools (e-mail, forum with students) and self-evaluation tools (tests, exams, homework).

In our work we can see the net as two different frameworks, as an information distribution system or as an educational one. We focused in organising the information and learning, avoiding designing a web-based distribution system that revolves around the site more than in the contents. We tried to design a multimedia tool that could provide students with a sound theoretical background and practical training through different homework and exercises. At the end of the course, students should be able to understand and interpret knowledge in different situations. The efficiency of an on-line environment depends on the organisation of contents and materials and the amount of proposed activities.

Our marks system has 10 as the maximum score. In order to pass the exam, the student must obtain 5 points, that is to say, *Aprobado*. The text values are more than 7 *Notable* and more than 9 *Sobresaliente*. Using WebCT tool we have found that our students achieve better marks in the subject. The best mark percentage (*Sobresaliente*) has increased outstandingly in the third year of using this tool.

Among of the reason of not using this service, we find that many of our students live in loaned apartments in the city, where usually there's no Internet access. In order to minimise this problem, the *Universidad de Cantabria* offers to these students the possibility of using her computer rooms in different faculties during the timetable. Following the statistics of the *CeFont* between May 2002 and April of 2003, they have served through Internet 125.59 gigabits of contents related to *Aula Virtual* with a diary average of 352.33 megabytes. From the 2 millions of demands of pages, the 49.23% has been made from the university, and mainly from Library computers room and the students computers rooms.

Finally, it's interesting to signal that one of our subjects has been selected to participate in the *CVC* (*Campus Virtual Compartido*) also known as G9, a virtual environment for nine universities to offer subjects and interchange students.

ACKNOWLEDGEMENT

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DOES ILT INVESTMENT HAVE AN EQUAL IMPACT ON ALL STUDENTS? EVIDENCE FROM THE UNITED KINGDOM'S LIFELONG LEARNING SECTOR

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ABSTRACT

This paper explores the impact of Information Learning Technology (ILT) on different learning groups within the United Kingdom post-16 education sector and suggests that the impact is variable. This paper reports on an ongoing research project and suggests that ILT has more impact on lower level students (students who are at a lower level than the norm for their age group) than on students studying at higher academic levels. Qualitative and quantitative data is used to demonstrate this effect particularly in students' use of the virtual learning environment (VLE), ILT's effect on student motivation and in staff expectations of the improvement in outcomes that accrue to this learning group.

KEYWORDS

variability; information learning technology; post-16 education; virtual learning environments; impact; lower level students

1. INTRODUCTION

1.1 The UK Context

The UK Government's consultation document, Towards a Unified E-Learning Strategy (Department for Education and Skills, 2003) envisages a future where nearly all education, including Further Education colleges (which cater for post-16 learning that takes place outside schools or universities) involves the use of information learning technology (ILT) or e-learning. Furthermore it sees a world where many more post-compulsory learners will access education remotely through virtual learning environments (VLEs) at work or in their homes. The UK Secretary of State Charles Clarke's vision assumes a more efficient and cost effective set of educational outcomes arising from the substantial investment the Department for Education and Skills has made in recent years. The National Learning Network (NLN), for example, has invested £156m into FE between 1999 and 2004 and the programme has been extended until at least 2006.

For institutional managers, substantial investment in ILT is both necessary and desirable so that colleges can attract students and provide them with the qualifications and skills that will enable them to succeed in the workplace. There is little doubt about the need for more IT skills in the workplace: one recent study demonstrated that by 2010, 90% of all jobs will need computer skills (Clarke and Engelbright, 2003).

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Clearly there is a need for IT skills among the workforce, but does teaching with ILT enhance teaching and learning in other, non-IT subject areas?

1.2 The Question of Impact

Many practitioners in fact question whether ILT investment can be shown to have any impact on student outcomes. Speaking at a Further Education Resources for Learning conference in 2003 John O'Donohue of the National IT Research Centre said: "Research ….. is inconclusive as to the effect of computer technology on student achievement. It is too easy to be lulled into the technology bandwagon, blindly installing networks and computers without thinking deeply about their role in the instructional process" (O'Donohue, 2003). Within the schools sector (which uses the language of information communications technology, or ICT), even those organisations that wish to highlight the effectiveness of information and communications technology on education have found that the positive effects that can be isolated are, in fact, variable in their impact: "There is no consistent relationship between the average amount of ICT use reported for any subject at a given [stage] and its apparent effectiveness in raising standards. It therefore seems likely that the type of use is all important" (Harrison, *et al* ImpaCT2, 2002).

If the type of use is important, this should also be reflected in the effects of different uses on different types of learners, and indeed further research in the secondary school sector seems to confirm this: "Findings suggest that communication aspects of ICT were important to certain groups, such as those that are disabled, and those 'at risk' of disaffection," while the information aspects (ie research capability) "were found to be more important to other groups such as the gifted or talented" (Department for Education and Skills, 2003). Evidence from the further education sector confirms that some aspects of ILT have more impact than others, for instance on motivation of younger learners, research skills and presentation of work, (Atwere, 2002) while other studies report variability of impact between subject areas (Adult Learning Inspectorate, 2003). However, there has yet been little research into the concept of variable impact by level beyond the school sector.

1.3 Evidence of Variable Impact?

In the UK lifelong learning sector, learning is divided by levels. The lowest levels, Foundation and Level 1 cover ability levels below that expected for 16-year-old school leavers, whilst Levels 2, 3 and 4 cover all education from school-leaving certificate to degree level. Our research into the impact of recent Government investment in ILT in FE colleges (the National Learning Network programme) suggests that there is, in fact, clearly variable impact across the levels, and this paper, based on our qualitative and quantitative data, aims to demonstrate and draw lessons from the concept of variability.

At the outset, we should make clear that there are known, external contributory factors such as social class which always impact on educational achievement. The 2004 edition of UK Social Trends reports on GCSE attainment in relation to parental socio-economic classification in 2002. Whilst 77% of children whose parents were in the higher professional category achieved five or more grade A*-C GCSEs, only 32% of those whose parents were in the routine (ie unskilled) employment category achieved this. Conversely, at the bottom end of the distribution, of those pupils whose achievements were limited to five or more grade D-G GCSEs, only 6% came from the higher professional category, whilst this was the peak score for 25% of pupils from the routine category (Summerfield and Babb, (eds), 2004). Children from middle class homes consistently perform better in education than those from working class homes up to the age of 16, which suggests that a majority of Level 1 and below students are from working class homes with less access to computers.

2. OUR FINDINGS

Our evaluation of the National Learning Programme combines qualitative and quantitative elements, both of which will be drawn on in this paper. The evaluation seeks to determine whether the investment in ILT has had an impact on practices, behaviours and pedagogies in the FE sector. The qualitative element consists of in-depth interviews and focus groups with learners and staff in eight case study colleges in England between

summer 2002 and summer 2004. The quantitative element consists of two e-learning users' surveys, one of staff and another of learners, administered between November 2003 and February 2004, which were intended to provide a baseline for further, more detailed surveys of ILT use and impact in the future. In total 687 learners and 347 staff responded to the surveys, drawn from the case study colleges and beyond; while the case study colleges are representative of the diverse FE sector (see below) the sample can only be described as indicative of the sector as a whole.

This paper is concerned with the variation between reported ILT use and behaviour involving different levels of learners specifically those up to Level 1 and those at Level 2 and above. For the purposes of comparison, all English qualifications up to Level 1 are taken to include Foundation level and SLDD (students with learning difficulties and disabilities) level and in the following analysis are compared to qualifications at Level 2, Level 3, Level 4 and above (in England, 16-year-old school leavers or those advancing to FE are expected to have achieved Level 2 qualifications). Whilst our evidence suggests that ILT has a disproportionate impact on poorer performing students, it should not be forgotten that students studying at higher academic levels may also benefit unconsciously from ILT investment.
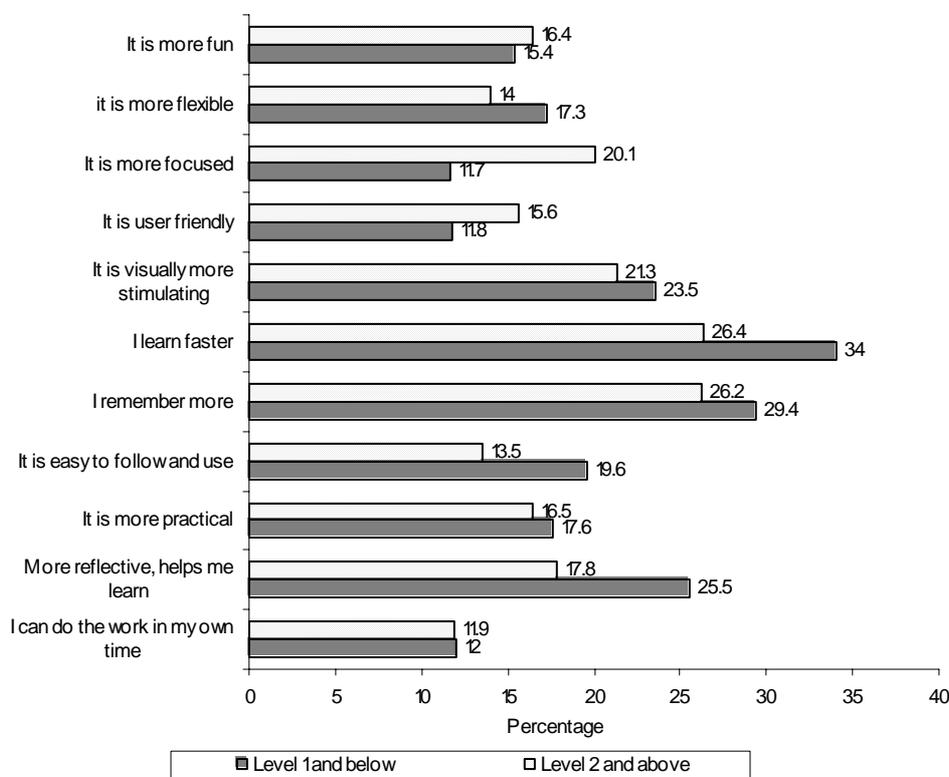

Figure 1. Attitudes to VLE amongst students

The UK Further Education college sector is hugely diverse in nature, and includes: predominantly academic colleges (known as Sixth Form Colleges); general FE colleges offering a mix of academic and vocational qualifications and which can be either urban, multi-sited colleges of over 20,000 students, or small rural colleges; colleges that are specifically vocationally inclined (such as land-based agricultural colleges); and still others that concentrate on adult education, usually involving non-accredited learning such as Spanish-for-beginners courses or indeed basket-weaving. In addition, there are a number of specialist colleges for the education of (for example) severely disabled on visually impaired students.

Our evidence covers three main areas of ILT usage and impact: that relating to the use of the Virtual Learning Environment (VLE) or college intranet by learners; that relating to the use of ILT in teaching and

learning in the classroom; and that relating to staff and student expectations of the effects on student outcomes. To begin with, we shall examine the views of students' perceptions of the VLE or intranet at their college. Although there was no difference in the proportions of students who were accessing the VLE from their home or workplace (approximately a third of each group), those students who were studying at Level 1 or below were much more enthusiastic about the advantages that the VLE offered. Figure 1 (previous page) illustrates this and shows that out of eleven variables, eight more positive responses are reported by Level 1 and below students than those studying to a higher level.

Although, in this particular sample there was no difference in the proportions of the two groups of students who accessed the VLE from home or work, there was a direct relationship between what level learners were studying, whether or not they had a computer at home and what sort of internet connection (if any) that they had. As suggested above, given the links between social class and educational achievement, it was not surprising to find that of those studying at Level 1 or below, 28.9% had no access to a computer at home compared to 10.1% of those studying at Level 2 or above. Of the Level 1 and below students, 14.8% had a computer but no internet access, 32.9% had internet dial up connection and 23.5% had broadband. This compares to 10.3% of Level 2 and above students who had a computer but no internet access, 38.4% who had a dial up connection and 41.3% who had broadband. The findings are quite clear. Those who are studying at Level 1 and below have less access to ILT at home, yet it is clear that they are the most enthusiastic about the advantages of the VLE.

This apparent distribution of enthusiasm for ILT is supported by qualitative data. Here are two sets of quotations from students, one set from a general college of Further Education (at which students working at Level 1 and below are more prevalent) and the other set from a high achieving academic sixth form college. The first group of quotations is from the general college of Further Education:

"PowerPoint is better as it offers more chance for the teacher to explain and is good for keeping the attention of students."
"Visualising things makes it easier for us to remember."
"Taking notes from teachers makes it hard to take it all in."
"(IT skills) make us more employable."
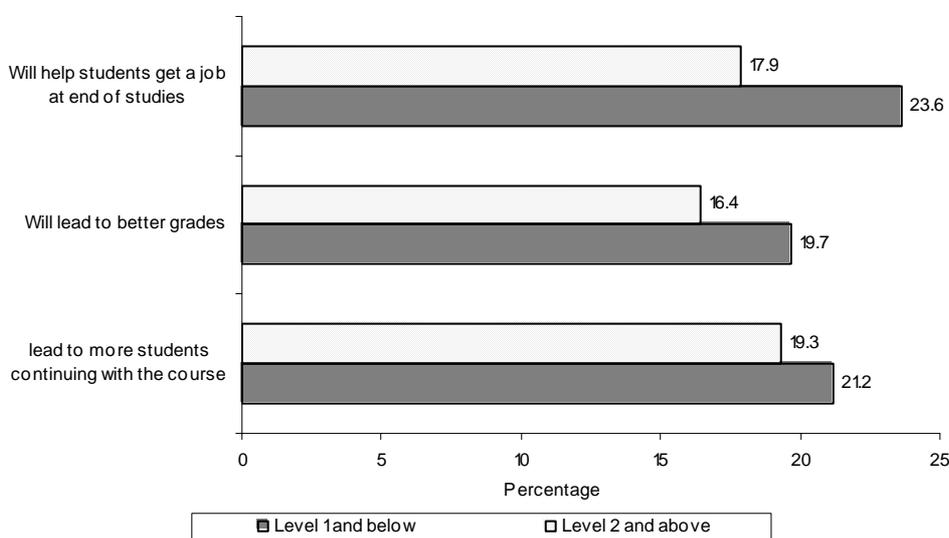
Figure 2. The impact of ILT on student outcomes

Compared to those from the academic sixth form college:

"You get more interaction without computers and projectors. I prefer it when teachers talk. There is the temptation to write down bullet points only."
"ILT use makes life better."
"Teaching staff are just using technology because they can."

"It just makes life easier, it is an add on and (with regard to future employability) it depends on the student."

As can be seen, this difference in attitude is striking. Further evidence can be seen in Figure 2 (previous page) which illustrates how much students believe the use of technology in learning and teaching will impact upon their outcomes. Again, lower level students are more enthusiastic and more likely to state that it will help them get a job at the end of their studies, that it will lead to better grades and also that it will lead to more students continuing their studies.

Evidence from the staff survey is more complex, not least because teachers do not generally exclusively teach students from Level 1 or below, making it problematic to disentangle the viewpoints of these two sets of groups. However, by grouping together those who teach at least some Level 1 or below and comparing them with teachers who teach Level 2 or above exclusively, some interesting patterns are seen to emerge. On the whole, the quantitative data suggested that teaching staff were less enthusiastic about the benefits of ILT on lower level students than were the students themselves, although there were exceptions to this. In particular, staff who taught at Level 1 were more enthusiastic about the possible future benefits, as illustrated in Figure 3.
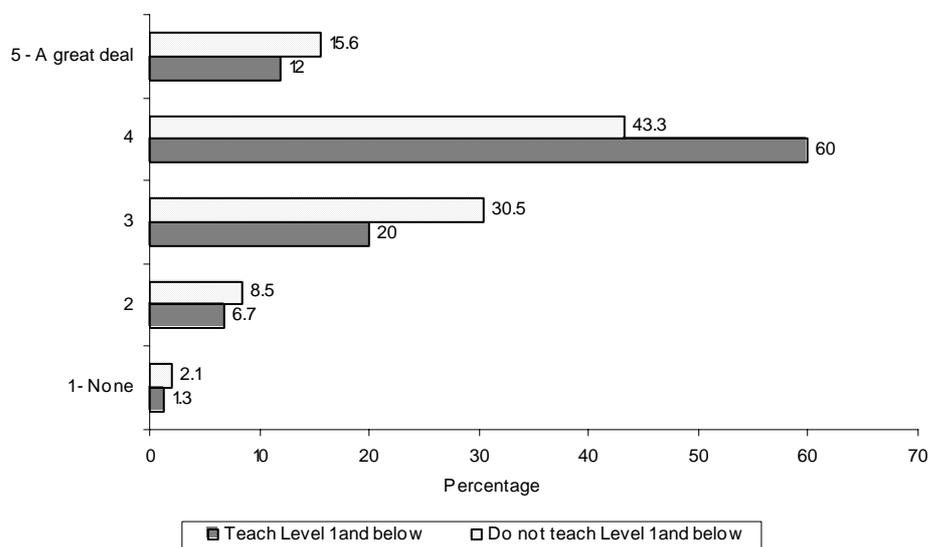

Figure 3. Impact of ILT on improving outcomes of students in the future

The qualitative data also provided evidence that reflected the students' enthusiasm and the following is a selection of comments made by staff at the case study colleges.

"I think the lower the motivation of the students, the bigger the impact."

"IT's contribution to motivation is greatest in students who're not so traditionally academic. They're the sort who are more likely to find IT contributes to motivation, not the sort of students doing [academic] A-Levels."

"When you are teaching very academic students, students who want to have their understanding and their concepts challenged to develop their learning, that, I don't think, can be done significantly by machines. They go part way towards it but at the end of the day the teacher needs to be in the classroom to develop that."

The worth of ILT amongst students who had learning difficulties or disabilities was particularly cited by staff:

"When you have got dyslexic students, speakers of other languages, anyone who is actually going to struggle a bit with hand written work it's so much easier to transfer that into IT and then edit, re-edit, develop it. The levels of frustration for the student I think are reduced and their sense of achievement is increased."

"Some benefit from ILT more than others. The spelling checker is a huge bonus for some students, it is a confidence boost."

The NLN evaluation has also revealed other findings, for example, it shows that staff who teach lower level students are less likely to make use of the VLE than other staff but are more likely to cite insufficient equipment or ill equipped rooms as barriers to using ILT. Other patterns of usage amongst staff and students are also apparent with lower level students being more likely to report use of Networked PCs, CD Roms and Internet Websites. Further research into self-directed learning among students may present a different picture.

3. CONCLUSION

All colleges need to have to have a rolling programme of ILT investment; clearly it is both necessary and desirable in order to provide the appropriate employment skills all college leavers require. However, our preliminary research suggests that there is disproportionate impact on lower level students, and this is evidenced quantitatively and qualitatively by the reported enthusiasm for ILT among Level 1 and below students. It is also evidenced by qualitative data from staff and some of the quantitative data from staff is supportive of the case. As this data is from an indicative rather than representative sample, further research in this area would clarify and illuminate these issues further.

Additional evidence from the NLN evaluation suggests that staff who teach Level 1 and below students report less use of the VLE and furthermore, are more likely to cite lack of specific resources as barriers to using ILT. If this is the case, the implications for policy makers and practitioners in the area of lower level student engagement could be substantial and allow the targeting of resources to the lower student levels.

However, it should not be forgotten that students studying at higher academic levels may also benefit unconsciously from high levels of ILT investment in ways that the current evaluation does not address and that all students ultimately benefit from the inclusion of ILT in further education colleges.

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E IS FOR ENVIRONMENT: CRITICAL SOCIAL SCIENCE, TECHNOLOGY AND THE LEARNING ENVIRONMENT

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ABSTRACT

Existing literature analyses the introduction of computing technology into learning environments at three levels: instrumental/technological, pedagogical and critical. While most work in this field has a good understanding of technological and pedagogical issues, few deal adequately with the concept of *environment* in a critical fashion. Salient ideas from environmental philosophy are introduced, particularly the relationship between "material" and "virtual" aspects of an environment, and the suggestion that all environments are collaboratively and continuously constructed by those systems and entities which act within them. A truly critical approach needs to ask whose interpretation of the learning environment is being encoded into learning environments and technologies. Ideally, lecturers and students together should negotiate the shape of any learning environment, including the technologies within it.

KEYWORDS

Learning technologies, learning environments, environmental philosophy, noösphere, critical pedagogy.

1. INTRODUCTION: THREE LEVELS OF ANALYSIS

This paper suggests terms of reference vis-à-vis the introduction of computing technology into learning environments. I suggest that most existing work considers only two parts of the three-way relationship represented in the term, "virtual learning environment" (VLE) (note however that I wish to consider learning technology in its various guises: not only VLEs but online teaching materials, virtual campuses, and so on). The three elements also represent three ways of thinking about social science: instrumental, pedagogical and critical. I suggest the last is the most productive way of studying the introduction of technology into learning environments, but that it is also the most infrequently addressed. The main task of this paper is to justify the critical stance by introducing insights developed from environmental philosophy and politics.

When the "V" is emphasised, this gives rise to a generally **instrumental** or **positivist** analysis of the use of technology in (virtual) learning environments. In positivist social science, the ideal is objectivity, but positivism always struggles to ask "what *ought* to be?" except with regard to narrow criteria that are "objectively" defined but which in fact give ideological support to the status quo and privilege technological solutions to perceived problems (Fay 1975, pp. 14-15 and p. 64). Positivist analysis implies that the decision to use computing technology in learning environments has already been taken; the question is, which is the best choice. This is invariably made only against technical or financial criteria (e.g. CHEST 2002).

Govindasamy (2002) criticises such approaches (and the learning technologies developed from them) as having no appreciation of **pedagogical** issues. Emphasising the "L" requires one to ask what the impact of learning technologies will be on teachers and students (Britain and Liber 1999). However, pedagogical studies can become little more than a psychology of students' response to new teaching methods. Without still higher levels of analysis, interpretive methods will struggle to explain underlying conditions which limit the possible responses of subjects. Because of this, they also "support the status quo" (Fay 1975, p.91). For instance, there could be no analysis of pressures that may result in students and teachers having particular technologies imposed on them even when they are believed by both groups to be detrimental to teaching.

This third level of analysis can be symbolised by the "E": *environment*. Considering the environmental factors which may shape or limit the pedagogical and technological options gives any study a **critical**

dimension. Critical social science "seeks to uncover those systems of social relationships which determine the actions of individuals" (Fay 1975, p. 94). To do so it must be holistic. Partly this is addressed by constructivist pedagogies and the idea of "rich environments for active learning" (Dunlap 1999) which account not only for technology and pedagogy but the interactions which constitute the social environment of a university (or other educational institution). But at the very least one must also consider the managerial context as well as student needs (McPherson and Nunes 2004). Above even this there are wider pressures from governments and the world economy (Robins and Webster 2002).

Yet holism alone does not equate to a truly critical approach. Critical social science should be a tool for the provocation of enlightenment, and thereby the empowerment, *of the research subjects themselves* (Fay 1975, p. 103). It recognises not only the influence of the environment upon research subjects, but that subjects can act autonomously to change these conditions. Who participates in the construction of social reality? What assumptions about reality are brought to bear? How do existing structures and conditions shape the new possibilities which can arise? How does the *act of research itself* influence the subjects, and what new cognitive tools does the researcher provide for action?

I want here to introduce some ideas from environmental philosophy to help clarify terms of reference for such a critical analysis. The relationship between entities, systems and environments is an idea which is essential to understand if one is to take a critical position.

2.   (RE)DEFINING ENVIRONMENTS

We often refer to "the environment" as a singular thing and this simplification is not without support. From some perspectives life on Earth appears as a single phenomenon which Vernadsky (1998) called the *biosphere*. In this model all distinctions between life and its environment disappear. For billions of years life has actively (although not exclusively) shaped its environment. Macro-level, or planetary, change can occur as the result of innumerable small events, aggregated by repetition over time.

All creatures draw upon their environment for resources. In material (biosphere) terms these may include food, water or minerals. But there is more to human existence than this. We draw equally on another "sphere" of existence that has been termed the *noösphere* (Samson and Pitt 1999). This is the sphere of cultural and scientific knowledge, of human communication and understanding. Resources *and environments* are defined with reference to both noösphere and biosphere. The word "environment" is used in many contexts: not just "the environment" but work environments, political environments, and of course learning environments. This is not just semantic sloppiness but is wholly indicative of the significance of this idea.

Even before the existence of computing technology, learning environments were comprised of both biospheric (material) and noöspheric (cultural, linguistic) elements. For example, the layout of a university campus materially shapes the learning environment. Multi-campus universities require different approaches to timetabling and perhaps even interdisciplinarity than single-campus institutions. But there is clearly more to a university environment than the layout of its buildings. The cultural ethos, intellectual paradigms, the students' motivations, government policy—all influence a university environment in general terms.

To this list of "virtual" factors we should add technology. Technological artefacts are points of interaction between biosphere and noösphere. Artefacts are material representations of the knowledge and values which have contributed to their construction. Inbuilt values and assumptions also shape decisions about which artefacts are built and how they are distributed. Technological infrastructure is therefore not a spontaneous creation but a record of prior decisions, values and power relations (Star 1999). The first step towards critical study of computing technology in learning environments is to recognise the reasons *why* technology is introduced into any given learning environment, and the effects that such a move will have.

We cannot only think about environments at the macro-scale, however. The word "environment" comes from the French *environ*, "that which is around [something]". This implies that there are different environments for different systems and different entities, existing at many scales. Interpretive approaches are well placed to acknowledge that *perceptions* of environments can differ depending on one's position. This may be a difference in location, social difference or abstract difference. For example, the "political environment" will vary depending on one's geographical location. The UK (two party, conflict-based politics, intolerant conservatism) differs from the Netherlands (multi-party, consensus-based politics, tolerant conservatism). Perceptions also depend on one's social status and political views. In 1984 a striking UK

miner and a contemporary Tory MP would have had entirely different perceptions of the political environment and therefore the *possibilities for action* within that environment. Conceptions of a particular environment are therefore sometimes incompatible and/or in competition. What interpretive approaches may miss is how power (whether this be political power, social status, technical expertise, or other manifestations) may be used to *impose* interpretations of (the "good") environment. When studying any learning environment, one should already be asking who participates in its construction and its constant reproduction. The debates on academic freedom versus government or corporate "interference" acknowledge this. When new technologies are introduced, we must additionally ask: whose conception of the "good" learning environment is coded into the technological artefacts and systems? What assumptions are made about students, lecturers or teaching? What pedagogical models are reinforced?

The main impact of this theoretical model comes when considering the relationship between research subjects and their environment. Ideally, the subjects of positivist research are isolated from environmental influences, so they can be studied under stable and constant conditions. Many writers have noted the limitations, even dangers, of such a "closed system" approach in social science (see Burrell and Morgan 1979, pp. 59-60). However, it is also noted that many projects which declare their adherence to an "open systems" approach—where environmental influences are acknowledged and investigated—are often "confined to recognising and emphasising the environment as an influence upon the subject of study and reformulating traditional models… the call to adopt an open systems approach has been interpreted as a call to take heed of the environment and often little else" (*ibid.*, p. 60). There is continued adherence to positivist methods like questionnaires, attitude analysis and controlled experiments, and assumptions that the researcher (whether positivist or interpretive) remains apart from the subject of study.

However, the biosphere is actively and continually constructed by every organism, from microbes up to humans; we also all participate in the constant production and re-production of the noösphere, of the various environments, technological artefacts and social systems which all exist as interactions between biosphere and noösphere. This view encourages the transcendence of both positivist and interpretive methods into a fully critical social science. This is based on interpretive methods (Fay 1975, pp. 92-95) but subjects are asked about their interpretations of an environment *in order that they may come to understand it themselves and if necessary, act to change it*. Environments are not neutral, unchanging spaces in which activity occurs, but are actively shaped by those activities. At the same time, environments retain an objective reality, and can be influenced by forces beyond the control of the systems or individuals within an environment.

3. CONCLUSION: TOWARDS A CRITICAL PEDAGOGY

The following terms of reference are therefore suggested for critical analysis of the introduction of computing technology into learning environments:

- Why is the technology being introduced or used? Who has made this decision? Is it subject to regular review? Are the assumptions which influenced the decision themselves open to enquiry?
- How will the technology integrate with the existing learning environment? What is it designed to supersede? Will it in fact do so? Who or what benefits from the introduction of the technology, and who or what loses out? Are these benefits/losses real or perceived?
- Who is involved in the construction of the learning environment? What contributions have its users, whether teachers or students, been able to make? Is the new technology dynamic: in other words, could it be continually updated in the face of diverse student needs? Is it technologically flexible (possibly through open source software—Tebb and Dee 2003)?
- How does the technology influence what is taught, what can be taught, and how it is taught?
- Is the technology accessible? Are any communicative or pedagogical distortions replicated, exacerbated or introduced by it? What skills (IT, study skills, social skills, communication skills) do students and lecturers require in order to successfully use it? Is it assumed that they will have them already? Are there any physical problems with accessing computers or other such interfaces? What of non-traditional users (disabled, ethnic minority etc.)? Does the technology continue to promote equal opportunities?

To conclude, I want to suggest that if one accepts that all environments are actively constructed by those who act within them, and that the interpretations of any given environment will innately be diverse, then

when thinking about learning environments one is forced to accept a strong argument in favour of a *critical pedagogy*. Increasingly, academics face criticism that universities are colluding in their own corporatisation (Miyoshi 2002). This is, essentially, a positivist approach to education, emphasising efficiency and dismissing the contributions of individual academics and students. (Re-)adopting critical pedagogical methods is one way that individual academics can challenge these trends. Of course, this is not as straightforward as all that. Positivism may be a flawed methodology for social science but one thing it can deliver is efficiency. Academics and their departments are faced with budgetary pressures; pre-packaged learning environments are therefore a tempting solution. Positivist or interpretive methods make research more efficient as well; certainly, the results are less abstract and therefore easier to report back to funding bodies. Yet to yield to these pressures is ultimately to perpetuate them.

Critical pedagogy emphasises dialogic teaching, possibly including a negotiated curriculum and learning environment (Shor 1996). It *must* start with lecturers asking themselves, "why do I teach? Why do I teach *in this way*?" And if, through such self-enquiry, a lecturer comes to believe that a particular technology is appropriate for a given course, then its application should be negotiated between teacher and students. Both sides should reach an agreement over the shape of a given course's learning environment. This is no easy task either. Shor (1996) observes that a great deal of entrenched feeling about what a university course (and a learning environment) "should be" remains to be overcome: students, managers and lecturers all have preconceptions here. Nor will it be feasible to engage in detailed negotiations every year: a VLE, say, cannot be rewritten from scratch for each new intake. But this is why learning technologies should be as flexible as possible, and not enforce particular pedagogies. Any system must be adaptable, particularly when faced with a dynamic environment that is constantly in flux, as pertains in higher education with its turnover of staff, students and technologies and changes in other relevant environments (e.g. political).

My intention has not been simply to criticise the introduction of computing technologies into learning environments. On the contrary, acknowledging that learning environments have always been an amalgam of the tangible and intangible, of artefacts and communication, helps us evaluate what might change, for better or worse, when we adopt IT within our teaching. There is nothing to fear from any technology if one is always aware that social processes and values will be encoded into it, sometimes subtly. Whether we use new technologies or not, the good learning environment will always remain one in which the teaching allows diverse students to reach new levels of understanding in effective, enjoyable ways.

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ANALYZIS OF AN E-LEARNING EXPERIMENT FOR STUDENTS TRAINED TO BECOME CHARTERED ENGINEERS

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ABSTRACT

In this article, we are going to analyze a teaching experiment undertaken with 160 engineering students. This experiment aimed at comparing the behaviour of two groups of students, one following a traditional course, the other a course on line. To set up the two groups, the students were selected randomly. It was shown, for the group following the on line course, that the fact to choose the time when they study was a significant factor of motivation for the students.

KEYWORDS

e-learning experiment, autonomy, HTML/FLASH technology, efficiency of learning.

1. OBJECTIVES OF THE PROJECT

We present the assessment of an e-learning experiment in fluid mechanics for students in an engineering school.

The objective was to compare this new type of teaching with a traditional course in amphitheatre. To do so, a group of 160 students was divided into two : one for e-learning teaching, one for traditional course. This teaching project aimed at giving the students the responsibility of their training. It gave them more autonomy by managing their timetable and by dealing with their personal work. In e-learning teaching, the self-learning took an essential place, the relation with the teacher was carried out using electronic mails, a forum and direct contacts. In our institution, this way of communicating between the students and the professor is not usual and strongly modified the working methods of the students and the teacher.

2. TEACHING SCENARIO

The students who followed the courses on line had six times less obligatory courses than the other group. The teaching scenario is shown on figure 1.
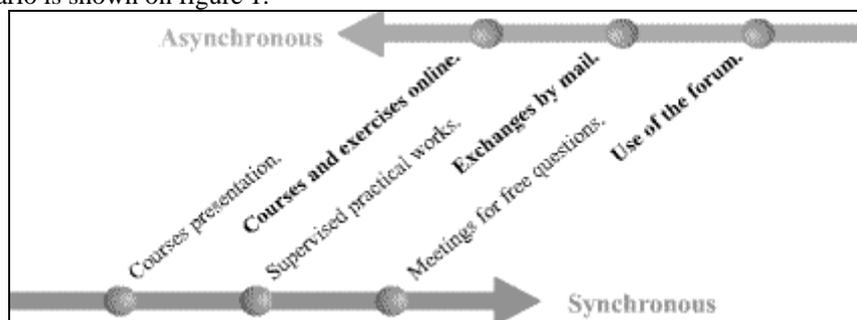

Figure 1. Teaching scenario

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The significant points are as follow : the nonobligatory courses are carried out at the request of the students and their contents are adapted according to the questions of the students asked by e-mail.

Directed work remains with the presence of the professor and are obligatory. They give rhythm teaching and each meeting has a specific topic. They remain an essential element in the acquisition of knowledge.

The students receive a guide with practical information, a calendar and the means of communicating with the teacher (telephone, e-mail), the address of the Internet site to be connected to the course. They also receive a support of written courses and duplicated lecture notes of exercises as well as the list of works available at the resource center.

3. USED TECHNOLOGIES

The course of fluid mechanics was modified to be adapted to this new means of learning. In order to avoid problems, we have worked with a team of ENIC Telecom Lille 1. They have several experiences in using Information Technologies and e-learning in training engineer students [MYS 03].

Thus, a learning portal was carried out on the basis of a web site in HTML/Flash technology. It included training contents rich in media (video clips, animated pictures, photos…). Exercises and quizzes were included at each training step to help the student to check his own acquisition of knowledge.

All the courses are accessible from the Internet and not only by the Intranet of the School [SLA 97]. Students may work whenever they want, with a simple computer and low Internet connection (56k).
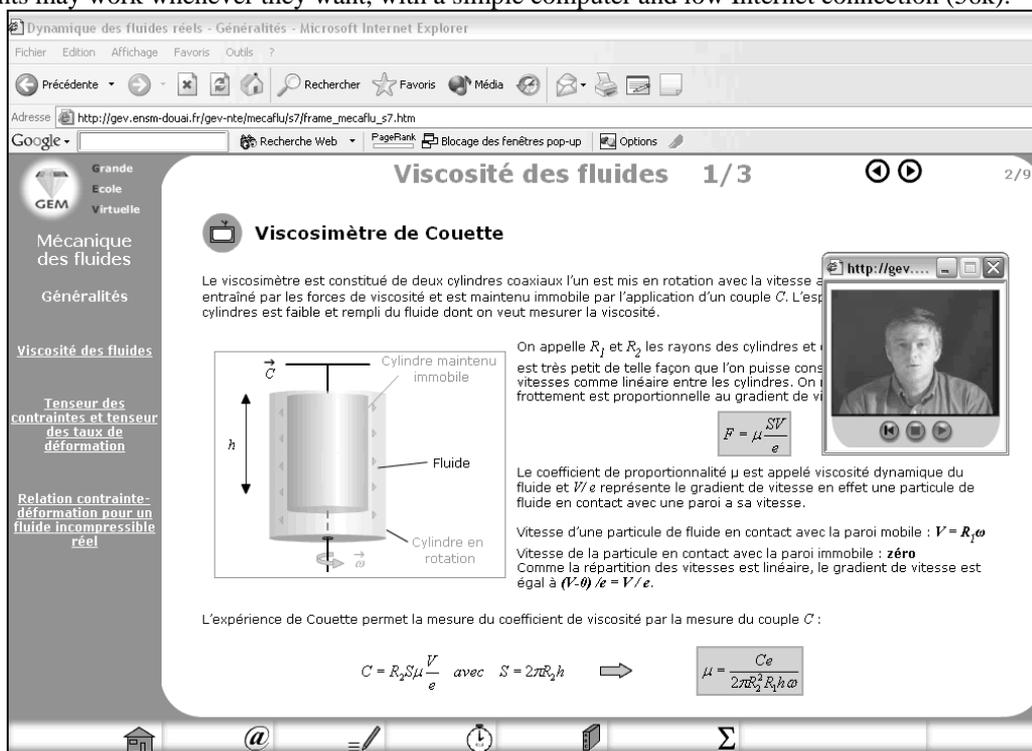

Figure 2. Screen copy of the on line course

4. TESTS OF EVALUATION

The two populations of students underwent the same written examination. No noteworthy differences between the two groups could be noted. Besides, the students of the "virtual" group obtained the best and the worst marks. That can be interpreted by the fact that students who were not motivated by the subject had

difficulty to work by themselves during their free time. But the motivated students benefited fully from the method. The results are shown on figures 3 and 4.
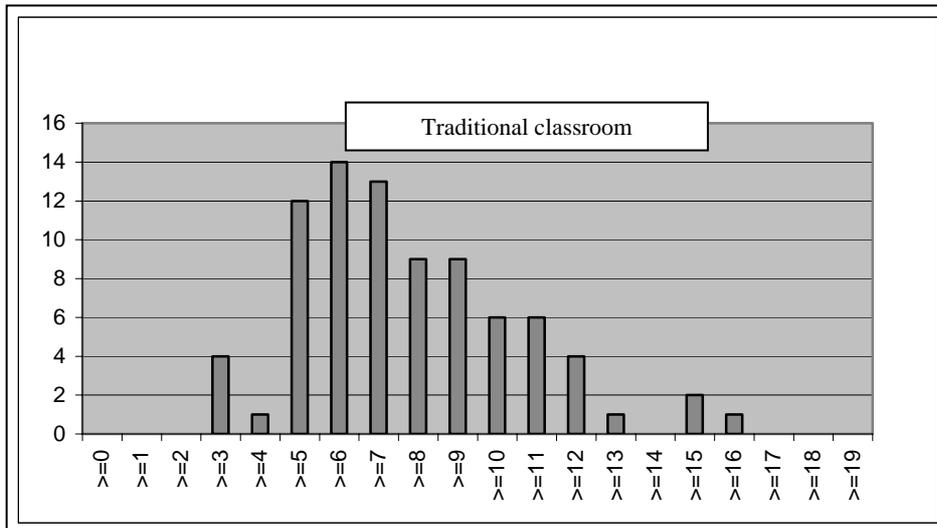
Figure 3. Results of the students of the traditional classroom
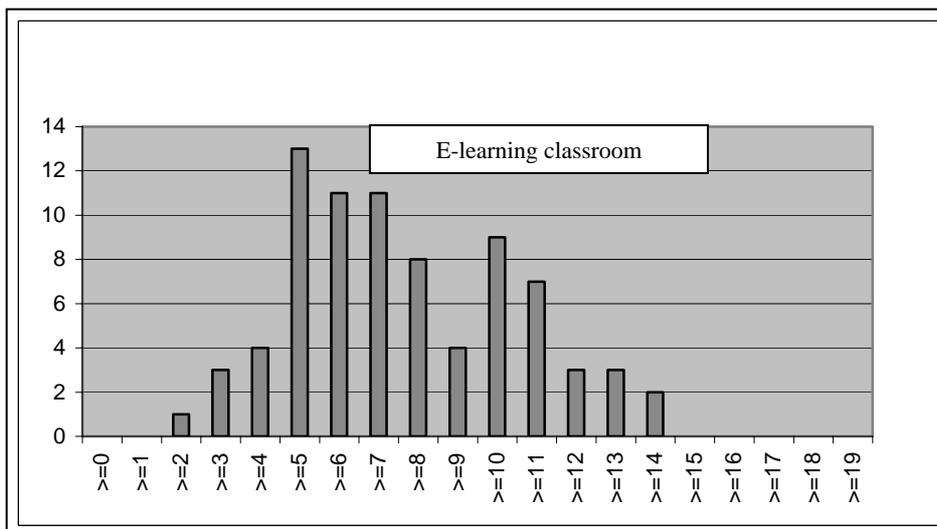
Figure 4. Results of the e-learning classroom

5. EVALUATION OF THE TEACHING SYSTEM AND CONTENTS BY THE STUDENTS

The students filled in the questionnaires of evaluation of the teaching system and the contents put on line. They appreciated the fact they could work at their rhythm, at the moments chosen by them. As a result they could better manage their timetable. Figure 5 shows the schedules of connection of the students, connections start at 8 o'clock the morning until the next morning at 3 o'clock.
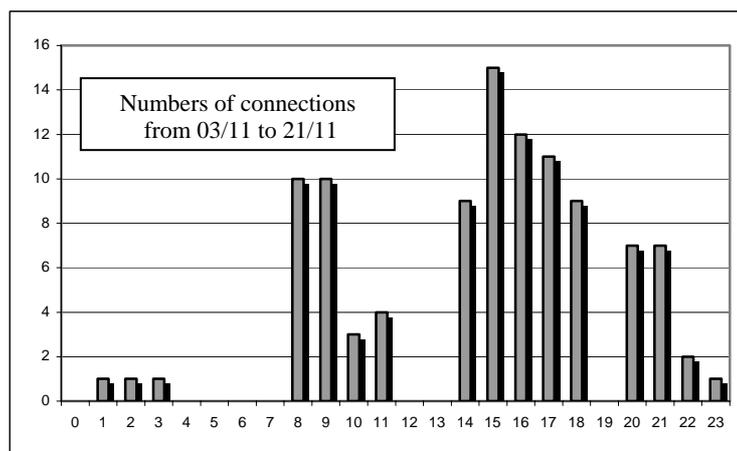
Figure 5. Schedules of connection of the students

The students insisted on the fact the support of course was of great quality. This way of working was considered better appropriate for 78% of them, 17% rather preferred to work with a professor while 4% are hostile with the method (difficulty to manage their timetable, need for immediate answers to their questions…). Figure 6 shows the appreciation of the e-learning teaching system by the students.
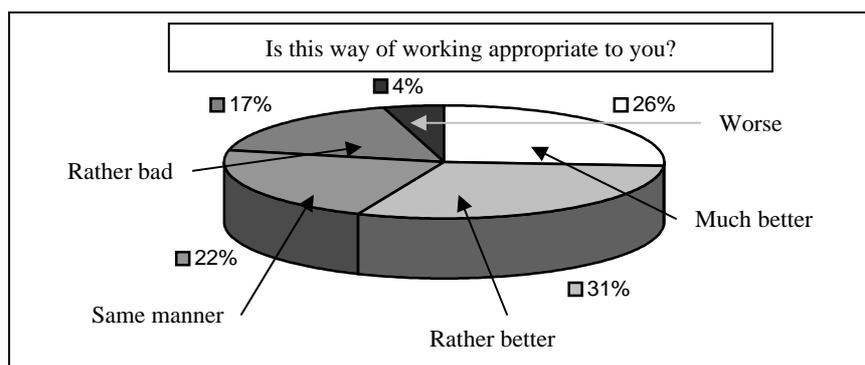
Figure 6. Appreciation of the e-learning teaching system by the students

6. CONCLUSION

The analysis of the results of this teaching experiment shows that even if the students on the whole appreciated this new way of working, the follow-up of the students as well as the student-teacher communication system need to be improved. The integration of the course on a pedagogical background would largely help with these improvements.

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DESCRIPTION OF THE ADAPTIVE WEB SYSTEM FOR E-LEARNING

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ABSTRACT

This article deals with principle of designed formal description of the adaptive web system. Basic motivation for creating adaptive web systems is the difference between individual users. Adaptive web system monitors particular user's behavior and characteristics. Based on them, the system compiles resultant, adapted, document. This document corresponds to user's qualification, capability, preferences and his specific needs. Formal description of adaptive web system is needful for unified communication platform in this realm, exact description of adaptive document behavior, automated implementation of adaptive web systems and next research (e.g. suitable levels of adaptivity).

KEYWORDS

Adaptive web system, E-learning, Formal description

1. INTRODUCTION

Since 1997 term Web Engineering has been appearing, this term represents application of systematic, disciplined and qualified attitude to development, performance and maintenance of web applications. Beside the contemporary Internet, the Web Engineering discipline [1] deals with development of new conceptions and technologies for the web. One of them is adaptive, personalized web [2], [3].

Adaptation of web behavior to user's specific object and needs is perspective realm of the Internet evolution. Adaptive web systems can be effectively used in many cases. As an example we can give E-learning [4], [5], [6] adaptation of web to the disabled users or personal navigation to web. The aim of this work is to contribute to development of theoretical base in the adaptive web systems realm. Formal description of problems is needful for installation of unified communication platform in this scope. Further, it will be used as a basic theory for automated implementation of adaptive web systems.

1.1 Basic Principle of the Adaptive Web System

Adaptive web system monitors particular user's behavior and characteristics. Based on them, the system compiles resultant, adapted, document from larger universal source document. Then, adapted document is produced to user.

Basic motivation for creating adaptive web systems is the difference between individual users. For this reason, it's suitable to prepare specific adapted document for each user. This document should correspond to user's qualification, capability, preferences and his specific needs. For example, we can adapt user interface of document, its information content and layout, topology of hypertext or other features. Thus, adaptive web system's users can't access to them anonymously.

1.2 Motivation for Formalizing this Realm

The aim of our work is to create a system for automated implementation of adaptive web systems. It represents a non-trivial engineering process, which needs to establish a formal description of the realm, like in many other scopes of computer science (for example theory of grammars etc.). There are some advantages (and disadvantages that we can meet) of formal description:

+ We can exactly describe behavior of adaptive document produced by adaptive web system.

+ Creating a unified communication platform for the realm of adaptive web, we will make easy to change the documentation and to describe the problems. Next, the formal theory is very suitable as a basis for functional and effective implementation of particular systems.

+ We can define quantities, which explicitly describe various properties of the adaptive system. These quantities will give image about system attributes, such as level of feedback and interaction with user, coherence and redundancy of information contained in the system, etc. This is very important for finding the level of adaptivity, which is productive for user and for finding the levels, over which the adaptivity can be contra-productive.

+ We use known and reliable mathematical apparatus - the theory of sets.

- During implementation of adaptive system, deficiently general and limiting formal description could cause ineffective use of technological capacity of web.

2. BASIC IDEAS AND CONSTRUCTS OF THE FORMAL DESCRIPTION

We have designed and published formal description of adaptive web system, for example [7]. This formal description is based on the mathematical logic and on the theory of sets. Because the complete formal description is too large for this paper, the full documentation is exposed on stabile URL http://webing.felk.cvut.cz/documents/adaptive.html. In the following text, we will discuss its basic ideas and principles.

2.1 The Static Part

In the static part of formal description, we deal with compilation of adapted document according to values of user's parameters (see Fig.1). This part begins by some action on client (user) side. Processing of feedback follows there, possible change of user's parameters values, compilation of adapted document and producing compiled document to user.
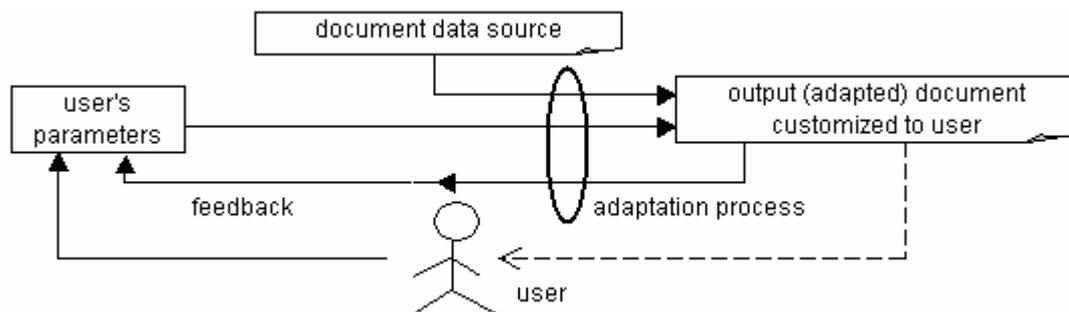
Figure 1. Principle of the adaptive web system

The characteristic of particular user is stored in system via user's parameters. Level of former knowledge from the scope of produced information, quality of user's memory, capability of information absorption and many others can be parameters like this. There is a wide spectrum of user's parameters and we will not deal with individual sorts of them at this general level. We just specify them formally.

The adaptive web system compiles adapted document for particular user. Its inputs are values of user's parameters and universal source document, called document data source.

The document data source is divided into blocks. The blocks fold up from elements. The element of document data source is a part of produced information text or control element.

During compilation of an adapted document, particular behavior of element is determined by value of control signal. The way of element's reaction on control signal (for example if the element will be displayed whole, modified or will not be displayed) is described in element metadata. There is a metadata and one or more control signals assigned to each element. This set creates the complex element, which is basic building unit of adapted document.

Compilation of adapted document is realized by adaptation functions. Input of adaptation function can be zero up to some user's parameters, output of the function are one up to some control signals.

The elements are divided to feedback elements and non-feedback elements. As an example of feedback element, we can give a question in some test from interpreted theme, a choice from several ways of arrangement of information on the screen or a time counter, measuring time spent in individual sections of document.

Like the elements, we divide user's parameters to feedback and non-feedback too. Values of feedback parameters we get via feedback during the run of adaptive system, values of non-feedback parameters we get in advance (for example by student's pre-testing) or we get them by dependency of parameters.

The feedback in adaptive system is represented by a link between feedback elements and feedback user's parameters. Using feedbacks, adaptive system gets and gives precision to values of user's parameters. Based on these values, particular adapted document is prepared for particular user and his needs.

2.2 The Dynamic Part

Run of adaptive system can be characterized as a sequence of iterations. The iteration of adaptive web system is current state of user's parameters values and resultant adapted document. We can imagine the iteration intuitively as one time shot from adaptive web system run.

Then, description of adaptive system is divided into static and dynamic part. As mentioned above, in the static part we deal with compilation of adapted document from document data source according to values of user's parameters (creating of one iteration). This part begins by some action on client (user) side. There follows a processing of feedback, possible change of user's parameters values, compilation of adapted document and producing compiled document to user. In the dynamic part we deal with sequence of iterations and time aspect of the problem.

In the dynamic part of description, system history in given iteration is defined. It is a set of all iterations preceding this iteration. As a sample, we can give its definition:

$$H_i = \{I_0,..,I_{i-1}\}$$

where i is iteration index and $I_0,..,I_{i-1}$ are iterations preceding iteration i.

Next, we define user's parameters iteration, which is a current state of parameter values. Ergo, user's parameters iteration is a subset of defined iteration. By analogy, we define user's parameters history in given iteration as a set of all user's parameters iterations preceding given user's parameters iteration, because we need it for a formal description of user's profile.

The user's profile is a set containing current state of user's parameters in given iteration and selected parts of user's parameters history in given iteration. It specifies data, which we store for particular user in adaptive web system.

Finally, we can give a definition of adaptive web system's user session:

$$AS = \{ P, B, X, I, F \}$$

where P is the set of all parameters, B is the set of all blocks, X is the user's profile, I is the current iteration and F is the set of all adaptation functions.

2.3 The Description of Adaptive Web System Properties

The designed formal description contains the quantities, which unequivocally describes the properties of the system. The typical example is the level of feedback in system of the ration of metadata in the document data source. The next group of quantities partially describes information semantic in document data source. Here

the formal description deals with content redundancy and coherence between information. Defined quantities are also used in the description of rightfulness in the adaptive web system.

3. RESULTS AND FUTURE WORK

We have verified one of the basic functions of designed formal description - exact description of the behavior of adaptive web document. The task is to create adaptive hypermedia document for foreign languages teaching. For describing the document data source we have used the XML. The result is satisfying. Usage of XML corresponds well with designed formal description. Next, we have implemented a visualization of document data source via XSLT stylesheet.

We have got the first values describing the document data source. In general, these values will be needful for finding the level of adaptivity, which is productive for user and for finding the levels, over which the adaptivity can be contra-productive.

The next step, intimately connected to the design of formal description of adaptive web system, is the support of adaptive web system's automated implementation. It means to use the formal description as basis in design and implementation of adaptive web engine, which will run on web server and provides users using the system with adapted documents. Formal description is going to be used also for designing of quasi-automated system to transfer educational documents to the document data source for adaptive web system.

The part of research in this realm is the beginning pilot project of adaptive web. The object of the pilot project is to get the feedback related to used implementation support and designed formal description. In the future, there are many iterations waiting for the whole system, that will lead to its improvement and increasing its effectiveness.

4. CONCLUSION

Formal description of adaptive web system is needful for installation of unified communication platform in the realm of adaptive web. Hereafter it is necessary as a basic theory for setting standards in this scope and next theoretical research. The main purpose of this theory is to run as a base for automated implementation of adaptive web systems. Using of well-known mathematical apparatus gives the theory the advantage of good understandability and makes it easy to apply.

Adaptive web systems can be effectively used in many cases, e.g. E-learning, adaptation of web to the disabled users or personal navigation to web. The aim of using of adaptive approach to student in E-learning is to increase effectiveness of E-learning process and to improve its ergonomic quality. Next, the goal is to present information in a way that is the most suitable for the particular user and to adapt the education process to the disabled students.

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ONTOLOGY BASED FEEDBACK GENERATION IN DESIGN-ORIENTED E-LEARNING SYSTEMS

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ABSTRACT

One of the essential elements needed for effective learning is feedback. Feedback can be given to learners during learning but also to authors during course development. In the current generation of eLearning systems automatically produced feedback is sparse, mostly hard coded, not very valuable and almost only used in question-answer situation. Valuable feedback, for example produced by a human tutor via e-mail, is often possible but this introduces delays and is time consuming. We want to develop mechanisms, based on ontologies, to create a rich supply of feedback, not only in question-answer situations but also in the context of design oriented education. With ontologies we specify (1) the knowledge to be learned (domain and task knowledge) and (2) how the knowledge should be learned (education). We will develop algorithms with which we automatically create valuable feedback to learners during learning, and to authors during course development. Furthermore, we will develop a formalism with which course developers can specify domain and task specific feedback to learners. In this paper we present our research plan.

KEYWORDS

Electronic learning environments, feedback, ontology, algorithms, design oriented education

1. INTRODUCTION

Feedback is used in many learning paradigms. The concept of feedback is crucial in educational psychology. It is an accepted psychological principle that one of the essential elements needed for effective learning is feedback. Knowledge of results is required to assess progress, correct errors and improve performance (Mory, 2003). Feedback describes any communication or procedure given to inform a learner of the accuracy of a response, usually to an instructional question. More broadly, feedback allows the comparison of actual performance with some set standard of performance. In technology-assisted instruction, it is information presented to the learner after any input with the purpose of shaping the perceptions of the learner. Information presented via feedback in instruction might include not only answer correctness, but other information such as precision, timeliness, learning guidance, motivational messages, background material, sequence advisement, critical comparisons, and learning focus (Mory, 2003).

In a classroom learners and teachers can easily interact, i.e. students can freely ask questions and teachers usually know whether their students understand (basic) concepts or problem solving techniques. Feedback is an important component of this interaction. Furthermore, educational material can be continually improved using information from the interaction between the lecture and the learners, which results in a more efficient and effective way of course development.

There is a frequent lack of feedback in electronic learning environment (or eLearning) courses in higher education (Mory, 2003). Almost all feedback is related to question-answer situations and is hard coded. Exceptions are the environments based on social constructivism (Duffy, 1996). In such environments learners solve complex problems through social negotiations between equal (human) peers in a contextual setting. Feedback occurs in the form of discussions among learners and through comparisons of internally structured knowledge (Mory, 2003). This type of feedback introduces delays and is time consuming. In specialized applications, for example programming and design editors, much more feedback is given. Some of these (for example JBuilder enterprise version 8) especially address feedback on the syntactic level. Semantically rich

feedback can only be found in specialized design environments. An example can be found in (Fischer, 1993) in which an environment for kitchen design is described. Unclear is how much effort is needed to realize such a system and how general the (interference) mechanisms are, i.e. what has to be done if the system is used in another domain. Other examples of feedback in eLearning systems can be found in (Hummel, 2001) and (Martens, 1998)

Many eLearning systems are based on ontologies. Aroyo et al (Aroyo, 2002 (1) (2)) describe an authoring tool based on ontologies to (1) support the development of domain and task ontologies and (2) support and perform (semi) automatic courseware authoring activities. Feedback is given in the form of hints and recommendations. Jin et al (Jin, 1999) describe an authoring system that uses ontologies to produce feedback (error, warning and suggestion) for an author. Both a domain ontology as well as a task ontology are used. The ontologies are enriched with axioms, and on the basis of the axioms messages of various kinds can be generated when authors violate certain specified constraints. Literature about giving semantically rich feedback to learners is sparse and is only found in specialized design environments. See for example (Fischer, 1993).

In our research we want to develop generic, domain and task independent, feedback mechanisms that produce semantically rich feedback to learners and authors during learning and authoring. We distinguish three types of feedback: (1) feedback given to a student during learning, which we call *student feedback, (2)* feedback given to an author during course authoring, which we call *author feedback* and (3) feedback from a group of learners who study a course to an author, which we call *group feedback*. With group feedback an author may be able to optimize his/her course. We will develop generic feedback mechanisms where ontologies are arguments of the feedback engine. This is important, because the development of feedback mechanisms is time consuming and specialist work, and can be reused for different ontologies. Besides generic feedback mechanisms we will also develop mechanisms by means of which authors can define domain and/or task specific feedback. We will focus our research on design environments for Computer Science courses, especially design environments in which artefacts can be made using languages like Unified Modeling Language (UML) and Object Constraint Language (OCL) (Warmerdam, 1999).

In this paper we introduce our ideas about an eLearning system, in the field of design-oriented education, that produces semantically rich feedback to authors as well as to learners. In Section 2 we explain our ideas with two examples and we give a sketch of the functionality and architecture of the system we imagine. The examples are related to the domain communication technology. In Section 3 we describe our research questions. Finally in Section 4 we draw our conclusions.

2. A DESIGN ENVIRONMENT THAT PRODUCES SEMANTICALLY RICH FEEDBACK

We imagine an eLearning environment for computer science courses, in which: (1) learners are able to design artefacts of certain domains using different types of languages, and (2) authors are able to develop courses. Learners as well as authors receive semantically rich feedback during learning, designing artefacts and developing courses based on different ontologies, for example a domain, a task, an educational and a feedback ontology. First we give two examples to explain our ideas: one about a learner who develops artefacts in a player, and one about an author who develops course material in an authoring tool. After that we give a short description of the functional architecture.

2.1 Example of a Player

A student first has to learn the concept (communication) network. Assume that a network consists of links, nodes, a protocol and a protocol driver. Each of these concepts consists of sub-concepts. The domain ontology 'communication technology' represents these in terms of a vocabulary of concepts and a description of the relations between the concepts. On the basis of an education ontology, which describes the learning tasks, the student is asked to list the concepts and relate the concepts to each other. Feedback is given about the completeness and correctness of the list of concept and relations using different dialog patterns.

In a second step the learner is ask to design a part of a local area network (LAN) using the network model developed during the first step. Instead of concepts, concrete instantiations must be chosen and related to

each other. The learner gets feedback about the correctness of the instantiations and the relations between the concepts. Some protocols for example need a specific network topology. There are various sequences of activities to develop a network, each of them with its own particular efficiency. The student gets feedback about the chosen sequence of activities on the basis of the task ontology. Further, the student receives different types of feedback, for example corrective/preventive feedback, critics and guiding. All these feedback types are further customized to the learning style of the learner.

2.2 Example of an Authoring Tool

An author develops and optimizes a course. He/she has to choose, develop and/or adapt particular ontologies and develop related material like examples, definitions, etc. Based on analyses of the domain, education and feedback ontologies, the author gets feedback, for example about:

- Completeness: A concept can be used but not defined. Ideally, every concept is introduced somewhere in the course, unless stated otherwise already at the start of the course. This error can also occur in the ontology for the course.
- Timeliness: A concept can be used before its definition. This might not be an error if the author uses a top-down approach rather than a bottom-up approach to teaching, but issuing a warning is probably helpful. Furthermore, if there is a large distance (measured for example in number of pages, characters, or concepts) between the use of a concept and its definition in the top-down approach, this is probably an error.
- Synonyms: Concepts with different names may have exactly the same definition.
- Homonyms: A concept may have multiple, different definitions.

The author defines specific feedback for the composed concept network, because group feedback shows that this composed concept is experienced as difficult: extra support in the form of feedback is needed. When the author changes the domain ontology, the generic feedback mechanism remains working.

2.3 Functional Architecture

To produce semantically rich feedback the system should contain several types of knowledge. To represent this knowledge we make use of ontologies At this moment, we distinguish knowledge about:

- **Domain** – For example: Communication Technology, or Distributed Programming
- **Modelling language** – For example: UML/OCL
- **Task/method** – For example: the sequence of phases during design in which an artefact is built
- **Education** – For example: concept learning, problem solving, examples and definitions.
- **Feedback** – For example: different types of feedback and patterns/phases during dialogs.

Figure 1 gives the architecture of an eLearning system that supports a generic feedback mechanism
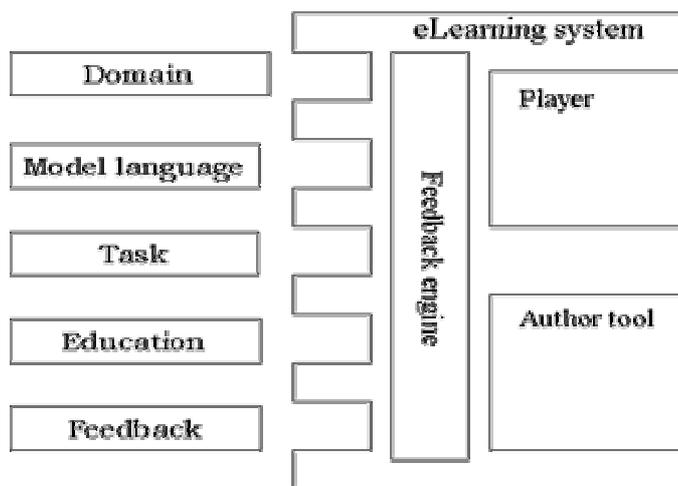

Figure 1. Functional architecture

The eLearning environment consists of three main components: a player for the learner, an authoring tool, and a feedback engine, and takes a set of ontologies as argument. The player consists of a design and learning environment in which a learner can learn concepts, construct artefacts and solve problems. The authoring tool consists of an authoring environment where the author develops and maintains courses and course related materials like ontologies, examples and feedback patterns. The feedback engine automatically produces feedback to learners as well as to authors.

The feedback engine produces generic feedback and specific feedback. Generic feedback is independent of the ontologies used and is applicable to all design activities and artefacts. Specific feedback is defined by the author and can be course, domain, modelling language or task specific. To construct feedback, the feedback engine uses the five argument ontologies. Since the ontologies are arguments, the feedback engine doesn't have to be changed if an ontology is changed for another.

The feedback engine can produce the three types of feedback mentioned. To produce student and author feedback, student and author activities are observed and matched against the ontologies mentioned. To produce group feedback information of a number of students working on a particular course is given to the author of the course. Using this information, an author may be able to optimize his/her course.

3. RESEARCH QUESTIONS

Two main research questions in this project are: (1) How can we construct an eLearning system that produces semantically rich feedback for a learner during design tasks and for an author when authoring course material, where feedback is based on a combination of ontologies and these ontologies can be changed, reused, adapted and/or extended? (2) How can we specify domain specific feedback?

There are many sub questions:

- Is a separation in distinct ontologies for domain knowledge, task/method knowledge, education and feedback knowledge meaningful and does a combination of these ontologies deliver valuable feedback to a learner in the context of design-oriented education in computer science?
- Which languages and structuring mechanisms are useful to represent knowledge types (ontologies)?
- How can we read and semantically interpret the activities of a (group of) learner(s) in the design environment?
- Is it possible to generate algorithmic feedback, for example based on grammar analysis techniques or are AI techniques needed?
- How can we specify in an efficient way generic and specific feedback during the authoring phase?
- Which classification of feedback types is valuable for the development of automatically generated feedback in design oriented eLearning systems?

Finally, we want to realize such an eLearning system as a prototype, and use this prototype for one or two courses, for example for the domain ontology 'Communication Technology' and modelling languages UML/OCL.

The focus in this research will be on the representation of ontologies using languages/grammars, grammar analysis techniques, algorithms and AI techniques to create feedback.

4. CONCLUSION

Feedback is crucial in education: it is an essential element needed for effective learning. Semantically rich feedback is sparse in most eLearning systems. In this paper we present our ideas about an eLearning system that produces semantically rich feedback for learners as well as for authors. The system we imagine consists of a generic feedback engine: different ontologies can be plugged in, i.e. they are the arguments of the feedback engine. This is important because mechanisms for automatically generating feedback are involved, and can and should be reused for different ontologies. The system supports the generation of generic as well as domain specific feedback.

An eLearning system that produces semantically rich feedback is very desirable, because feedback is crucial in effective learning, feedback is sparse in most eLearning systems, and the number of eLearning systems and eCourses is growing rapidly.

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CULTURAL PERCEPTION OF USER INTERFACE OF A WEBSITE: COMPARATIVE STUDY BETWEEN LIBERAL AND PRESCRIPTIVE CULTURES (BRITISH VS. ARAB)

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ABSTRACT

This study is being conducted to investigate the cultural perception of the user interface elements of a website among two distinct cultures: liberal (British) and prescriptive (Arab). It aims to identify the main differences in the preferences regarding the website user interface elements between the two cultures. This study is part of an ongoing research project.

Based on the results of a pilot study, the sample questioned for this study consisted of 96 randomly selected individuals within two targeted groups i.e. students and IT professionals. This selection aimed to have a representative sample of two national cultures (Oman and UK). This paper presents the findings of the qualitative, open-ended part of the user questionnaire that was conducted among the two groups.

KEYWORDS

Website, accessibility, usability, colours, culture, Oman, UK

1. INTRODUCTION AND BACKGROUND

By the end of year 2004, non-English speaking users will make up over 70% of the total online population (International Data Corporation, 2001). Yet current websites are mostly in English and are influenced by American Web design standards. The appropriateness of this practice is increasingly being questioned and therefore localisation is becoming more and more important. Another way to accommodate the cultural diversity of users is to adopt internationalisation, which means to strip a website of all cultural contexts. In order to localise to a particular market or to internationalise, designers need to know about its preferences, likes and dislikes, so they can provide cultural metaphors, real world representation of the user interface objects, and eliminate any culturally offensive material. Many factors need to be considered when designing for an international audience. Such factors have been categorized as overt and covert factors (Yeo, 1996). The overt factors are tangible, straightforward and publicly observable elements. These include dates, time, calendars, weekends, telephone number and address formats, character sets, reading and writing direction, punctuation, translation, units of measurement and currency. Covert factors deal with the elements that are intangible and depend on culture or "special knowledge". Graphics/visuals, colours, functionality, sound, metaphors and mental models are all covert factors. Covert symbols usually have the same meaning to members of a particular culture. Screen metaphors can be misinterpreted in different cultures. The original "trash can" symbol used on desktops, for example, would not be understood by Thai users because in Thailand, a "trash can" is a wicker basket (Sukaviriya and Moran, 1990). Certain covert elements may be preferable in one culture but offensive in another. In most English-speaking countries, images of the ring or OK hand gesture may be understandable but in France the same gesture means "zero", "nothing" or

"worthless". In some Mediterranean countries, the gesture implies a man is a homosexual. Barber (Barber and Badre, 1998) gave examples of colour-culture for different countries, for example, the colour red means different things for different people: for the Chinese it means happiness; for the Egyptians death; for the French aristocracy and for the Americans danger/stop. Graphic literacy may also affect navigation. What may be assumed as a universal may not be even known to others or it may have an opposite meaning; Andrews (Andrews, 1994) points out that to an illiterate Zulu speaking person the emergency exit sign is interpreted as meaning "*don't run that way or you will get head, hands and feet chopped off*". There are many other documented examples of such differences (Amory and Mars, 1994, Murrell, 1998, Hars, 1996).

2. RESEARCH OBJECTIVE AND APPROACH

The overall objective of this study is to investigate the cultural perception of user interface elements of a website between two distinct cultures: liberal (British) and prescriptive (Arab). The study aims to identify the main differences in the preferences regarding the website user interface elements between the two cultures. This study is part of an ongoing research project which amongst other methods used a 9-page questionnaire for web users and another similar questionnaire for web designers. The user questionnaire included two types of questions, *structured* questions (the majority) and *open-ended* questions. This paper deals with the qualitative *open-ended* part of the users' questionnaire. In it, web users were asked for any comments on user interface and website usability. They were also asked: what sort of images/graphics do you not want to see on a website? and what is your favourite colour? Because these were not structured questions but were giving users an opportunity to express their views freely, a full statistical analysis of their replies was not possible but where the answers lend themselves to statistical analysis, this has been indicated. These questions were included to test the general assumption that the Arabs have much stronger feelings about their culture and religious beliefs than the British, and this is likely to influence their views on the virtual world of online user interfaces. The final question aimed to explore whether the colour has any national significance to either of the two groups.

2.1 Data Collection Procedure

The data collection process was started during summer 2003 in Oman and completed spring semester 2004 in Britain. IT Students and professionals, who constitute the majority of Internet users or are likely to become the regular users of the future, were asked to fill out the users' questionnaire. They were approached individually and were given enough time to complete their answers.

Based on the results of the pilot study, the sample questioned for this study consisted of 96 randomly selected individuals within the two targeted groups. This selection aimed to have a representative sample of the two national cultures (Oman and UK) and similar numbers of males and females. The computing experience of Arab subjects was also taken into account to reflect the fact that the Arabs generally use websites in their own language when surfing the Web. The aim was also to choose an Arab audience not overly exposed to the North American culture which is currently predominant in Software and Web technology. Omani subjects were chosen because the researcher was born and raised in Oman; this was expected to facilitate the research. The British subjects were chosen for comparative purposes as the researcher is studying in the UK. They were also expected to show differences in their preferences, which would facilitate the comparison process. Differences in cultural backgrounds, language, and real world experiences across the two groups were expected to influence the participants' preferences and expectations of a website.

The 96 students and IT professionals who responded to the questionnaire consisted of 62 Arabs and 34 British with a roughly equal number of males and females from each country. Demographic profile and descriptive statistics of the respondents can be found in (Al-Badi and Mayhew, 2004). The majority of the respondents were 18-28 years of age and most were educated to graduate level. They were asked to self evaluate their computing and surfing skills and it is clear from the results that the Arab respondents were less self confident in these areas than their British counterparts.

2.2 User Interface and Website Usability: General Comments

The comments of the British respondents were mainly related to the technical aspects of the usability of user interfaces. They could be grouped into *seven* categories: (Website aesthetics or what is called "design consistency"; contents; navigation; overall effect; computing environment; readability and page layout). Examples of the British respondents' quotes are as follows: "Websites should follow the same font and style and layout throughout. Images should only be used in addition to text"; "Text size should be considered so that it can be read in all screen resolutions easily"; "websites should not assume a certain screen size"; "What I find important is that a website is easy to read and catches my eye, as well as having a good style to it"; "I think that the most important aspect of a website is to have order and symmetry. Use the same background for all pages of a website"; "I think it is important to have a navigation bar on all pages"; "I don't mind adverts on websites as long as they don't dominate the page and are appropriate to the site". "It's the overall picture that counts with a website". The Arab respondents gave less sophisticated answers on the technical side but their answers were rather more attuned to their culture and religious beliefs. They were also more concerned with the website performance, i.e. the speed of rendering a web page. This may be due to the slow Internet connect currently available to surveyed audiences. Their answers could be grouped into *four* categories: (Aesthetics; Content; Navigation; Performance and Security). Examples of the most frequent Arab respondents' quotes are as follows: "I didn't like to see pictures of exposed human body"; "I don't like advertisements on websites"; "The most important thing that the information provided should be very clear, well organized and easy to read and to understand"; "website must adhere to the culture and Islamic beliefs"; "The instruction colour should be highly visible". There was also concern about security and performance: "The security is one of the most if not the most - important features of a website"; "The links, buttons and icons really help users and makes his/her life easier"; "Web warnings should be clear and effective in all situations"; "website should be fast to render on all kind of Internet connections or computer environments".

2.3 Disliked Images/Graphics on a Website

In this regard, the responses of both groups can be divided into two categories: 1) Mental and emotional responses (affect the moral and cultural beliefs) and 2) Physical responses (affect eyes and brain). Examples of the British respondents' quotes are as follows: "Inappropriate adult images"; "Irrelevant images or graphics"; "Unnecessary animation which distracts from the text, large adverts";" Images that flash and move around too much as it hurts the eyes";" Images that are distracting". These show a tendency towards physical responses. Only one mentioned "Exposed human body". A number of British respondents replied "Not bothered" to this question, indicating that they have a fairly relaxed attitude to anything they see on a website. Apart from two comments about images affecting website performance, Arab respondents put more emphasis on mental and emotional responses. A number of respondents said they disliked "pictures of exposed human body"; "images used for advertisement"; "Pictures/images that could be offensive to Arab culture or Islamic Beliefs" or used similar words. These results confirmed the results obtained from the quantitative part of the questionnaire (Al-Badi and Mayhew, 2004).

2.4 Colours: Nationality and Gender Perceptions

The question as to whether colour has any national significance was indicated by the strong preference for green amongst Arabs although this was more religious than national significance as this is the colour of Islam. The favourite colour of British was blue but there appears to be no particular reason for this and blue was a popular colour with Arabs as well. The survey showed, however, that *gender* has some effect on the choice of favourite colours. Females tended to prefer soft/light colours such as purple, pink or blue whereas males tended to prefer dark colours such as black and green. To investigate whether the six selected colours had a specific meanings, the respondents were given a number of options for each colour and asked the following question: What do the following colours mean to you? (For each colour please select the closest meaning). The highest rated two meanings for each nationality are shown in the table 1, and the highest rated two meanings for each gender are shown in table 2.

Table 1. Meaning of Colours Nation-wise

Colour	Arab		British	
	1st	2nd	1st	2nd
Black	Nothing	Formality	Formality	Nothing
Blue	Freedom	Truth	Nothing	Tranquillity
Green	Nature	Safety	Nature	go
Red	Danger	Attention	Attention	Anger
White	Peace	Neutrality	Neutrality	Nothing
Yellow	Nothing	Happiness	Nothing	Happiness

Table 2. Meaning of Colours Gender-wise

Colour	Male		Female	
	1st	2nd	1st	2nd
Black	Formality	Nothing	Nothing	Formality
Blue	Freedom	Nothing	Freedom	Nothing
Green	Nature	Safety	Nature	Safety
Red	Danger	Anger	Attention	Anger
White	Peace	Neutrality	Neutrality	Neutrality
Yellow	Nothing	Happiness	Nothing	Happiness

By looking at the tables above, there appears to be little, if any, difference either nation-wise or gender-wise. In fact there is almost a consensus on the meaning of listed colours. It must be remembered that although the British and Omanis have similar views of the listed colours, it does not mean that other nationalities will share their opinions. The survey has not uncovered any significant colour preference for website design but nevertheless, has shown that the cultural significance of, and gender preferences for, certain colours should be taken into account when designing these websites.

3. CONCLUSION

The general comments of both groups highlighted the importance of the website aesthetics or what is called "design consistency", contents and navigation. The British respondents also highlighted the importance of the overall effect, page layout, target-computing environment and the site's readability. In addition, the Arabs were more concerned than the British about the website performance, that is, the speed of rendering a web page. The security of a website was an issue raised by the Arab respondents but not by the British.

Regarding the type of images/graphics on a website, the British showed that they have a fairly relaxed attitude to anything they see on these sites, whereas the Arab audience was rather more attuned to culture and religious beliefs in their answers. The national significance of colours was limited to the green colour by the Arabs which might be due to the fact that it is the colour associated with Islam; otherwise the views of the two groups were basically similar. The two groups also shared similar views on the interpretation of the meaning of the listed colours.

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MODELLING CONTEXT FOR THE DESIGN OF REMOTE ELECTRONIC VOTING SCHEMES

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ABSTRACT

There exists in the academic literature, a plethora of electronic voting schemes (for example Cranor & Cytron 1997, Benaloh & Tuinstra 1994, Juang, & Lei 1997). Typically, proposed schemes are accompanied by a description of the properties that an implemented electronic voting scheme would be expected to exhibit. These properties are described informally as for example, ``ballot secrecy'' or ``universally verifiable''. To evaluate the proposed scheme, these informal notions are commonly incorporated in a mathematical model before a proof is outlined demonstrating that the proposed scheme does indeed exhibit the necessary properties.

A disadvantage of this approach is that the required properties for a electronic voting schemes are implied to be static, with each new scheme to be evaluated against that standard. However, the context in which a voting system is employed varies considerably. Voting systems are employed in a variety of applications, with varying properties required as a result. Even voting systems that are employed in similar contexts, such as different electoral systems, exhibit varying properties according to the priorities of an entity organising a vote.

This paper outlines the perceived failing of the current approach to designing and implementing electronic voting schemes, with regard to the considerable variation in the properties required. In addition, an approach is outlined that models the required properties of voting systems with the intention of providing a basis for evaluating electronic voting schemes in a particular context.

KEYWORDS

Context for Electronic Voting

1. INTRODUCTION

In the academic literature, the design of electronic voting schemes has commonly been assumed to be an application of cryptography (Murk 2001, Rjašková 2003). Indeed, a plethora of electronic voting schemes employing cryptographic primitives have been proposed, analysed and refined, for example, (Cranor & Cytron 1997, Benaloh & Tuinstra 1994, Juang & Lei 1997). Typically for such proposals, before the new electronic voting scheme (or refinement of an existing scheme) is introduced, the properties against which the scheme will be evaluated are defined.

Implicitly in this consideration is the distinction between a *voting system*, which specifies certain properties as to how the vote will be conducted; and a *voting scheme*, which should be implemented with the desired properties. The voting system is therefore the specification of how a decision will be reached, via some vote casting process, a definition similar to Farquharson's (Farquharson-1969). The properties of the voting system may be defined informally for example, ``*secrecy: only the voter may know how they voted*'', before being modelled more formally alongside the cryptographic primitives of the new scheme. Proofs are then developed in order to demonstrate that the scheme does conform to the required properties for the voting

system. Some indication of the complexity of the voting scheme, with respect to number of computations or communications for different participants (voters, election authorities etc) may also be included.

The assumption that remote electronic voting schemes require cryptography does result in some limitations for the schemes. Most significantly, each voting scheme is only evaluated within a specific voting system context. The potential applicability of electronic voting schemes is limited to voting systems that mirror the particular properties that the scheme is shown to satisfy. Such properties may sufficiently describe a single voting context, but there is no indication of the appropriateness of the voting scheme with regard to other voting system contexts. This limitation may be illustrated by the range of electronic voting schemes that have been proposed for highly specific contexts, for example Jury Voting Protocols (Hevia & Kiwi 2002) or circumstances where the relationship between votes and voters may need to be revealed (Lee 1999). More subtly, the range or properties associated with voting systems used to select representatives for government of organisations (electoral systems) prevents electronic voting schemes developed for one electoral context unsuitable for another.

By example, consider the electoral system for the United Kingdom (UK) and the Republic of Ireland (RoI). Both currently employ a paper ballot and ballot box voting scheme, and so it may be argued that the scheme employed in the UK is transferable to the RoI. However, the specific implementations of the voting scheme vary to reflect the required properties of the voting system. The UK electoral system employs a simple plurality mechanism for choosing a single candidate in a constituency (RPA 1983), whereas single transferable vote is employed in RoI (Jackson 1997). As a consequence, Irish voters must mark the ballot paper with an ordering of candidates, an action which would spoil a ballot in the UK. More significantly as a result of a legal ruling, the marking of ballot counter-foils with a voter's electoral roll number is specifically barred in the RoI, in order to guarantee that in no circumstances can a voter's choice be identified (McMahon 1972). In the UK, the same technique is employed to permit a scrutiny of ballots in order to remove those found to be cast illegally from the tally (Jackson 1997).

This example indicates that although there has been a substantial body of research developing electronic voting schemes, there has been less consideration of the context in which an electronic voting scheme may be deployed. This presents a difficulty for election administrators, and indeed for commercial vendors, since at present, there is no appropriate framework for deciding which electronic voting scheme is optimally suitable for a particular context. Indeed, such a framework might indicate that no existing electronic voting scheme adequately satisfies a particular context for a voting system.

2. PROPOSED MODELLING FRAMEWORK

The above introduction outlines the difficulty of evaluating and comparing the properties that voting systems require for their implementing voting schemes. To remedy this situation, it is proposed to develop a modelling framework for voting systems that identifies the particular properties required for an implementing voting scheme. Using this model, it is anticipated that, for example, election administrators would be able to determine the properties of the voting system for their context. This model would then be employed in choosing an existing voting scheme that is demonstrated to be suitable, or for vendors to develop a new voting scheme for the context desired by a vote administrator. The significant contribution of this approach would be permit the context of a voting system to be specified within a standardised framework, permitting the evaluation of voting schemes in different contexts.

In the remainder of this paper, the scope of the various components of the proposed framework is outlined. An outline of the various parameters that will be specified for each component is included to outline how the new framework will be constructed.

Secrecy

As noted above, secrecy is a commonly assumed property required by voting systems, particularly electoral systems. However, as noted in the comparison of UK and RoI electoral law, the notion of what constitutes secrecy varies considerably, depending on the context of a voting system. Including statistical information regarding the vote (the tally of values cast, for example) further complicates the notion of secrecy. For example, certain jury voting systems require the result of a vote to be announced as being within a certain

threshold (unanimous guilt, undecided etc), rather than the precise tallies of votes. In other circumstances, far more information is released regarding the vote, for example in committee voting where votes are recorded as being associated with their choice. In order to model the secrecy requirements of a voting system, it is proposed that the release of information concerning votes cast be specified by a set of *permitted channel*s. Each channel is specified by a set of properties:

- Participants - roles within the voting system. This may include voters, voting authorities, external observers, or other roles necessary for the voting system. An entity may adopt several roles in parallel during the operation of the voting system.
- Capabilities - the on the channel (read and/or write). Through the specification of Participant capabilities, types of channel are identifiable.
  - Unicast - a single participant in the voting system has read capability.
  - Multicast - at least two participants in the voting system have read capabilities.
  - Broadcast - all participants in the voting system have read capability.
  Given that an entity may adopt several participant roles simultaneously, the framework must also provide the capability to regulate participants active on several channels.
- Persistence - the period through which participants may employ their capabilities. The persistence of a channel may be further specified by a start and stop event, for example a date and time.
- Legal Content - the information that may be legally written onto the channel by a participant with the appropriate capabilities.

Through this approach, all information is assumed secret, unless permitted for release via a designated channel. This approach permits a concise definition of secrecy for a voting context, and in particular permits an evaluator to determine whether a voting scheme releases extra information than is desirable.

Verifiability

Ensuring that information released concerning votes cast is a requirement commonly associated with voting schemes designed for electoral systems (Benaloh & Tuinstra 1994). Verifiability for electoral systems is often complicated by the requirements outlined above, which limit the amount of information released concerning votes cast. However, which particular components of information need to be verified varies between voting systems. Further, the action of verifying different components is the capability of different participants in the voting system. Consequently, verification requires the following parameters to be specified:

- The specification of a component of information generated for the voting system to be verified.
- A participant who wishes to verify the information from the voting system.
- The criteria by which the participant will decide whether they have verified the information from the voting system. This criteria should not make reference to the verifying mechanism, a consideration for the particular voting scheme implementation.

Complexity

The complexity of a particular voting system has considerable impact on the choice of voting scheme to implement. For electoral systems, where a considerable variation exists in the methodology for electing representatives exists (various proportional and plurality systems for example), the choice of an implementing mechanism that would ameliorate increased complexity for the voter may be desirable. Further, voting schemes that reduce the effort required by authority participants to compute a tally for complex electoral systems may also be desirable. However, modelling complexity for voting systems is non-trivial, and may be expressed in a number of elements of the system.

To begin the modelling of complexity for vote casting, it is possible to provide a generic definition of a vote for which parameters may be chosen to model a particular voting system. Such parameters would include:

- Number of options on the ballot
- Maximum and minimum number of options to be selected by the voter.

- A yes/no option as to whether an ordering is applied to the options selected by the voter.

Other, more complex requirements also need to be specified, for example, the number of interactions necessary between participants during vote casting. Evaluation of a voting scheme against complexity requirements thus provides a description of practicality, independent of the assurance achieved for secrecy, verifiability, or other requirements.

3. CONCLUSIONS

Research into electronic voting has resulted in a considerable number of schemes that are analysed with respect to the particular properties they exhibit, rather than the particular context within which they may be employed. The framework proposed here attempts to remedy this deficiency by providing a standard method for specifying the properties of voting systems. This framework, rather than evaluating each voting scheme in isolation, would permit each to be evaluated against particular requirements as specified by the context of a voting system, rather than the designers of a voting scheme.

ACKNOWLEDGEMENT

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AN ARCHIVING MECHANISM FOR REAL TIME VIDEO TRANSMISSION EMULATION IN PACKET NETWORKS

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ABSTRACT

This paper proposes a framework for real time video transmission emulation in a packet network using devices incapable of encoding in real time. It can also emulate a number of real time streams from a single inadequate PC permitting a pragmatic traffic generator capable of flooding an experimental network for testing purposes. Video is considered in one of two classes: (i) On Demand (OD) and (ii) Real Time (RT). For OD video compressed sources are archived to be requested and subsequently transmitted to the recipient independent of time. For RT the video is transmitted from the archive to emulate RT by gating appropriately. The method consists of two stages: one for archiving and the second for transmission, with packet release time estimated from knowledge of the frame rate, frame alignment policy and the encoding standard being used. Experiments are presented to show the operation of the method described.

KEYWORDS

Multimedia Transmission, Real Time Video Transmission, Video Transmission Emulation, Video Archiving.

1. INTRODUCTION

A real time transmission is limited by network capacity, available bandwidth, traffic load and router/switch capability. Transmitter/receiver capability is a key factor in the multimedia transmission. At both ends the limitations are: codec performance, operating system house keeping, memory requirement and processing power. The encoding process particularly requires large resources compared to the decoder and tends to be the limiting factor in the communication. Even in today's commercially available platforms only small image size and low frame rates are possible using an 'off the shelf PC'. Multiple source generation is therefore prohibited from a single PC because of resources.

In this contribution video is considered to exist in one of two classes: (i) On Demand (OD) and (ii) Real Time (RT). For OD video compressed sources are archived to be requested and subsequently transmitted to the recipient. The requested data can be buffered in a streaming application or simply archived for later play out. This can be achieved using multicast (Chih-Chang H. et al. 2003) or broadcast protocols (Choi C.C.Y. and Hamdi M. 2003; Kulkarni S. 2003; Hu A. 2001; Cleary K. 1995). Example OD applications include tele-shopping, video games, Cinema-Theatre, advertising, catalog shopping, news and sports reviews.

For RT, video is usually transmitted as it is being captured, assuming the hardware has sufficient capability. The encoder delivers packets to the network as soon as they become available and the decoder must accommodate the loss, delay and jitter which occur. Techniques are available to facilitate different classes of delivery for real time transmission (Paris J.-F. et al. 2003; Hong Z. et al. 2002). Example RT transmissions are online TV, video conferencing and tele-surgery.

In an experimental network which seeks to evaluate traffic performance the availability of RT video is important. Dedicated hardware is generally required since software codecs are only capable of low

fidelity/frame rates and are significantly impacted by the operating system house keeping. An alternative approach is to encode the video off-line, archive it and then release it to the network by gating at the appropriate time as if it were encoded in RT. To achieve this requires knowledge of frame rate, picture structure, Group of Blocks (GOB) structure, block structure and their associated time values. By achieving this it is possible to create RT traffic from the network perspective using low-end/low-capability software processing. It is then possible for a traffic generator to randomly access portions of the pre-encoded files and in doing so create unique yet truly representative video streams for simulations and experimental purposes.

This paper is divided as follows. Section 2 describes the method for archiving the encoded video. Section 3 explains the method for transmission of the archive. Section 4 presents three experimental scenarios and results. Finally, section 5 concludes the paper.

2. ARCHIVING

The archiving method describes the formatting and archiving process itself. There are three main associated activities: video coding, pseudo-packetising and storage. The method is defined as follows:

Step 1 Video Coding: the video is encoded in the normal way according to the host platform capabilities. The boundaries of each (GOB) are identified. An estimate is made for the frame rate on a picture by picture basis since the instantaneous can vary according to bit-rate constraints. Full knowledge of the codec being used is unnecessary; nevertheless, frame rate and GOB identification are compulsory for true emulation.

Step 2 Pseudo-packetising: integer multiples of GOBs (application level framing) are stored into a pseudo-packet. The packet is formed using a header to control the release time in RT transmission emulation, followed by the payload (encoded stream). The header is formed by inserting the frame rate, payload size, media type, last I frame and packet number within the frame. The frame rate field stores the rate at which the video was encoded and intended to be displayed. The payload size of the pseudo-packet is indicated in the next field. The media byte has options related to type of encoding (I, P, B), and the media type i.e. audio, video, still or meta-tag. The I frame number from which the pseudo-packet is predicted is contained in the last I frame field. This permits the identification of dependents during network transport and allows network efficiency arbitration to be performed (under current investigation). The frame number to which the packet belongs to is shown in the frame number field.

Step3 Video Storage: the built packet is sequentially stored into a file. The archive, determined by the size and number of pseudo-packets contained in it has a finite size but can be used to generate infinite sequences by randomly accessing arbitrary portions of it as required.

3. TRANSMISSION

In the process of transmission two factors are considered: i) addition of a transmission time field for network arbitration and ii) calculation of release time. The release time is derived from the frame rate, packetisation policy and the encoding standard. The transmission method is defined as follows:

Step1 File reading: the file is read from disk and the size determined.

Setp2 Building transmission packet: a pseudo-packet is read and the control header field examined. Two new fields are added to the header, they are: flow packet number and transmission timestamp, due to its absence in UDP. They are used for packet loss, delay and jitter estimation.

Step3 Packet transmission time calculation: the packet release time is calculated by using formula (1). The GOBs_per_frame is defined by the codec standard being used and should be known a priori. The packetisation policy (JongWon K. et al. 2000; Rhee I. 1999) defines the number of GOBs_per_packet. The GOB number within the frame is specified by n.

$$TxTime = \frac{1 * n}{frame\_rate * GOB\_per\_frame * GOB\_per\_pkt} \qquad (1)$$

4. EXPERIMENTS

Three experiments are performed to illustrate the practical operation of the methods discussed: 1) direct transmission from the video encoder 2) real time video transmission emulation for a single stream 3) multiple and concurrent real time transmission emulations. The network statistics studied are bit rate, packet length, interarrival time, delay and packet loss. The first three metrics are obtained by using the TFPFLW (Paredes M.) statistics tool. The received video quality is assessed according to PSNR. The experimental QoS Research Network consists of a series of Linux boxes running Red Hat 7.2 and Kernel 2.4.7-10, with Zebra routing software running BGP. The routers are synchronized using the Simple Network Time Protocol (SNTP). The system runs on 10 BaseT Ethernet and uses any available second hand PCs. 10 BaseT is used instead of higher bandwidth Ethernet to permit flooding and congestion using our proposed RT system. The network is divided into three autonomous systems. One assigned for the core routers and the other two for the edge routers. The transmitter runs the Real Time Linux Kernel 2.4.18 (KURT- Kansas University Real Time Linux).

Three video sequences are studied in the experiments. These sequences characterise high (Rugby), medium (Weather) and slow (Interview) motion content. The sequences are encoded using an H263+ encoder. Each video sequence has 1110 CIF images and they are encoded at 30 frames per second. An I frame is forced every 10 frames.

Experiment 1: An H263+ video sequence (Interview) is transmitted directly from the encoder as it is being encoded on a low end machine incapable of RT generation.

The packet flow inter-arrival time is shown in figure 1a. It is observed that most of the packet's arrival times fit within the 5-22.5 milliseconds range. This is reflected in the burstiness and bit rate variation presented in figure 1b. The bit rate fluctuates from 0 to 120kbit/s. This is caused by the processing time taken by the transmitter to perform the encoding itself. As the processing time and power needed to encode increase the transmission bit rate decreases. About 80 % of the packet sizes fit within the 1- 4kbit size range. PSNR is higher for the first 100 received frames. It takes approximately 1-2 seconds to encode a frame on the hardware employed. The results show that for the economical infrastructure used here real time transmission is unrealistic.
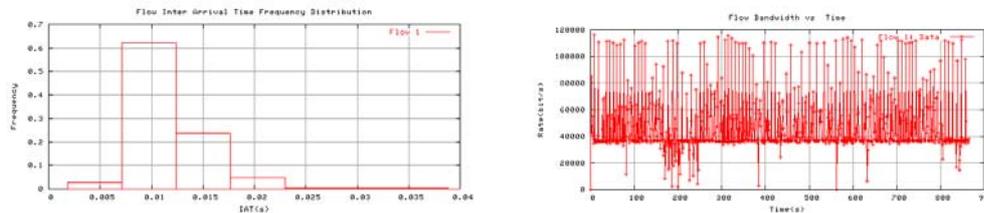

Figure 1. (a) Inter Arrival Time Frequency Distribution   (b) Tx Flow Bandwidth

Experiment 2: the video sequence from experiment 1 (Interview) is encoded, pseudo-packetised and archived. Subsequently, the video archive is packetised and transmitted according to the transmission method from section 3. It is observed that packets are now transmitted with a different pattern from experiment 1. About 98 percent of the packets are transmitted within a time range of 2.05-2.1 milliseconds as shown if figure 2a. This time range is caused by a small frame rate variation where the desired frame rate (30 frames per seconds) is not achieved by the encoder. This pattern fits the expected transmission time calculated from equation (1). The obtained frequency distribution is reflected in the smooth pattern of the flow bit rates observed at transmitter (see figure 2b).
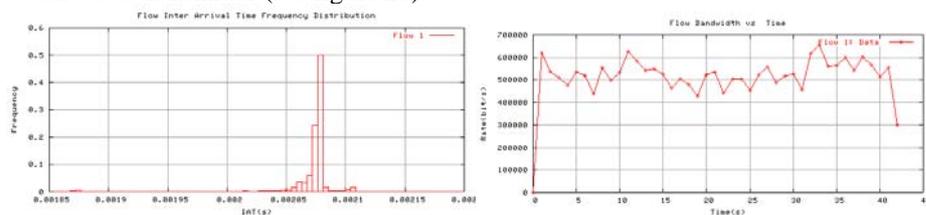

Figure 2. (a) Inter Departure Frequency Distribution   (b) Tx Flow Bandwidth

Loss is observed and may be caused by network congestion, background traffic or the limited buffer capacity at the routers in the transmission path. However, the video quality is acceptable (32 dB) for most of the frames (1-650).

Experiment 3: the previous experiment is extended to study the concurrent RT transmission of three archived video sequences: interview, weather, rugby. The same transmission pattern from experiment 2 is observed for the three sequences. The bit rate and its variation are related to the motion content. It also dependents on the GOB size contained in its payload. The traffic smoothness is a result of the small time range in which most of the packets are concentrated for the inter-departure time. The PSNR for Interview is the one most affected, given the compromised network conditions caused by the concurrent transmissions.

5. CONCLUSIONS

This paper presented a framework for real time video transmission emulation in a test packet network using devices incapable of encoding in real time. An RT archiving mechanism was presented, where video is encoded off-line, archived and then released to the network by gating at the appropriate time as if it were encoded in RT. The method consisted of two parts; the first one for archiving and the second for transmission. Packet release time was estimated from knowledge of the frame rate given by the pseudo-packet control header, the frame alignment policy and the encoding standard being used.

Three experiments were presented. In experiment 1, for the economical infrastructure used; real time transmission is shown as unrealistic. Experiment 2 generated RT transmission patterns using the framework, and showed that the traffic is indeed real-time in nature. Experiment 3 demonstrated the use of multiple concurrent streams generated from the same PC, which ordinarily is incapable of coping with a single RT transmission.

Using this scheme a unique traffic stream may be generated, by randomly accessing groups of pictures from the archives. Thus traffic generation for network flooding and packet loss creation for experimental purposes becomes trivial, yet still maintains the RT traffic signatures. Whilst it is acknowledged that the addition of control headers decreases the utilisation this should be seen in the context of other experiments (Siller M. and Woods J. 2003) where it is used for Quality of Service network arbitration purposes.

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M-COMMERCE PAYMENT SYSTEMS IN SOUTH KOREA

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ABSTRACT

With the growth of information and communication technologies, various new developments are taking place in the world. One of the major developments, which are gaining important in Korea, is mobile payment system. The objective of this paper is to discuss overall view of mobile payment systems and its impact on m-commerce in Korea. In the first part of the paper, mobile commerce in Korea is characterized. Subsequently, mobile payment mechanism is described by analyzing two major mobile operators focused on their payment service. Future research directions are given and implications of the study are discussed.

KEYWORDS

Mobile commerce, Mobile payment systems, Wireless Internet.

1. INTRODUCTION

Internet and related technologies are becoming more prominent and their usages are having wider both in developing and developed countries. With the rapid development of information technology, payment services have been one of the major applications of mobile commerce. All these happened to be backed up certain technological advantage in that country. In recently years, Korea came into the mainstream along with the mobile payment systems. Based on well-established infrastructure, the trend for utilizing mobile payment systems is noticeably increasing in Korean market.

This paper looks into the application of the mobile payment systems and driving forces for utilizing them in Korea. The remainder of this paper is organized as follows. In section 2 we discuss the literature review of mobile commerce and its payment systems. Next in section 3 we describe the general environment and the structure of mobile payment markets in Korea and perform case study. Finally, in section 4, we present the main conclusion of our research and delineate future related research.

2. OVERVIEW OF MOBILE PAYMENT SYSTEMS

Several researchers defined mobile commerce and mobile communications in various ways. Mobile commerce is defined as any transaction with a monetary value that is conducted via a mobile telecommunications network (Zheng and Chen, 2003). Mobile communications can be defined as delivery of

content, notification and reporting including transactions with mobile devices (Kumar and Zahn, 2003). As the markets are moving global with shifting working conditions from desk to the different locations mobile phones are increasingly becoming essential to both businesses and the Organizations. Unlike fixed telephones, mobile telephones can adjust to these emerging conditions of work anywhere and any time transcending the geographical boundaries. Most of these applications are promising in Europe and Asia (Dholakia and Dholakia, 2002). More particularly in East Asia, Korea has a better-established infrastructure and a stronger customer services to suit to these emerging conditions. Korea has also introduced advanced and effective technologies such as VDSL (Very High Speed DSL), IMT2000 that applies both to wired and wireless Internet. One of the most important features of mobile commerce is that it is not a single entity and its success depends upon several other related industries both software and hardware fields (Barnes, 2002; Sabat, 2002). Thus, the essence of digital economy lies in a proper cooperation, coordination for any activity to become successful. This phenomenon is widely seen in mobile industry. In these industries there is a fundamental split in business models between customers and the supporting services with underlying communications networks and the ownership of rights to offer wireless services through there devices.

The term "mobile payment" means payment methods that are based on the mobile phone (Henkel, 2001 Mobile payment is becoming a major area in mobile commerce. Many research surveys predict that worldwide mobile commerce market will reach more than $200 billion by 2004 (Vetter and Kalakota, 1999). It means that there will be a rapid growth in the areas of mobile shopping and mobile advertising in future. There are several payment methods both existing and which are developing (Zheng and Chen, 2003). There are two methods, which are commonly used. First, the account-based system is where a customer is associated with specific number, which is provided by Internet Payment Provider (IPP), and accordingly the customer is billed based upon his balance in his card. Second, in token-based payments method a customer has to convert currency to their electronic equivalent in the form of tokens. The payment methods vary in time and space. In the following section we will discuss under Korean conditions with two major players in the market.

3. THE CASE OF SOUTH KOREA

Korea is becoming a huge market for mobile business with the success of Internet business and online transactions. With the introduction of IMT-2000 service this market is expected to increase dramatically (Park et al., 2002). E-commerce market in Korea is now shifting its customers towards mobile commerce with mobile ticketing and payments. Mobile commerce market in Korea is divided into three mobile operators: SKT, KTF and LGT which are based upon CDMA technology. The number of users as of January 2003 exceeded 35 million surpassing the fixed –line users. Because of high sophisticated infrastructure it took very shot time to penetrate into the market. As of January 2003, the market shares of SKT, KTF and LGT were 53%, 32% and 15% respectively. Their respective shares of wireless Internet service were roughly the same at 51%, 35%, and 14% as shown in Table 1.

Table 1. Market share in the mobile communication market (Yoon et al., 2003)

	SKT	KTF	LGT	Total
Mobile internet subscriber	14,789,000	10,241,000	4,055,000	29,085,000
Market share of mobile carriers	50.8%	35.2%	13.9%	100%
Mobile service subscriber	17,220,000	10,333,000	4,790,000	32,343,000
Market share of mobile carriers	53.2%	31.9%	14.8%	100%

With the introduction of CDMA 2000 1x/EV-DO service, the mobile market is in a rapid phase of development. In near future it is expected to grow at an average annual rate of 18 trillion won by 2007 (Yoon et al., 2003). Wireless technologies have developed a wide range of products and services in a constant and systematic phase in Korea. So far, three kinds of services has introduced in mobile market. First, CDMA 2000-1X was introduced with QUALCOMM's technology in October 2000 with transmission speed of 144Kbps. Second, in 2002, SKT and KTF launched EV-DO technology which can transfer data at up to 2.4Mbps which is 16 times faster than the transmission capability of CDMA 2000-1x as shown in Table 2. The new 3G services were introduced in Korea in 2003 based on W-CDMA technology known as IMT-2000, which is launched by KTF and SKT (Seo et al., 2003).

Table 2. Wireless technologies in Korea (Seo et al., 2003)

	2G		3G
Specification	IS95A/B	CDMA 2000-1x	CDMA 2000-1x EVDO
Mobile carriers	SKT, KTF, LGT	SKT, KTF, LGT	SKT, KTF
Coverage	National wide	National wide	Metropolitan, Provincial cities
Service starting date	Oct 1999	Oct 2000	May 2002
Switching method	Circuit switching	Packet switching	Packet switching
Maximum speed	14.4 ~ 64Kbps	144Kbps	2.4 Mbps
Killer services	SMS, Download, Browsing	Image VM-based services	MMS VOD

There are various mobile content services such as short messaging services, downloading, video streaming, multiplayer games, and mobile payment, which provide support for transaction processing in Korea. Regarding mobile payment, SKT offers a variety of service applications such as purchasing, transport services, auctions, and shopping, whereas KTF introduce mobile payment system with brand name "K-MERCE". As mobile payment services become mature market, the role of two major players, SK and KTF, capturing 86% of the market share also becomes very important as well. Korea's mobile commerce can be understood with analyzing both SKT and KTF as mobile operators at a given point of time. SKTs history dates back to 1984 when it started with Korea Mobile Telecommunications Service Co., a government run agency that was acquired by SK Group, which is a major shareholder of the company. SKT has introduced variety of new services that includes mobile media, wired and wireless integrated multi-internet service, financial network with a cellular handset, global roaming service, and network service. In November 2002, SKT commercially launched a full-featured mobile payment system called "MONETA" which is a mobile terminal enabled e-wallet relying on IrDA communication by Points of Sale+ SIM card +PKE+AAA Server (Kim, 2002; Chung, 2003). This gave a boost to the mobile commerce business in general, which then introduced all types of mobile commerce transactions such as catalog sopping, Internet banking, online gaming over cellular pones, PDA's, and other mobile instruments. MONETA further helps the customer in making calls, payments for public transport, and membership services (Kim et al., 2003). Figure 1 illustrates the structure of MONETA service. As of December 2003; 800,000 of SKT subscribers availed MONETA services and they are expected to increase this service to all of SK subscribers by 2004 to take advantage of the existing 50% market share of SKT (Kim et al., 2003). This will certainly spread widely across all sections even to common people of this time.
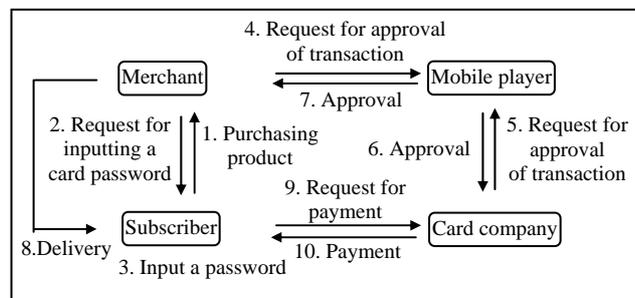

Figure 1. MONETA service (Kim et al., 2003)

KTF, the second largest service operator in Korea, was established in May 2001, which later merged with Hansol PCS Corp. KTF introduced its mobile payment system K-MERCE in June 2002 and later upgraded it to new K-MERCE phones on IrFM communications in December 2003. K-MERCE is providing various wireless solutions for personal finance, shopping and payments all on one cellular phone. K-MERCE services are divided in to three categories such as finance which provides services like banking and payments, sopping which allows purchasing, reservations and tickets purchasing, and payments that provides services to pay on/off line with a mobile phone using methods such as electronic wallet and phone. MONETA and K-MERCE have widely accepted as a common payment media with the recent strategic alliance between mobile operators and bank companies.

4. CONCLUSION

From the review of literature and case study, we learn that there is much chance for m-payment system to happen in Korea. Through a discussion we came across the following findings. First, the results from case study clearly reveal that mobile payment systems have widely accepted in Korea. Our results show that the rapid spread of mobile payment systems is strongly related to the initiatives such as sensitive in adopting new technology, continuous providing of new contents related to the mobile payments services, and well established infrastructure. Korea has utilized successfully this situation very well. It also utilized its widespread and advance infrastructure up to its requirements. This was well taken by its population who are receptive in adopting new technologies, which are advanced by respective companies. Second, even though higher levels of support are noted in mobile payment service area, Korea has problems still hang in around such as lack of core technologies, financial problems in the economy and some emerging privacy problems. This result lead us to the conclusion that with a proper approach to these problems both at policy level and at implication level may successfully give the world a concrete and standard mobile payment system.

The findings of this paper provide several contributions to theory and practice. The main business benefits of this study can be summarized as followings. First, with the rapid growth of m-commerce, mobile payment systems play an important role as a tool for providing transaction efficiency. Second, we give some implications both on the development of those technologies itself and at the same time its implications on the wider spread of those technologies. This study has the following limitations that needed to be overcome in the future research. First, some other academic references related to mobile payment systems should be reviewed thoroughly. Second, Our works focus on overall view of Korean mobile payment systems due to characteristics of Korea's informatization status. Therefore, more detailed case studies focused on transaction process of mobile payment systems in Korea should be conducted.

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EVALUATING INFORMATION AGENTS' IMPACT ON DECISION PERFORMANCE

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ABSTRACT

The constant development of the information and communications technologies (ICTs), associated with the growing use of the Internet, leads to information overload, which is aggravated by the diversity of information sources and formats. This situation makes it very hard to select and process the information required to support the decision-making process. The objective of this research project is to identify some aspects in which the intelligent software agents may benefit the decision-making process, namely by improving the performance of information research and selection over the Internet.

KEYWORDS

Intelligent Agents, Information Systems, Decision-Making, Information Search, Information Relevance.

1. INTRODUCTION

The quality and efficiency of the decision-making process has benefited from research due to its relevance to organizations performance [10,26].

In order to ground a good decision, the decision-maker needs to gather the most relevant information for the process because of: the instable, highly competitive and constantly mutating environment that most organizations are facing [1, 2]; and of the constant developments in the information and communications technologies (ICTs), such as the growing use of the Internet, that are causing information overload [4, 12, 14, 19, 21].

Several authors propose the intelligent software agents as the most adequate technology to deal with information overload [12, 14, 18, 21, 25]. Nevertheless, the volume of research on the use of this technology in the decision making process is limited. The present work proposes a framework to evaluating information agents regarding their ability to moderate the information overload problem as well as to improve the timeliness and the relevance ratio of the information obtained to support the decision making process.

This paper is organized as follows: Section 2 provides a brief literature review; Section 3 formalizes the research hypotheses and proposes the Agent Evaluation Model; and, finally, Section 4 presents the concluding remarks and future work.

2. LITERATURE REVIEW

Decision-making is associated with the moment of choice of an alternative, among several alternatives available. However, it involves a whole process, of several interconnected and interdependent steps, that requires the realization of a set of activities [16,22].

The two most relevant models of decision-making processes are: the Simon's model [22], composed of three phases: Intelligence (identifying the problems that need decisions), Design (identification of possible alternative directions or solutions) and Choice (selection of a direction or solutions); and the model of Mintzberg et al. [16], also composed of three phases: Identification, Development and Selection. Mintzberg's model offers additional details that result in an increased complexity. For the objectives we have in mind, we consider that it is adequate to add to Simon's model some detail inspired by Mintzberg's work, which results in the model in Figure 1.
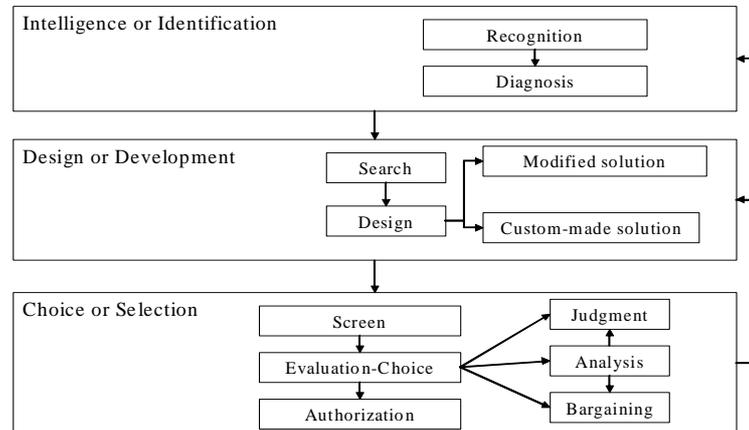

Figure 1. Decision Making Process

The decision-making process may benefit from the contribution of intelligent software agents [27]. An intelligent software agent is a computer program acting on behalf of the user in an autonomous way, without the need of human supervision [12, 14, 18]. So, the agent releases the user from doing boring and repetitive tasks, as an human assistant would do [12, 14, 18].

Wooldridge and Jennings [28] are pioneers in systematizing and pointing out a set of attributes that qualify a software or hardware system as an intelligent software agent. These attributes are organized in two groups: the essential properties, which correspond to the weak notion of agent, and the optional properties, that refer to the strong notion of agent. The weak notion is based in the following essential properties: autonomy, social-ability, reactivity, proactiveness and persistence [28]; the strong notion considers the following additional properties: mobility, veracity, benevolence, rationality, learning, cooperation, intentionality and character [8, 18, 28].

3. PROBLEM, HYPOTHESES AND RESEARCH MODEL

3.1 Research Problem

The research question is: *Weather the intelligent software agents can provide significant contributions to the decision making process?* This question is addressed analyzing the software agents' features, and the features of the different phases of the decision-making process.

We found support in the literature regarding the advantages of using agents in the following activities of the decision-making process: (a) Search and filtering of information in several stages of the decision-making process [12, 18, 24, 25, 27]; (b) Support in the use of decision-making technologies [12, 13]; (c) Support in the choice of models and techniques that fit the decision maker profile and the problem [20]; (d) Replacing the decision maker on routine and repetitive decisions [13, 17, 18].

Analyzing these activities and considering the current development degree of the intelligent software agents, that includes the information agents, which perform laborious information gathering tasks, such as: locating and accessing information from different on-line information sources; resolving inconsistencies in the retrieved information; filtering away irrelevant information; integrating information from heterogeneous

information sources; and adapting over time to their human users' information needs [6], we selected the search and filtering of information in several stages of the decision making process as the focus of the study.

Focusing on the information agents participation on the search and filtering of information, we refine the question as: *Which is the impact of the use of an information agent over the decision making process, in what regards to the decision quality, process efficiency and decision maker satisfaction?*

3.2 Hypotheses

The use of intelligent software agents in the search and retrieval of information from the Internet increases the proportion of relevant information in the set of information retrieved [4, 11, 12]. In order to evaluate the impact of an information agent in the relevance of the information retrieved from the Internet, we adopted a measure called "Precision", which is defined as the fraction of pages retrieved that are relevant [15]. Our first hypothesis is that:

H1: The use of information agents to support the decision making process, in the search of information stage, improves the Precision of the search.

Assuming that intelligent software agents are a kind of decision system, they will be evaluated based on Evans and Riha [7] System Evaluation Criteria, which include efficiency and effectiveness. The contribution of the decision quality to the effectiveness score leads to the second hypothesis:

H2: The use of information agents to support the decision making process, in the search of information stage, increases the quality of the decision.

Evans and Riha [7] consider the time of decision as an efficiency criterion, what contributes to the third hypothesis:

H3: The use of information agents to support the decision making process, in the search of information stage, decreases the information gathering time, and consequently, decreases the decision duration time.

Several authors claim that user satisfaction and confidence on the final decision are positively correlated with the future use of the information system [3, 5, 23], which is considered by Evans and Riha [7] and Iivery and Ervasti [9] as an efficiency criterion. So, the fourth and fifth hypotheses evaluate the impact of the information agent in the decision maker's perceptions:

H4: The use of information agents to support the decision making process, in the search of information stage, increases the decision maker satisfaction with the process.

H5: The use of information agents to support the decision making process, in the search of information stage, increases the decision maker trust in the solution found.

3.3 Agent Evaluation Model

The Agent Evaluation Model presented in Figure 2 graphs the hypotheses above according to which the use of an information agent will result in higher Precision which, in turn, will result in increased decision quality, increased effectiveness of the decision process and increased decision maker satisfaction and confidence.
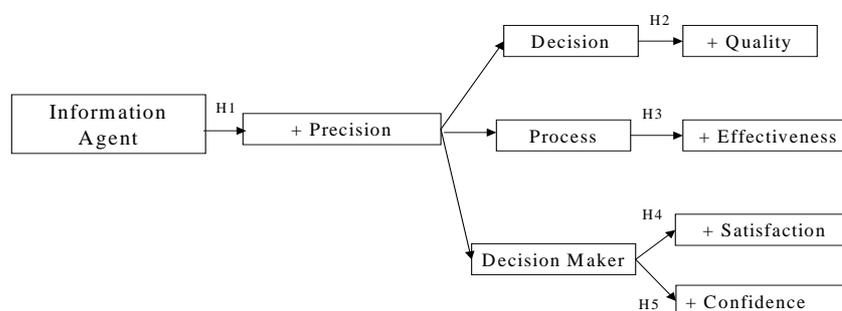

Figure 2. Agent Evaluation Model

4. CONCLUDING REMARKS AND FUTURE WORK

The current work reviewed the relevance of the decision-making process and the potential that intelligent agents may offer to improve it. Since the analysis of the intelligent agents' contributions focused on the tasks of searching and selecting the relevant information to the decision process, we focused on a specific type of intelligent agents: the information agents. Regarding the information agents impact on the decision-making process, we proposed a model, whose applicability, we intent to test in future work to evaluate it.

This project's next step is to determine, through a laboratorial experiment, the impact of an information agent operating on Internet over the relevance of the information found, on the decision quality, on the process efficiency and on the decision maker's perceptions.

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MODELING OF THE MANAGEMENT KNOWLEDGE FOR MANAGEMENT SUPPORT SYSTEMS

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ABSTRACT

In this research, we propose a novel method for building an extensive knowledge-base to deal with various specific high managements requirements. In the proposed modeling, the different management conditions can be represented by a set of key attributes expressing profitability, profit rate, productivity, etc. In this work we introduce the new concept called management space, Ms, in order to represent the management plan including all its corresponding attributes expression and the restrictions to be satisfied. A management space is fully described by 4 components <P, D, R, C>. Where P is the set of parameters and attributes, D represents set of domains, R represents relationships and C is the set of constraints and conditions. The hierarchical structure of the management space allows for user friendly implementations, moreover the complexity of management problems can be reduces by using different management space representation. In this paper we explain the basic theory of management space and we illustrate the problem solving ability of Ms with two examples.

KEYWORDS

Management space, management knowledge, management support system, management modeling

1. INTRODUCTION

The small-scale enterprises are characterized by small managerial staff and limited number of customers. Therefore, for this kind of enterprises the business activity area is restricted and the target is to offer the best quality of service by establishing close relationship with costumers. Depending on the business area, the management techniques are different, but the main challenges remain the same: minimum management resources, and development of the management basic on the know-how of experience staffs. In such a small-scale place of business, the manager is not limited only to management decision; he is also involved into day to day operations and therefore, doesn't have the necessary time to sufficiently grasp the total flow of information. Thereupon, in the recent years, different support tools, such as accounting, business management, and business analysis, were introduced. However, most of them are unable to address the complexity of the management know-how, and are limited in terms of adaptability for specific needs of various small scale enterprises. Thus it is necessary to develop new methods that allow the managers and those involved with operations to systematically update the management knowledge in user friendly and no consuming time ways.

In this paper, we propose a novel method for building an extensive knowledge-base to deal with various specific high managements requirements. We introduce a new concept called management space, in order to represent the management plan including all its corresponding attributes expression and the restrictions to be satisfied. The hierarchical structure of the management space allows for user friendly implementations, moreover the complexity of management problems can be reduced using different management space

representation. The basic theory of management space is detailed, the corresponding methodology and the solutions are explained and the simulation results of two examples of management problems are illustrated.

2. BASIC CONCEPT

2.1 Management Space

The different management conditions and management plan can be represented by a set of key attributes expressing profitability, profit rate, productivity, etc. The management space represent the management plan including all its corresponding attributes expression and the restrictions to be satisfied. A management space is fully described by 4 components <P, D, R, C>. Where P is the set of parameters and attributes, D represents set of domains and domain restrictions, R represents the set of the restrictions which should be materialized between attributes and management conditions and C represents set of constraints or expressions between attributes and attributes dependency. A simple illustration of the introduce management space is explain in the example of figure 1. This figure shows a price determination problem. Where, cost, price, sale, payment and profit denote respectively: unit purchase price of product, price of product commercialization per unit, total value of sales, total value of purchase and value of the exercise result. Here, the number of sale of a product n changes according to Price, for example, is taken as n=1000-10* (Price-Cost). Moreover, the number of sale is set to n>=100 from the minimum purchase quantity restriction. The management space is shown in Fig. 1 (b). In this management problem, a management plan can be expressed using management attribute P= {Profit, Sales, Payment, n, Cost, and Price}. If the Cost is set to 60 JPY and the prices are ranged discretely every 10 JPY from 50 JPY to 150 JPY, then the domain restrictions D become D={Cost=60 and Price   {50, 60, … 150}, Profit, Payment, Sales, and n   integer}. The attribute dependency R is a set of expressions, such as Profit calculation, lots purchase Payment, Sales and the number of sales n. R= {Profit = Sales-Payment, Payment = Cost*n, Sales = Price*n, n= 1000-10 (Price-Cost)}. Similarly, the management restrictions set C is a set of inequality to determine profits if there is any and to set the minimum number of purchase lots, C = {n>=100, Profit>0}. The management plan of the price decision problem is a set of six attributes that satisfy all the requirements of D, R, and C.

In management space, if the value of some attributes is determined, the value of other attributes can be determined using the relation R between attributes. When attribute a is decided uniquely from $b1, ..., bn,$ then the attribute a is called the upper rank attribute of $b1, ..., bn$. Moreover, $b1, ..., bn,$ are conversely called lower rank attributes of a. For example, Profit is the upper rank attribute of Sales and Payment, because it decides Profit from Sales and Payment by Profit=Sales-Payment, and Sales and Payment are the lower rank attributes of Profit conversely. By using the dependency between attributes it is possible to select the base attribute which corresponds to the set that decides a management plan uniquely. For example, the dependency shown in figure 1(c) can be obtained from four expressions of relations of the management space Ms shown in the same figure 1(b).

(a) Price determination problem

(b) Management space   (c) Attribute dependency

Figure 1. Management space of the price decision problem

2.2 The Generate-and-Test Solution Method for Management Space

In this section, a solution method using management space is described. Since solving management problems analytically is a hard task, the manager assumes management plans and examines whether they fulfill the conditions of the problem or not following the trial/error procedure. Basing the methodology on management space provide a manager with a more generalized technique. This can be achieved by assuming the values of base attributes, calculating the upper rank attributes using expressions of relations, and verifying various kinds of restrictions. This procedure is designated by generate-and-test method and is explained in the management space Ms of Fig.1. The data flow diagram in Fig.2 exhibits the proposed solution by the generate-and-test method of Ms.

In Fig.2a, the double frame (1) represents the value assumption of base attributes and is designated as the *assumption generator*. The single frames (2), (3), (4) and (5) represent the calculation of an attribute value, and are designated as *relationship function* followed by the *attributes verification* as shown in frames (6) and (7). Here, *assumption generator*, *relationship function*, and *attributes verification* are generically called calculation steps. Moreover, the arrow which link two successive calculation steps is an attribute. Generally, an *assumption generator* and a *relationship function* have both inputs and outputs; *attributes verification* has only inputs. The role of the assumption generator is to assume in a non-deterministically way the output attribute values from the input ones. The *relationship function* calculates an output attribute uniquely from a corresponding input value. The *attributes verification* test whether restriction conditions for a given input attribute are satisfied or not. In Fig.2a, (1) assumes a price, (2) calculates the number of prediction sale from the cost and the price. The Sales are calculated from the price and the number of prediction sale at (3), and the payment is calculated from the cost price and the number of prediction sale at (4), and at (5), Profits are calculated from sales and payment, (6) verifies whether it has profits or not and (7) verifies if the prediction sales exceed the minimum lot possible to purchase. The Fig.2b exhibits the implementation of the proposed data flow diagram and the generation of the possible solution space. In this example the maximum profit solution corresponds to a price value 100.

(a) Data flow diagram   (b) Generate and test method
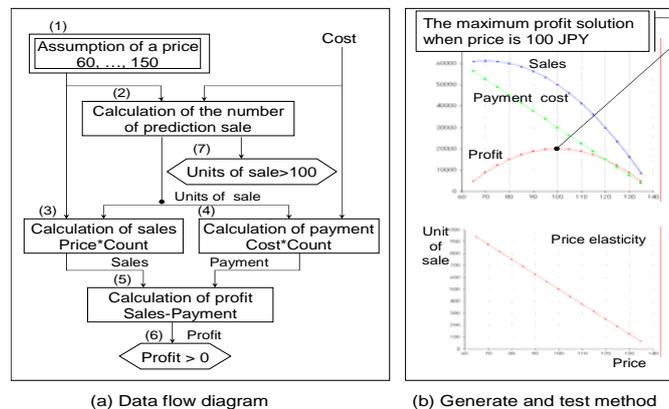
Figure 2. Data flow diagram for the generate-and-test method

3.   REPRESENTATION OF THE MANAGEMENT PROBLEM

3.1 Management Space Using an Actual Problem

In this section, we consider an actual management problem of a rental wedding dress business. This problem is represented and implemented using the proposed management space and the experimental results are shown. The management problem is formulated in Fig.3a where the manager has to determine the average

price for two kinds of wedding dress noted as dress A and dress B. the proposed management space for this problem is developed in Fig.3b and the attributes definition can be found in Fig.3c.

Problem:
the company is willing to promote two new kinds of dress among its existing products during a three months business period, Determine the rental rate for dress A, and dress B as well as the corresponding quantity ratios, in order to maximize the total gross margin. Note that rented quantities of both types A&B doesn't have to exceed 35% of the total quantity of sales for all products.

(a) Dress rental rate determination

Ms = < P, D, R, C >

P: { Price A, Price B, Price G, Quant A,
    Quant B, Quant G, Sale A, Sale B,
    Sale G, Rate A, Rate B, Profit }
D: { Price A { 20.0, 25.0, …, 50.0 }
    Price B { 30.0, 35.0, …, 60.0 } }
R: { Quant = Quant A + Quant B + Quant G
    Sale A = 100 - 3 * (Price A - 20),
    Sale B=150-4(PriceB-30)
    Sale G = 300 - 12.5 * (Price G - 5)
    Rate A = Quant A / Quant T,
    Rate B = Quant B / Quant T
    Profit = Sale T – Cost T }
C: { Rate A + Rate B < 35%, Profit > 0 }

(b) Management space

Attributes

Price A: The price of dress A
Price B: The price of dress B
Price G: The prices of the remaining items
Quant A: The number of dress A
Quant B: The number of dress B
Quant G: The number of the remaining items
Sale A: Sales of dress A
Sale B: Sales of dress B
Sale G: Sales of the remaining items
Rate A: Dress A rate
Rate B: Dress B rate
Profit: Gross margin

(c) Attribute's definition

Figure 3. Representation of the dress rental rate determination problem

The maximum sales gross margin for dress A and dress B is 38 million JPY

The price solution of the dress A for the maximum gross margin is 350,000 JPY

The price solution of the dress B for the maximum gross margin is 580,000 JPY
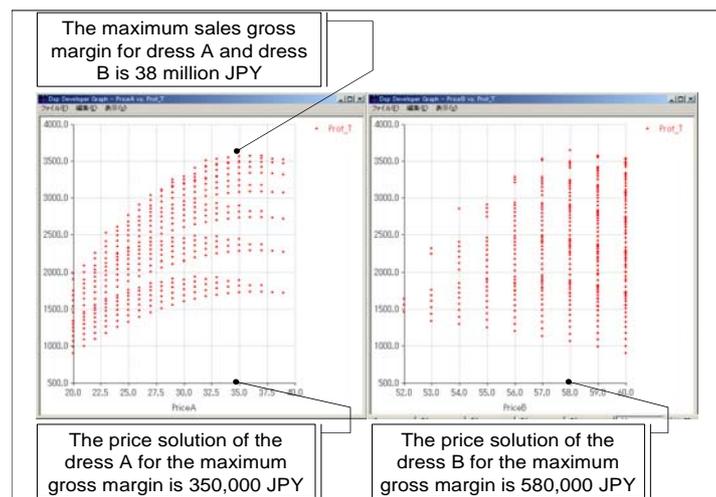
Figure 4. Optimal price solutions

In rental wedding dress business, it is necessary to keep a proportional balance between all kinds of products. Moreover, for an effective decision making during the purchase and sale phases, it is important to decide the pricing according to an accurate sales estimation. However, this decision making process has been based exclusively on the manager experience and empirical evaluation.

The experimental results and optimal price solutions for this problem are shown in Fig.4 where, horizontal axis represents the prices of dresses A and B, and vertical axis represents the profit gross margin.

In this management problem, the value of the maximum gross margin for optimal solution is 38 million JPY, and the solution prices for dress A and dress B are respectively 350,000 JPY and 580,000 JPY. The previous manager evaluation for this problem was based on his experience. The pricing for dress A was evaluated between 300,000 and 350,000 JPY and for dress B was in the range of 550,000 and 600,000 JPY. The obtained optimal pricing solution using the proposed method fits accurately the empirical evaluation of the manager. Therefore, the effective modeling and simulation of the manager know-how using management space is clearly proved.

In addition to the optimal pricing solutions, the proposed modeling allows the assessment of a given dress rate's influence on the expected profit, and taking into consideration the integrity of the business environment.

This new approach will help the manager or any staff member, to evaluate the loss and profit situations during purchase/sale activities in correspondence to certain dresses or items.

3.2 Application of Some Management Space

A large size or complex management problem can be represented by various management spaces. Here; we describe a management example for music education business and its outlines.
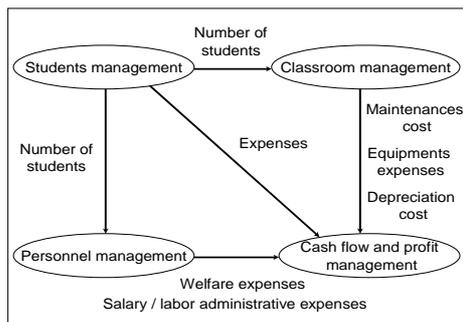
Figure 5. Relationship between management spaces

The educational service is offered by carrying out advertisement and student collection, the students pay monthly fee according to the educational rank. The educational service is offered by lecturers, who receive a job training in order to offer high quality of education. In this business, the manager concentrates his attention on four key points: student management, classroom management, personnel management, and management of cash flow and profits. Those key management tasks can be represented by four management spaces as described previously in section 2. Fig.5, illustrates the typical relation between the different management spaces, where the ellipses represent management space, and the arrows represent the information flow between them.

4. ENVIROMENT OF EXPERIMENT

The implementation of the proposed model and experiments were conducted using the knowledge representation language environment DSP as shown in Fig.6. This language has two concepts, data flow diagram and generating-and-test method. Therefore, the implementation program can be written declaratively.
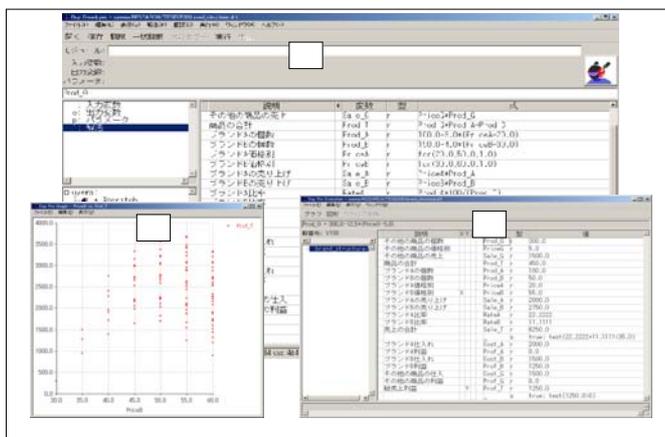

Figure 6. Environment of experiment

The Design Spreadsheet Processor platform, DSP, used in this work is developed by NaU Data Institute Inc. The experimental application is based on three major tools shown in the windows of Fig.6:

1. The language environment tool to edit, process knowledge and perform the necessary calculations. In this tool the assumption generator of the corresponding management space is implemented.
2. The hierarchical reporting tool which implement the relationship function and attribute verification components of the management space. It describes all solutions and provides detailed results for the different key attributes.
3. The graphical analysis tool that provides description of solution's distributions and detail analysis of attribute's contribution to support the decision-making visually.

5. CONCLUSION

In this paper, we proposed a novel method for building an extensive knowledge-base to deal with various specific high managements requirements. We introduced a new concept called management space, in order to represent effectively the managerial know-how taking into consideration key attributes, relationship function between attributes and the management restrictions. The hierarchical structure of the management space allows for user friendly implementations, moreover the complexity of management problems can be reduced using different management space representation. The basic theory of management space is detailed, the corresponding methodology and the solutions are explained and the simulation results from two management problems are illustrated. A rental dress business management problem was treated following the proposed methodology. The managerial know-how was successfully implemented and experimental results proved the effectiveness of the proposed knowledge-base. In the music education business example, the ability to reduce problems complexity was illustrated by proposing four management spaces. The implementation of this novel method was possible by using the Design Spreadsheet Processor platform. It allows for an intuitive implementation of relationship and management restrictions, in order to obtain the analysis or simulation results. It is a friendly tool for non skilled managers in programming languages. Therefore, the managerial staff has more flexibility in the analysis process. Thanks to the tree structure it is possible to analyze any attribute with regards to any hierarchical level. Moreover it allows for a quick identification of problems within the attribute dependency. In this work a knowledge base could be built using these representation methods and will be extended as future works to include a knowledge base system.

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A METHODOLOGY FOR CONTINUOUS COMPUTER SECURITY AUDITING

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ABSTRACT

This paper presents an approach to a methodology for continuous computer security auditing. It consists on measuring and controlling the security level of any organisation as a continuous process. This process establishes a method that permits organisations to control and to monitor the security level in real time, to be able to take the appropriate countermeasures in case a deviation occurs. The ability to measure the current state of the security is essential to continue improving the safeguard of our information. This will allow a proactive position regarding to security issues as one can be aware of the level acquired as well as the level required. The paper gives a brief overview of security metrics, discusses how the metrics are obtained and provides an example of carrying out a continuous audit.

KEYWORDS

Computer security, continuous auditing, security auditing, security metrics.

1. INTRODUCTION

Measuring our organisations security level has always been a difficult challenge. Current audit techniques allow obtaining a snapshot of the state of the security in a given moment. When an audit is accomplished, corrective measures are taken to increase the security level and solve deviations. Nevertheless, the period between two audits is not evaluated and important events may happen during this time (see figure 1). These events can decrease the security level of the systems significantly making successful attacks possible as the system may not be secure anymore.
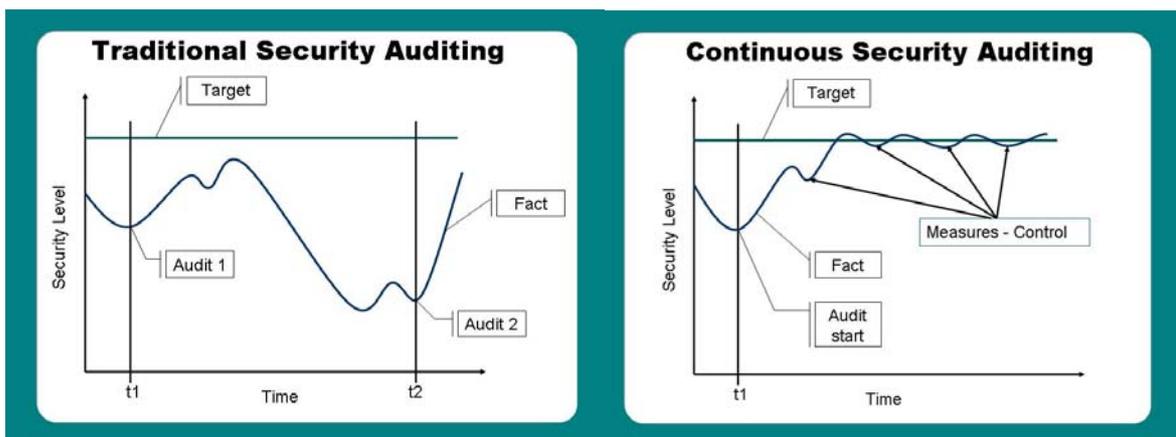

Figure 1. Traditional security auditing Vs. continuous security auditing

While the concept of continuous auditing (CA) [CICA99] is over a decade old, the rapid advances in technology have now made it feasible [Kog99] [Gro89]. Up to the moment, CA had only a financial meaning. In a computer security context, the process of CA consists on measuring and controlling the

security level, performing continuous monitoring in time and taking proofreaders actions if necessary. This process establishes a method that allows organisations to control and to monitor the security level in real time to be able to take the appropriate measures in case a deviation occurs.

At this moment, we are working in a project called secu-AUDIT, which seeks to analyse and define a methodology for the realisation of continuous audits of network security in organisations.

2. METHODOLOGY

The CA model starts on an initial meditation of what do we need to measure in order to get an overall security state. In this new method, it is necessary to select automatically measurable metrics and the tools that will provide those measurements. Once we collect the security metrics in a database, we suggest a formula based on a statistical analysis of the behavior of each metric. This way, the security administrator and even the enterprise management can easily analyse the organizations information system's security level in real time just by means of checking its representation and assess the risk that involves any change of the level.

2.1 Tool of Tools

A security tool, "munix", has been developed in this University as a result of the secu-AUDIT project. This tool audits the system in a continuous and automatic way and updates periodically its data bases of vulnerabilities directly from Internet.

The idea of "munix" is to obtain the information related to security from the maximum quantity of tools or information sources in order to measure the security level as accurately as possible. "munix" is not limited to only discover which are the vulnerabilities of our organisation's IT system (as many auditors do), but also detects intrusions and monitors the most significant servers and services.

Based on a Linux system, the first approach integrates three known security tools available under GNU General Public License [GNU89]: Nessus vulnerability scanner, Snort Intrusion Detection System [Roe99] (rule-based system [Cas93]) and Nagios monitoring package.

2.2 Auditing the Data: Security Metrics

We understand security metrics as a uniform monitoring method and an objective way to document our organisation's security attitude. Security metrics are required to understand the current state of security and its improvement in time. It is necessary to establish control points in order to evaluate the state of the effectiveness of the security. This will improve the protection level. The metrics will permit us to work on security as a dynamic process and not as a final product.

In order to calculate the security level, a set of metrics that allow to carry out the measures and the pursuit of the security level in situ and in a completely automatic way has been identified (which could be expandable). Measuring the security metrics, it is possible to determine their influence in the audit process and see whether a continuous improvement is obtained.

This way, starting from the data that are capable to catch the previously installed tools, we suggest 6 different measures:
- Number of high/medium/low risk vulnerabilities
- Number of intrusions
- Time of down servers
- Time of down services

These variables are in their simpler form, and they will be modified later for an easier analysis.

It seems logical to evaluate the interaction of the variables with the environment. The security level can differ from big organisations to smaller ones, even if the measure of a variable is the same. For example, it would not be unusual to have a lot of login attempts, intrusions or viruses in a big organisation, and this would give us a certain security level. On the other hand, if a small organisation had the same values, the security level value should be much lower.

To solve this problem, the measures have been transformed into metrics that are independent from environment.

Taking the number of vulnerabilities as an example, we realise that it was necessary to divide the measure into two metrics; in one hand the total number of vulnerabilities per host, and in the other, the number of different types of vulnerabilities. The reason of dividing the metric is that, for example, we can find a great number of vulnerabilities in an organisation, but most of them can be the same one (in different hosts). In other words, it is like one key that opens several doors with the same bolt. Instead, finding few vulnerabilities but all of them different could be even more dangerous, and an attacker could have much more possibilities of breaking into the system (several keys that open several doors).

Now, these metrics stop from being environment dependant, and it would be valid for companies of any size.

In order to define more exactly our metrics, their behavior have been reflected in a graphical way. We consider a continuous model as a base for their behavior: the bigger the independent variable is, the lower will be the dependent one (security level). After that, it is only necessary to translate the behaviors into a mathematical form, trying to reflect them in the simplest form (for example polynomial). Continuing with the previous example, the result would be the following:
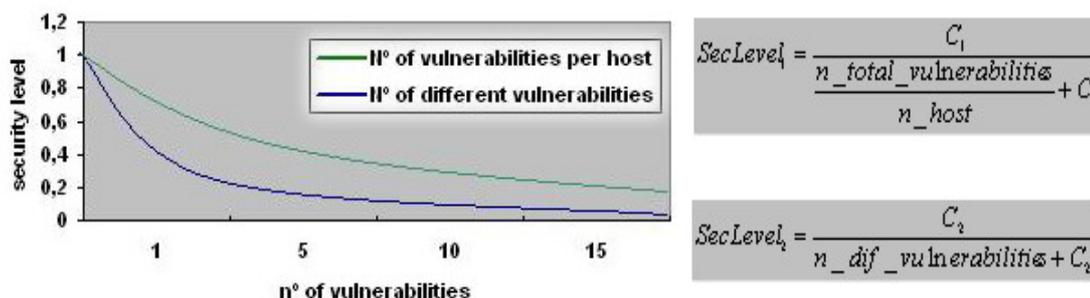

Figure 2. Behavior of the vulnerabilities, and formulas that represent the behaviors

$$SecLevel_1 = \frac{C_1}{\frac{n\_total\_vulnerabilities}{n\_host} + C_1}$$

$$SecLevel_2 = \frac{C_2}{n\_dif\_vulnerabilities + C_2}$$

being C_i the number of vulnerabilities that make security level decrease down to 50%. This way, each company administrator can establish what number of vulnerabilities can tolerate in his system (the tolerance to the risk may differ from one organisation to other).

Now, it is necessary to link these metrics with the calculation of the level of global security. The global security level depends on a function involving all metrics (and time): $level= f(m_1,m_2,...,m_i, t)$

Based on a study accomplished by the Computer Sciences Corporation [CSC02], the impact of each metric within the total security of the system has been evaluated. The threats or metrics that can be automatically obtained have been extracted from this study. Then, it has been calculated the weighting or ratio scale of the impact to include in the final formula. Table 1 shows how the study has been interpreted:

Table 1. Impact of the metrics within the total security of the system

	Metric	Impact	%	Tool
1	Number of high risk vulnerabilities per host	***	10.34	Nessus
2	Number of medium risk vulnerabilities per host	**	6.9	Nessus
3	Number of low risk vulnerabilities per host	*	3.44	Nessus
4	Number of different kind of high risk vulnerabilities	***	10.34	Nessus
5	Number of different kind of medium risk vulnerabilities	**	6.9	Nessus
6	Number of different kind of low risk vulnerabilities	*	3.44	Nessus
7	Number of intrusions	****	13.8	Snort
8	Time of down servers	****	13.8	Nagios
9	Time of down services	****	13.8	Nagios
Total			100	

Finally, linking these metrics, their behavior within the security and their impact over the total security, the formula that will measure the security level in any given moment is obtained:

$$Level = \left(\frac{C_1}{T\_Down\_Servers + C_1}\right)*13.8 + \left(\frac{C_2}{T\_Parada\_Services + C_2}\right)*13.8 + \left(\frac{C_3}{N\_Intrusions + C_3}\right)*13.8 +$$

$$+\left(\frac{C_4}{\frac{N\_tot\_Vul\_h}{N\_Hosts} + C_4}\right)*10.34 + \left(\frac{C_5}{\frac{N\_tot\_Vul\_m}{N\_Hosts} + C_5}\right)*6.9 + \left(\frac{C_6}{\frac{N\_tot\_Vul\_l}{N\_Hosts} + C_6}\right)*3.44 +$$

$$+\left(\frac{C_7}{N\_dif\_Vul\_h + C_7}\right)*10.34 + \left(\frac{C_8}{N\_dif\_Vul\_m + C_8}\right)*6.9 + \left(\frac{C_9}{N\_dif\_Vul\_l + C_9}\right)*3.44$$

Figure 3. Global security formula

being C_i the constants that make security level decrease down to 50% for each variable (defined by the system administrator).

3. FURTHER WORK: OVERALL RISK ASSESSMENT

Traditionally, risk assessment methodologies are based upon a simplistic model of risk which identifies threats and the vulnerabilities they exploit to affect a security breach. Countermeasures which mitigate the threat/vulnerability pairs are identified. Loss due to a security breach is calculated based on the probability of the threat overcoming the countermeasure and creating the breach [Dra94].

The security CA model can be extremely helpful to asses those risks. It is useful for evaluating the effectiveness of each countermeasure against each threat/vulnerability pair, analysing the impact of the overall security level after any action is taken. The next step to be taken during this research is how to obtain the cost of improving the security level of each metric. This will depend on the technology and resources used for that meaning.

4. CONCLUSION

Continuous security auditing is possible with little effort by means of combining existing security tools. Although this type of combined system is not enough by itself, it is a good starting point to make our site a safer place. The system that has been implemented can be improved adding more security metrics so more aspects of the security of our company will be covered, and this will give higher reliability to the system.

Measuring security effectiveness is a challenging enterprise. None of the metrics can be used productively without understanding the relative importance of system security for the organisation's mission.

An improvement on the global security is achieved when a patch is installed on an organisation. Thanks to this unique system, it is possible to minimise the efforts by only choosing the most significative ones.

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UTILISATION DIAGRAMS: AN AGILE MODELLING TECHNIQUE FOR INFORMATION SYSTEMS

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ABSTRACT

Within Agile development environments there has emerged a need for a modelling approach which combines systems requirements with systems architecture. This paper proposes an Agile modelling technique that is suitable for Information Systems development. It is based on an abstract model of the implementation architecture which is then used to model the functional requirements of an Information System. Key features of the approach are: it forces the development team to think about how the system will be used; it is iterative and can grow as the development moves forward; it is simple both conceptually and in deployment; it uses a natural, textual format.

KEYWORDS

Agile, Implementation Architecture, System Architecture, Utilisation Diagram

1. INTRODUCTION

There is a resurgence in the recognition of a need to develop concurrently both system functionality and the corresponding implementation architecture (Nuseibeh, 2001). Over twenty years ago Swartout and Balzer (1982) noted that in practice both were developed concurrently, although there was then no formal mechanism to model this approach.

It awaited the introduction of the Dynamic Systems Development Method, DSDM, in 1994 for an approach to systems development which openly supported such concurrent development. DSDM is an Agile method; by Agile we mean a method or framework that is iterative, incremental, user centered, and lightweight on models and documentation. Stapleton (2001) observes that both system functionality and architecture may change across iterations within a DSDM development.

The problem is the absence of an Agile approach to model this concurrency. Even though concurrent development of system requirements and the implementation architecture is now fashionable, there is a gap between what practitioners do and the models arising from object-oriented and structured system

development approaches. Moreover Avison and Fitzgerald (2003) have recently reported that developers have rejected development approaches; this rejection was due to the approaches being over complex because of the use of highly technical skills that are difficult and expensive to learn or acquire.

This paper proposes a possible approach to solving this problem for Information Systems. It uses an abstract model of the implementation architecture as the basis for modelling the functional requirements of an Information System. Each functional requirement is modelled as a subsystem architecture of the abstract implementation architecture. Subsystem architectures decompose a complete architecture into functional areas that may be homogenous or heterogeneous in nature. A completeness assumption is made when combining the subsystem architectures to form the whole (Moriconi, Qian and Riemenschneider, 1995). The possible heterogeneity of a subsystem architecture is important when modelling Information Systems, as the software architecture generally consists of an object-oriented interface to a relational database or legacy system. The rapid iterations and user involvement in Agile development suggest that the model would benefit from being composed of a simple diagram complemented by a description in a natural, textual format.

The paper is structured as follows. In Section 2 the abstract implementation architecture is defined. Section 3 provides an overview of the modelling technique formally known as an utilisation diagram. Finally a conclusion is presented in section 4 along with future work.

2. ABSTRACT IMPLEMENTATION ARCHITECTURE

Usually Information Systems have an implementation architecture that includes a database managed by a database management system, DBMS, which can be accessed by multiple simultaneous users via a network. The following functionality is normally present in Information Systems:

- Information storage and retrieval managed by the DBMS.
- Information dissemination managed by the network.
- Information security managed by the DBMS and the network.
- The functional requirements of the system are carried out by one or more subsets of an application program that interact with the DBMS
- Constraints on the data are managed by the database. However some constraints may have to be managed within the code of a subset of the application program.

From the functionality above we can derive an abstract implementation architecture, AIA, (Figure 1). The application programs that realise the functional requirements of the system are represented by the interface and event handler components of the AIA. These are the components of the AIA that will be coded to form the application program, together with the database. The DBMS could manage a relational database, legacy system, object-relational database or object database.
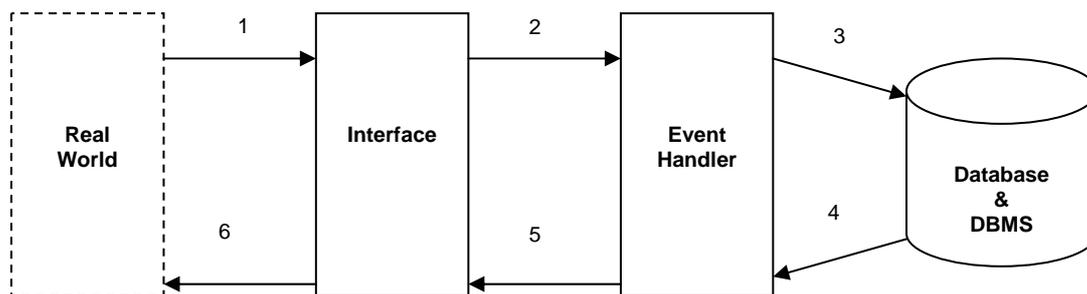

Figure 1. Abstract Implementation Architecture

The real world component has been included as part of the architecture because it defines the interactions that take place between actors participating in a real world event. This concept was invoked when developing problem frames by Jackson (2001) who states "… to study and analyse a problem you must [first] focus on

studying and analysing the problem world ….". It is important to include this component because it allows the definition of the real world post and pre conditions for success in meeting the functional requirement.

In Table 1 is provided a textual representation of the AIA connections. The connections and components of the utilisation diagram (Figure 2) would be defined in a similar way. However the textual representation would be system specific.

Table 1. Abstract Implementation Architecture Connections

Connection	Represents
1	Data produced by a real world event passing to the interface component which structures the data ready for processing by the system event handler.
2	Structured data passing to the system event handler which forms a request in the data manipulation language of the DBMS.
3	Request passing to the database via the DBMS which generates a reply in the form of a result set, system-updated message, or error message.
4	Reply passing to the system event handler which structures the data in the reply for processing at the interface.
5	Structured data passing to the interface which transforms the structured data so that it can be transmitted to the real world.
6	Transmitted data passing to the real world which causes some form of action to be taken in the real world.

The AIA is not put forward as part of the modelling technique, but is seen as a platform for the utilisation diagram. In practice the utilisation diagram would be adapted to reflect the specific implementation architecture of the system under development.

3. MODELLING TECHNIQUE

A utilisation diagram, UD, (Figure 2) models a functional requirement as a subsystem architecture of the AIA. The components and connections within the UD correspond to the components and connections within the AIA, but at a lesser level of abstraction. The real world and interface components have been divided in order to allow the separate modelling of inputs and outputs. Moreover the event handler component is related only to the specific functional requirement modelled by the UD, and is responsible for the hybrid link between the heterogeneous front end and back end components of the system.

The components and connections within the UD bridge the gap between real world events and system events. The need to model these connections and components is supported by Snoeck et al (2003) who observe that "In the real world events can occur without human [or machine] intervention, in an enterprise Information system, some human [or machine] is required to notify the Information System that an event has occurred.". The event handler is responsible for converting the real world event to a system event, based on a request from the calling interface.

Each component and connection in the UD is described in a natural, textual format. Whilst formal notations can be useful, the people involved in their use must really know how to read and write them. The non-technical development team members (users) are generally more comfortable with natural language. A description of a connection consists of one or more of the following: an event, data, or constraint(s). Connections 1 and 6 show how an actor in the real world may interact with the subsystem architecture in order to play some part in realising the functional requirement. It is important to include the network component of the implementation architecture in the UD to show whether or not the connections are network connections, to ensure the development team reason about network specific issues.

For example: the receiving interface for a particular application program subset could be a printer. The speed of the network during peak load times could cause the print time for a priority report to be degraded. Showing the network connections on the UD enables the development team to consider the issue at an early stage in the development.

The calling interface, system event handler and receiving interface represent subsets of the application program that need to be developed in order to realise the functional requirement, with constraints being dealt with by the calling interface, system event handler or DBMS. They can be looked upon as containers for diagrams, prototypes or documentation that evolve iteratively during system development.
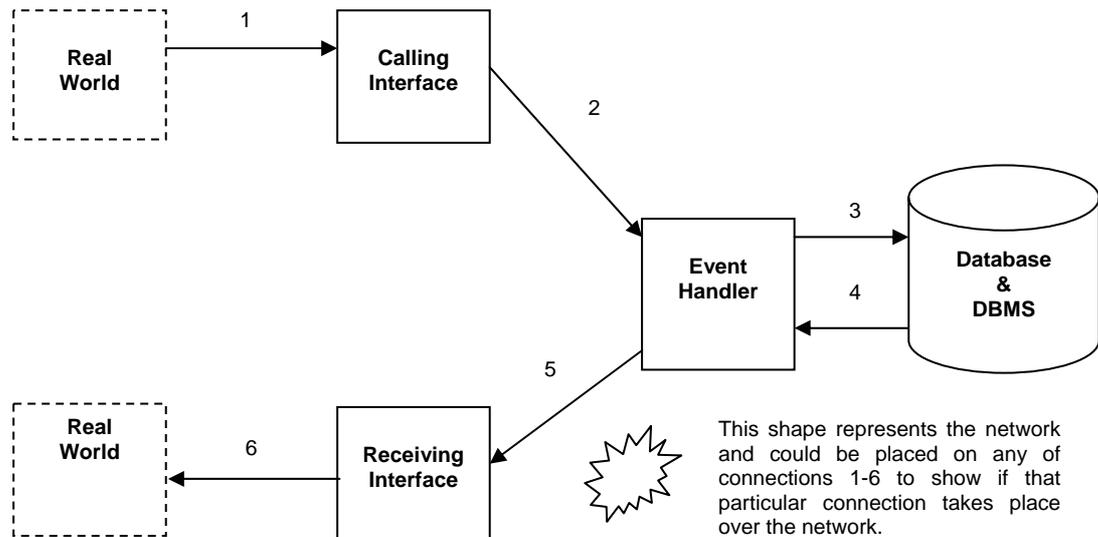
Figure 2. Utilisation Diagram

Throughout the development, the UD will evolve iteratively. Initially the descriptions of components and connections are described in a natural, textual format. Over successive iterations they would move towards a more formal notation. Typically connection 3 which represents a request passing to a database via the DBMS would evolve from natural, textual format, to a request structured in the query and data definition language of the DBMS.

4. CONCLUSIONS AND FUTURE WORK

Utilisation diagrams provide a simple yet powerful diagrammatic representation of Information System requirements at a level of granularity appropriate for Agile systems development. Their simplicity addresses some of the issues raised by Avison and Fitzgerald (2003) by allowing system functionality and the implementation architecture to be modelled on the same diagram. These diagrams represent at a high level the constraints, data, and events for the various application program subsets that realise the functional requirements of an Information System. This realisation is complemented by the inclusion of two components from the implementation architecture, viz the network and the DBMS and database. The key benefits of utilisation diagrams are that they:

- are not paradigm specific and so can be used to model heterogeneous Information Systems in the sense of an object-oriented application program that makes calls to a relational database or legacy system;
- are easy to understand as the diagram is simple and the components of the diagram are described in a natural, textual format;
- force development teams to think about how the system will be used;
- are iterative and can grow as development moves forward;
- can be used as a container diagram for hybrid structured and object-oriented developments;
- are simple both conceptually and in deployment, the technique is well within the capacities of the user and crucially should not take up a lot of development time.

Page et al (2003) have shown the need to reason about obstacles to functional requirements. We are particularly interested in combining utilisation diagrams with that work, during Agile development, in order to manage dynamic inconsistencies between functional requirements and the operational Information System. We believe an utilisation diagram would aid the reasoning process.

The main focus of future work will be the setting up of an industrial trial in order to investigate the usefulness of the utilisation diagram and define a set of heuristics for tailoring the utilisation diagram for use with specific implementation architectures used in industry. The final phase of the work will be the development of a tool to support the approach.

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PROCESS FOR REENGINEERING OF LEGACY SYSTEMS

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ABSTRACT

The aim of this work is to give a general idea about the software reengineering process and the approaches that can be taken when modernizing a legacy system that has become obsolete, though it maintains its functionality and its efficiency has been proved. We show the characteristics of a development process very suitable for this type of systems that is verified by means of a case study, the transformation of an application written in an imperative and unstructured language to a new visual and object oriented language, describing the different methodology stages applied to a particular case.

KEYWORDS

Reengineering software, reverse engineering, methodology, process, legacy systems.

1. INTRODUCTION

Software reengineering concept refers to reusing inherited systems but transforming them in order to make easier their maintenance. Usually these systems have some problems such as the exposed by Postema (1998), they have been developed and maintained by many people, and the developers often use their own techniques and programming styles; besides, after some time the specifications have usually changed and the design (it ever existed) has gotten lost. The basic advantages of the reengineering are risk and cost reduction.

It presents several difficulties (Pressman, 2002): lack of exhaustive planning for software reusability, absence of use of specifically designed components for reusability support, resistance of the specialized personnel against the reusability concept, suggestion of methodologies that do not facilitate the reusability, or lack of incentives in the companies in order to produce reusable components.

All systems are not suitable for carrying out a reengineering process. Before making this decision is possible an evaluation by using, for example, the decision matrix of Jacobson (1991), in order to determine if the system has a great business value and, therefore, reengineering is advisable. Ten elements of software can be reused (Jones, 1994): project plans, cost estimates, architecture, specifications and models of requirements, designs, code source, user and technical documentation, human interfaces, data and test cases.

2. STAGES IN THE SOFTWARE REENGINEERING

The software reengineering consists of (Sommerville, 2002): system re-documentation, system reorganization and restructuring, rewriting the system in a more modern programming language, modification and updating of the structure and the values of the system data.

Other authors (Leiva, 2003) develop a model that locates the user as the main collaborator in the task of specifying the requirements of the system. The stages would be: problem definition, study of the old code, viability, redesign of specifications, creation of prototypes, planning of the implementation and improvement.

3. PROCESS FOR REENGINEERING OF LEGACY SYSTEMS

This process has as a primary goal the restructuring of old applications that are still useful, but they need to be easier to maintain and to be adapted for supporting more evolved and modern software. It is then, a methodology that allows modifying legacy systems, which it is necessary to rewrite without changing their functionality. The methodology suggested by Sommerville (2002) was proved, but the results were not the expected ones. In addition, there were peculiarities that made the work different, such as the improvement of the user interface, and it was necessary to make it more intuitive and more pleasant. It was necessary to reconsider the process; however an approach of the type of results had already been gotten.
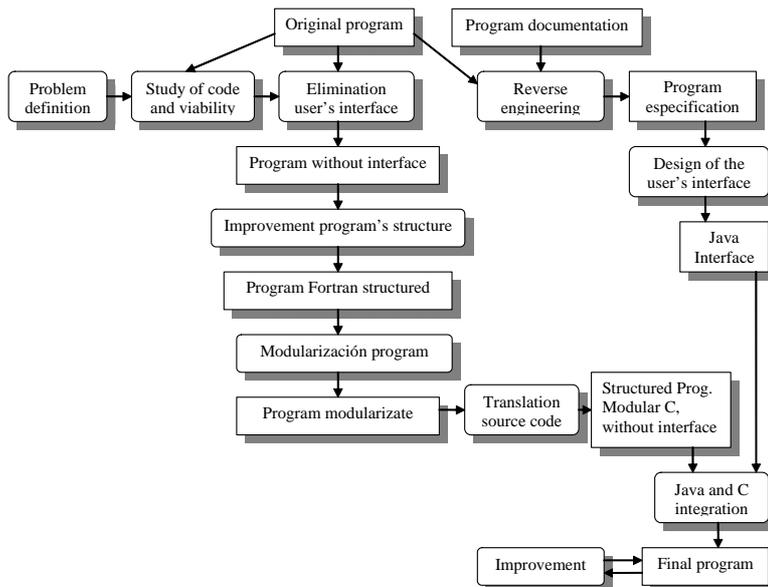

Figure 1. Reengineering process

In the development of the methodology we saw that starting from the source code, some stages could be attempted in parallel (fig. 1). On one hand, it could be the reverse engineering and the design of the new user interface and, on the other hand, it could be all the processes related to the old code improvement.

3.1 Study Case

The reengineering process has been carried out on a scientific application that does the treatment of the most frequent reactions models automatically, although the user can provide new models, facilitating the characteristics of the new models. The application was developed in MS-DOS, written in Fortran 77 and it consisted of a main program, together with a series of subroutines in charge of carrying out the different treatments and necessary calculations. The program had about 10100 code lines.

The final application obtained maintains its original functionality; it has a user interface written in Java, and several routines written in C, these routines are accessed by means of the JNI programming interface.

3.1.1 Problem Definition

The new required application must run in a graphic mode that allows the introduction of the data in a more intuitive manner. In this way, the use of the application will be easier for a non-expert user, but the original data files must be maintained because some of them are necessary so that the mathematical libraries could work, and others, because they allow to facilitate the input of some data to the application. It was necessary to analyze the structures, since they should be kept and this fact conditioned the reengineering process. It was necessary also, to maintain the values of the data, because the application has to be compatible with the great amount of input files experimentally obtained that are still in use. The output data or results should be obtained in the same format as the old one.

3.1.2 Study of the Code and Viability of the Product

Application source code was written in Fortran 77, a version, although extended, it has not many structured sentences. We tried to translate automatically, but we verified that the generated code was not valid, because their size was increased a lot, but the results of the calculations that we obtained were quite closer to those of the Fortran version. Therefore we had to reconsider the stages of the development, first we had to simplify and to structure the application, even separating the part corresponding to the user interface, and after to obtain the code C. The more important was to verify the project feasibility.

3.1.3 Elimination of User Interface

Java was chosen as the implementation language for the user interface, which had to be rewritten completely. The interface code also contained unconditional sentences of jump that had to be modified, this made that this stage preceded the following one, and, in this way, the code to be treated in the following stage was reduced.

3.1.4 Improvement of the Programs Structure

The principal task was to eliminate unconditional sentences GOTO. The main program had 2146 lines, when carrying out the structured program, and when transforming the main program without the user interface in a function to be translated to language C, it had 587 lines.

3.1.5 Modularization of the Program and Elimination of Redundancies

Several tasks were carried out to reduce code parts when making it more structured, modifying conditions, restructuring sentences and using chained IF, or structure chained loops. In other cases some actions carried out were to eliminate redundant or not used variables. All the code that showed data by screen was eliminated, given that the new application also generates the files of results and includes options for their visualization and printing.

3.1.6 Translation of the Code improved to C

It was important the accuracy of the transformation, since any modification in the code would take to obtain inadequate results, for that reason we analysed tools of translation of code. For many authors, a translation of source code only can be carried out if there is available an automatic translator, and this is the case.

3.1.7 Reverse Engineering

There was not a specification document of the previous version, reason why an analysis of the implemented system was carried out from the provided documentation and source code. This stage is necessary because it is not possible a direct translation of code from a procedural language to an object oriented language (Gall et al., 1995). It was necessary make a representation (Chikofsky, 1990). In order to carry out this task there are tools that analyze the source code and generate AST (Abstracts Syntax Trees). Other methods such as recovering traceability (Antoniol et al., 2002) or program slicing (Beck and Eichmann, 1993) decompose programs automatically by analyzing the data flow and the control flow. In our case all analysis was carried out in a manual way. The type of diagrams chosen for representing the old system were flow diagrams or flowcharts, although other alternatives could have been used (Landis et al., 1998; Rugaber and Clayton, 1993).

3.1.8 Design of the New User Interface in JAVA

Once we had the specifications of the user interface, we began to design the new interface. Due to the existing variations depending on the model and type of the selected optimization, the design of the user interface in a OO language was not simple (Gall and Klösch, 1995). When we implemented a new user interface we solved problems such as the input of invalid values or unfeasible options in some cases.

3.1.9 Improvement of the Resulting Application

Once completed the application, it was tested with a set of test cases with real cases that had been executed in the old application, in this way they could be contrasted with the new results. Some improvements were added, mainly in the user interface (activation of buttons, commentaries in buttons, help of the application).

3.1.10 Integration of the Application JAVA with the Functions C

Dialogues and windows for user data input were written in Java. The inputs are passed to the functions (written in C) in charge of the calculations. It is necessary to use JNI (Java Native Interface) in order to be able the use of native code of a language like C, from an application JAVA, Its use is required given that the code C uses mathematical libraries and it was ineffective to rewrite all that code in Java.

4. CONCLUSION

There are different methodologies that deal with the problem of legacy systems; some of them are specific for certain aspects, such as design recovery, development of lost documentation, or source code translation to an object oriented language. Our development process tries to maintain the functionality of the system, maintaining the data, but using a new code that is codified in an object oriented language, with a completely new user interface, more modern and therefore easier to use for the end user. In addition it adds new specifications with their corresponding documentation that will allow the system growth.

Although, the tendency in most of the software reengineering methodologies is to look for a complete automation of the processes, it is very difficult that all stages of the process can be approached without the human intervention. Nowadays, the knowledge of experts becomes indispensable even, although this knowledge only is necessary either in certain moments of the application of the methodologies or to contribute with their ideas in the development of certain tools. In our development process we have used tools when it has been possible, because they facilitate the work, the development of new tools better adapted to the necessities and a formalization of the process integrating the tools could be interesting.

An advantage of this methodology is that some of their stages can be carried out in parallel, as it is noticed in figure 1. This make that the process can be tacked by different human teams, even if they belong to a different areas of specialization, and on the other hand, when overlapping themselves the stages make that the time of development of the project are reduced. Another advantage is that this process can be adapted to scientific domains, in which the time of processing is important and the user interface is clearly differentiated from the processing and the obtaining of results.

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AN OBJECT-ORIENTED SYSTEM FOR DISTRIBUTED WORKFLOW AUTOMATION

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ABSTRACT

Workflow has evolved from coordinating transaction-based tasks around the database system for automation of business processes, to orchestrating concurrent tasks and asynchronous events for distributed application services in the network. While process protocols and regulations may differ from one organization to another, they may also change from time to time. It remains a challenging design problem to deliver an information system solution with the flexibility to support the needed customization for protocol changes in workflow automation. This paper presents an object-oriented system for workflow automation to provide a new level of flexibility for system customization including protocol changes. It describes an architectural design built upon the central idea of the workflow object, which brings together relevant information items along with protocol knowledge in one encapsulated unit. The workflow object serves to coordinate communication between collaborating agents in the network, while the agents involved serve to perform the tasks in the business process. The locality of reference in the workflow object demonstrates ease of administering with the flexibility for system customization. A workflow definition tool integrated into the system can create and edit workflow templates to support workflow design and validation.

KEYWORDS

object-oriented system, distributed workflow automation

1. INTRODUCTION

Taken from the Workflow Handbook 2001, published by the Workflow Management Coalition, workflow is defined as the automation of a business process, in whole or in part, during which documents, information, or tasks are passed from one participant to another for action according to a set of procedural rules (Allen,2001). Workflow automation therefore refers to the execution of a business process in the context of an information system. Workflow started as the coordination of transaction-based tasks in the database system for business automation. With the proliferation of networks, workflow now deals with the delivery of distributed application in the coordination of asynchronous events and concurrent tasks (Aalst,2002).

Consider the case when a nurse orders medication for a hospital patient. The prescription may require the approval of a doctor before the pharmacy can accept it. The pharmacy may or may not have the specific medicine in stock. The nurse must be notified if the prescription cannot be filled. If the medicine is available, the medicine dispense record must update inventory while the patient record must be updated with the active medication. Workflow is the execution a business process, but it may involve multiple parties spatially distributed, and coordinated by asynchronous events over time. We must design the protocol to observe the business rules. However, the business rules may differ from one organization to another. Even in the same company, the protocol for business processes may change from time to time. While flexibility in software is often conceivable, it remains a difficult and challenging problem to deliver an information system solution with the flexibility to support customization for protocol changes in workflow automation.

In this paper, we present an object-oriented system for workflow automation. We will first briefly review the history of workflow research. Then we will describe the system architecture, built around the central idea of the workflow object. The design is a distributed information system for workflow automation in the network environment, integrated with a workflow definition tool to support workflow design and validation.

In separating coordination from performing the tasks in workflow automation, the workflow object with its locality of reference demonstrates ease of administering. The integrated system provides a new level of flexibility to support customization for protocol changes in workflow automation.

2. BRIEF REVIEW OF WORKFLOW AUTOMATION

In the 1980's, with database technologies maturing, workflow automation was built upon the database management system. The business processes to be automated involves transaction-based tasks coordinated in concurrent collaboration while preserving information integrity in the database and observing business rules. Workflow automation primarily deals with the coordination of transaction-based tasks performed by knowledge workers around the database system. The approach is known as the transactional model of workflow automation (Marinescu,2002). In the early 1990's, with network-based systems becoming commonplace, workflow dealt with the management of collaborative work for business processes in the network. Research effort began to extend the transactional model: there might be long-lasting transactions in a workflow (Dayal,1990). Relatively few addressed the issue of customization for protocol changes (Gangopadhyay,1993). Instead of coordinating tasks around the database system, workflow was concerned more about the distributed application in the network (Casati,1995; Proper,1995)In the late 1990's, the concern began to focus on the robustness and flexibility of workflow in a distributed system (Alonzo,1997; Borgida,1999), as well as issues and situations when workflow moves beyond the organizational boundaries (Aalst,1999). It is thus known as the network-based model of workflow automation (Marinescu,2002).

3. AN INTERGRATED WORKFLOW MANAGEMENT SYSTEM

A workflow automation system is an information system for the automation of business processes. That however leaves support for workflow design out of focus: that is, the creation, modification, and validation of workflows. An integrated system includes also the facilities to support workflow design. We called that an integrated workflow management system, which comprises the workflow automation system and the workflow definition sub-system. We will first outline our approach to workflow automation, based on the workflow object, which we will describe in further details. Then we will describe the draft architecture of the integrated workflow management system.

3.1 Workflow Automation Service

Workflow automation is the execution of a business process involving multiple parties in the networked environment. Instead of distributing instructions incorporated with protocol knowledge to different parties, our approach is to isolate coordination of communication with these parties from performing the tasks of the workflow. We gather together all relevant information items, along with the protocol knowledge for the business process, into one encapsulated unit. We call it the *workflow object*. The workflow object then takes up the responsibility of coordinating activities for the enactment of the workflow. When a workflow object is created, a workflow is initiated. During its lifetime, it works within the environment of a workflow server. Figure 1 illustrates the interaction between the workflow object and agents in the network. It sends a request for service or waits for the completion of service requested. These agents are software components on behalf of the

Figure 1. The workflow object communicating with an agent
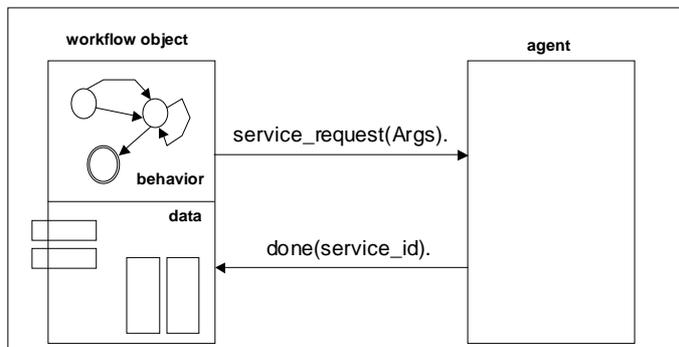
parties involved in the workflow to perform various tasks. They should be registered with directory services accessible to the workflow servers. The workflow object serves only as the traffic officer to coordinate tasks performed by the agents, and it lives on till the completion of the workflow. Workflow automation is a service offered by the workflow servers in the network.

3.2 The Workflow Object

The workflow object encapsulates all relevant information items and the protocol knowledge. It consists two parts: the data part, and the behavior part. The data part contains the relevant information items, or references to them. These are mostly represented as attributes and corresponding values, but may also include passive methods and active constraints imposed on the attribute values. The value of an attribute may also be a reference to another object, which may also be a workflow object. It is noteworthy that this hierarchical composition of workflow objects in the model implies that the enactment of a workflow may include the enactment of other workflows. The behavior part is a model of the workflow for the protocol knowledge. This can

Figure 2. Statechart model of workflow object behavior

The arc label in statechart model:

event: an event that triggers the state transition;

conditions: boolean expression of terms of the attribute values or parameters instantiated by the event;

actions: messages to send to agents simultaneously upon state transition.

be done in several ways: rule-based system, Petri-Net, and state chart model are some common ones. For simplicity in implementation, we have chosen to use the state chart model (Harel,1987). Here we will briefly explain the model to illustrate the concept in our design.


Figure 3. Workflow Object Example – Medication Order by Nurse

The workflow object is created to initiate a workflow. The state chart model actually represents the state changes of the workflow objects throughout its lifetime. Upon creation, it is in the start state. It may then transition from one state to another until it comes to a termination state when the workflow is completed. State transition may take place only when there is an arc connecting one state to the next. A label on the arc indicates the events, the conditions, and the actions pertaining to the state transition. State transition must be triggered by the events indicated, but the conditions must be tested true for the transition to take place. When state transition takes place, the actions specify the messages the workflow object must send to the various agents at the same time. Figure 2 illustrates the arc label construct in the state chart model.

Taking the workflow example of a nurse ordering medication for a patient, figure 3 illustrates the workflow object in a specific instance with medication ordered by nurse Smith, requiring approval by doctor Stone. The embedded prescription object contains the patient identity and medicine information.

Without data for instantiation, the workflow object is a template – the "class" facility to create a workflow object upon request for workflow initiation. Workflow design therefore deals with the creation, modification, and validation of workflow templates. A workflow definition tool can be integrated seamlessly into the system. The workflow definition tool maintains a repository of workflow templates to support

creation, editing, and testing for validation. Workflow servers share read-only access to the repository. Furthermore, protocol changes can be made using the definition tool without taking the system down. Workflows initiated subsequently will use the new template and observe the revised protocol while existing workflows started before the change will continue to follow the old protocol till completion. As long as the agents continue to support the tasks to be performed, there is no need for re-programming.

3.3 The Workflow System Architecture

The integrated workflow management system may comprise multiple instances of the workflow server distributed over the network, depending on the workload and the performance requirements on demand. Each workflow server must have its own recoverable store to maintain the workflow status to be failsafe. Each workflow object is managed by a workflow server, generally the one which served the request for workflow initiation. Throughout the lifetime of each workflow object, supported by the workflow server, it communicates with agents on the network. The agents served on behalf of the various parties involved in the workflows, and they must be registered to a directory service accessible to the workflow servers. The workflow definition tool is integrated to the system, along with the repository of workflow templates.

4. CONCLUSION

We presented the draft architecture of an object-oriented system for workflow automation. The system is designed around the central idea of the workflow object. Instead of distributing protocol knowledge to the various parties involved in a workflow, the workflow object encapsulates in one unit, all relevant information items along with protocol knowledge. The workflow object can then coordinate the tasks to be performed by communicating with the parties involved. Our approach has clearly separated coordination from service of the tasks in the enactment of the workflow. Furthermore, it allows us to integrate a workflow definition tool to the system seamlessly, to support workflow design, that is, the creation, modification, and validation of workflows. Indeed, the system facilitates a new level of flexibility in customization for protocol changes.

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E-SCIENCE WORKFLOW ON THE GRID

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ABSTRACT

Grid computing, which can be characterized as large-scale distributed resource sharing and cooperation, has quickly become a mainstream technology in distributed computing. In this paper, we present the idea of applying certain grid workflow management techniques to mediate various services for grid-based e-science processes. The techniques of adaptable workflow services, aggressive sub-workflow scheduling, and application-level checkpointing are used to improve the performance and trustworthiness of e-science workflow on the grid. A protein structure prediction application is presented as an example to show how the embedding of a large-scale e-science application in a grid-based workflow can be used to achieve high performance simulation in this context.

KEYWORDS

Grid Computing, e-science, Workflow, XML.

1. INTRODUCTION

Grid computing is an emerging technique to support on-demand "virtual organizations" for distributed resource sharing and problem solving on a global scale for data-intensive and computation-intensive applications [Goble, C. and Roure, D. D., 2003]. In the grid-computing environment, large-scale computational resources, global-wide networking connectivity, access to high-end scientific instruments, participation of scientists and experts in different areas, and coordination of organizations make the grid a powerful and cost-effective platform to carry out e-science operations. The combination of these operations permits the implementation of scientific tasks, such as analyzing raw data streams, performing large-scale computations, designing cutting-edge technological products, collaborating on interdisciplinary research, and implementing a particular scientific computing process, to name a few. Despite the attractive characteristics of grid computing, to successfully apply grid techniques to e-science, the grid environment presents a number of challenges that must be overcome. These stem from properties of the grid such as dynamism, cross-domain physicality, heterogeneity, lack of intrinsic trustworthiness, reliability, and performance [Foster I. et al., 2001; Foster I. et al., 2003]. Workflow management services on the grid are designed to efficiently manage and organize dynamic grid resources to provide reliable and effective services for e-science applications [Chen Q. et al, 1999; Cao J. et al, 2003]. In this paper, we present some techniques coming from grid workflow management to address certain issues in grid computing to aid in implementing high-performance and trustworthy e-science applications.

The remainder of this paper is organized as follows. In Section 2, we analyze grid-based workflow as from the point of view of e-science applications. In Section 3, we present grid workflow techniques including adaptive workflow services, aggressive scheduling, checkpointing, and validation to achieve high-performance and trustworthy e-science computations. Finally, Section 4 summarizes our work, and discusses related future research directions.

2. E-SCIENCE WORKFLOW ON THE GRID

2.1 Grid-based Workflow

Originally, workflow was an administrative concept from the field of managing business operations,. Workflow refers to a business process that delivers services from one participant agent to another. In 1996, a workflow was described by the Workflow Management Coalition as [Allen, R., 2001]:

The automation of a business process, in whole or part, during which documents, information or tasks are passed from one participant to another for action, according to a set of procedural rules.

The emergence of workflow introduced automated processes which enforced data validation and verification within business operations, overcame constraints in time and space, maintained consistency in the business system, and significantly eliminated possible human errors. Workflow is making important contributions to many types of business applications and processes. Nevertheless, the concept of workflow extends beyond its use in conventional business process management, and is now used more broadly in e-science, e-commerce, and other related areas. More recently, workflow techniques have been introduced into the grid computing environment to efficiently and effectively manage different grid services and resources [Fox, G. and Walker, D., 2003; Cao J. et al, 2003].

2.2 Components in a Grid Workflow

Workflows require many capabilities, and as mentioned in their "e-science gap analysis" [Fox, G. and Walker, D., 2003], four key components are highlighted to describe a workflow:

- Composition/Development: To provide an Integrated Development Environment (IDE) to virtually form the graph of a workflow.
- Language and Programs: To describe the workflow using a formal language. Some specialized workflow languages have been developed for grid services or web services, including BPEL4WS, WSFL, GSFL, SWFL, and XPDL.
- Compiler: To translate the above two steps into the executable form.
- Enactment Engines: To support the execution of the workflow in the execution environment.

These four components correspond to related capabilities in a conventional programming environment.

2.3 Describing a Grid Workflow in XML

A scientific computing task on the grid is normally composed of a number of subtasks, and so the corresponding workflow on the grid can as well be decomposed into smaller units. These units can be described as follows:

- Operation: Operations are the smallest elements in a grid workflow. Each operation in a grid workflow corresponds to a computational operation and is usually carried out on an individual grid node.
- Sub-workflow: A sub-workflow is a flow of closely related operations that is to be executed in a predefined order on the grid resources within a virtual organization. Each sub-workflow represents a specific scientific computing subtask in an organization. Sub-workflows may be executed in parallel.
- Intermediate-workflow: An intermediate-workflow mediates sub-workflows running in different organizations. It carries out tasks such as sub-workflows coordination, checkpointing, computation verification, and result validation operations.
- Workflow: A workflow can be represented as a flow of several loosely coupled activities described in a scientific computing process. Each activity consumes various grid resources and can be represented by a sub-workflow.

The grid workflow management service schedules the sub-workflows in a workflow to the appropriate target organizations. Then, operations are executed on the grid resources within the organizations. The intermediate-workflow coordinates the execution of sub-workflows. XML (eXtensible Markup Language) is used to describe a grid workflow. XML is fast becoming the standard for data interchange on the grid due to its well-defined syntax and platform independency. Thus, XML is used as the primary message format for

communications within grid services. In fact, an XML document is an information container for reusable and customizable components, which can be used by any receiving services. The grid services in a workflow may use an XML format to explain their "problems," defining new performatives in terms of existing and/or mutually understood ones. Based on commonly agreed upon tags, services in a workflow may use different style XML DTDs (Document Type Definition) to fit the taste of the units they mediate. Therefore, XML is widely used to address the heterogeneity issue in grid computing and to enable cross-domain cooperation among grid services [Fisher, L. 2002; Bivens, H. P., 2001].

Figure 1 illustrates an example of a grid workflow diagram and the corresponding XML description. The workflow is decomposed into three sub-workflows with each sub-workflow to be scheduled on a grid organization specified by the "organization" tag. The "order" tag indicates the execution order of these sub-workflows, and the "operation" tag carries out the "problem description" of the current operation, including the application-specified actions and requested grid resources.


```
<WorkFlow id = "mainworkflow">
  <SubWorkFlow id = "subworkflow1", order = 1>
    <Organization id = "organizationA"> </Organization>
    <DataTransfer> … </DataTransfer>
    <Operation> description of operation 1 and 2
    </Operation>
    <DataTransfer> … </DataTransfer>
  </SubWorkFlow>
  <IntermediateWorkFlow id ="intermediateworkflow1">
    <DataTransfer> … </DataTransfer>
    <Operation> checkpointing, validation, …
    </Operation>
    <DataTransfer> … </DataTransfer>
  </IntermediateWorkFlow>
  <SubWorkFlow id = "subworkflow2", order = 2>
    <Organization id = "organizationB"> </Organization>
    <DataTransfer> … </DataTransfer>
    <Operation> description of operation 3, 4, 5, 6
    </Operation>
    <DataTransfer> … </DataTransfer>
  </SubWorkFlow>
  <SubWorkFlow id = "subworkflow3", order = 2>
    <Organization id = "organizationC"> </Organization>
    <DataTransfer> … </DataTransfer>
    <Operation> description of operation 7,8,9
    </Operation>
    <DataTransfer> … </DataTransfer>
  </SubWorkFlow>
</WorkFlow>
```
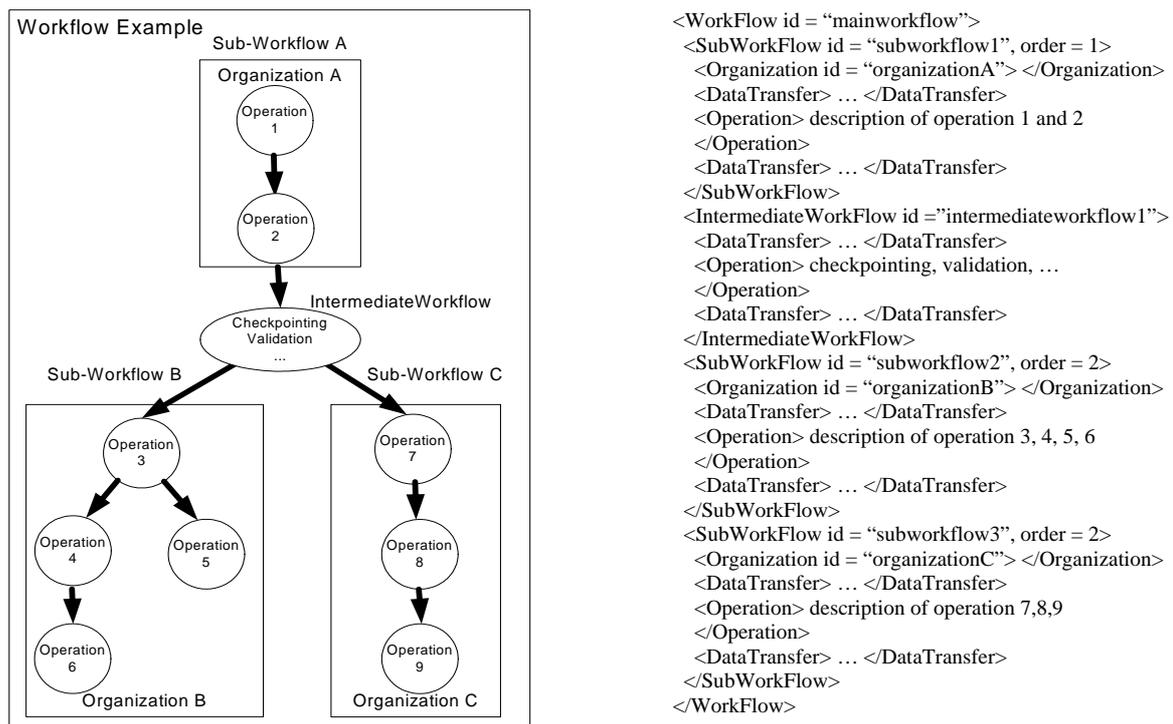
Figure 1. Grid Workflow, Sub-workflows, Intermediate-workflow, and Operations

3. TECHNIQUES OF HIGH-PERFORMANCE AND RELIABLE GRID-BASED E-SCIENCE APPLICATIONS

3.1 Workflow Service with Adaptable Behavior

E-science on the grid is a dynamic scientific computing environment. Many e-science applications favor large-scale computational resources and dynamically request available resources to achieve optimal performance. Therefore, grid services for a computational operation in a workflow need to be established dynamically on demand. However, conventional software agents running on the grid, including many web-based service providers, have pre-defined functions but lack the capability of changing role and behavior dynamically. For example, a SETI@home [SETI@home, 2002] agent can only perform SETI computations, while a folding@home [Folding@home, 2000] agent has only protein folding functionality. A

folding@home agent is not able to use idle and available resources known to it for SETI@home services. Lacking the ability to adjust their behaviors, conventional agents may be too limited for mediating high performance e-science applications properly. The dynamic nature of e-science requires more "flexible" agents and services in grid organizations to be based on a dynamic ontology. To meet this requirement, grid-based workflow services can be designed to be capable of handling "plug-and-play" e-science computations.

The enactment engine is the key component in a workflow to address the issue of dynamism. The enactment engine has the functionalities of workflow management, which are responsible for binding the workflow expression to the actual grid-service components and setting up the necessary inter-service communication registrations. Based on the "problem description" of the operation in the workflow, it picks up appropriate and available grid services, schedules the operations to the grid resources, executes the workflow operation, and collects the operation results. An enactment engine usually does not have a fixed set of predefined functions, but instead, it carries application-specific actions, which can be loaded and modified on the fly. This allows a grid node running the workflow service using the enactment engine to adjust its capability and play different roles to accommodate changes in the grid organization environment and computational requirements. Figure 2 shows the architecture of a workflow service using an enactment engine.
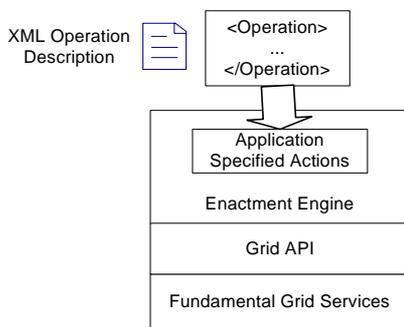
Figure 2. Architecture of a Grid Agent Providing Workflow Service using an Enactment Engine

An agent providing workflow services in a grid-computing environment utilizes the underlying management grid facilities including distributed communication, object storage, database access, job schedule, GUI, and grid resource management. The fundamental grid services enable the workflow agent to carry data, knowledge, and objects, and execute programs. The data and control logic described in XML form its adaptable part. Their application-specific behaviors are obtained from the workflow process, which instruct the agent to perform high-level operations. Based on these application-specific data, the workflow agent is capable of allocating appropriate grid resources and then processes the corresponding computational operations specified in the workflow. Workflow systems provide flow control for e-science process automation. An e-science application often involves multilevel collaborative operations. Each operation represents a computational piece of work that contributes to the e-science process.

E-science computing processes may be thought of as a kind of multi-agent cooperation, in the sense that an individual or a group of grid workflow agents can be used to perform an operation in a workflow, and a workflow can be used to orchestrate or control the interactions between grid services or agents. Multiple grid services or agents working cooperatively may accomplish a particular part of the workflow process, such as a single computational operation. When an operation is complete in a grid workflow agent, based on the workflow description carried in the XML, the workflow control logic and data will be passed to the next workflow agent for the operation at the next step. Therefore, multiple grid workflow services can cooperate to provide plug-in workflow support.

3.2 Aggressive Grid Sub-Workflow Scheduling and Computational Result Validation

The nodes that provide CPU cycles in a grid system will most likely have computational capabilities that vary greatly. A node might be a high-end supercomputer, or a low-end personal computer, even just an intelligent widget. In addition, these nodes are geographically widely distributed and not centrally

manageable. A node may go down or become inaccessible without notice while it is working on its task. Correspondingly, an organization will have greatly varying computational capabilities as well. Therefore, a slow node or organization might become the bottleneck of the whole e-science process. A delayed operation or sub-workflow might delay the accomplishment of the e-science process while a halted subtask might prevent the process from ever finishing.
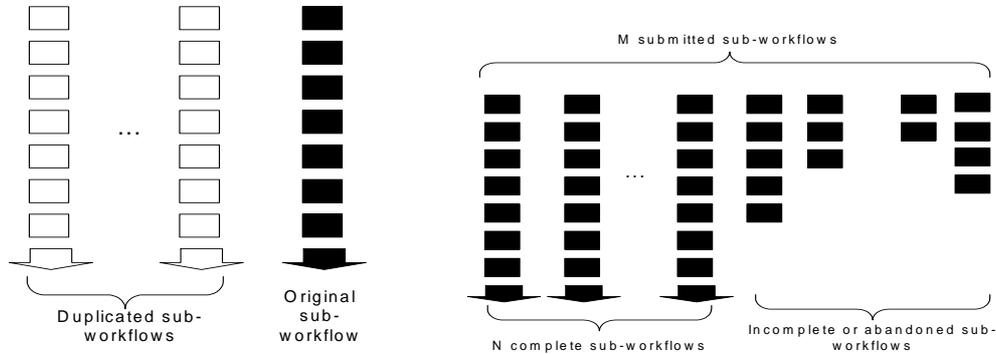

Figure 3. The Replicate Scheduling Schema and the N-out-of-M Scheduling Schema

To address this issue in grid computing, a replicate scheduling mechanism can be used. In replicate scheduling, in addition to the original sub-workflow, replicate sub-workflows are carried out in other organizations as well. When one of these sub-workflows is complete, the workflow can move forward. For those applications that exhibit statistical characteristics, such as most Monte Carlo applications, a more aggressive scheduling mechanism, the N-out-of-M strategy [Li, Y. and Mascagni, M., 2002], can be applied. The N-out-of-M scheduling schema dispatches M sub-workflows based on different random sample sets while only N (N < M) partial results are actually needed. When the N sub-workflows are complete, the e-science workflow can move ahead to the next step and ignore the other M – N computations. Compared to replicate scheduling, the N-out-of M scheduling is more effective [Li Y. et al, 2003; Li, Y. and Mascagni, M., 2003]. Figures 3 illustrates the schemas of both replicate scheduling and N-out-of-M scheduling.

Another advantage of both duplicate and N-out-of-M scheduling is that by scheduling more sub-workflows than needed, one obtains a way to validate the computational results on the grid and detect the possible misbehavior of a grid node. Duplicate checking [Aktouf C. et al, 1998] or majority vote methods [Sarmenta, L. F. G., 2001] can be employed in a duplicate scheduling schema by comparing the results of the same sub-workflows executed in different organizations – a mismatch indicates possible errors or malfunctions. The partial result validation approach [Li, Y. and Mascagni, M., 2002] can be applied in N-out-of-M scheduling by checking the statistical nature of the partial results to identify suspiciously erroneous results. These approaches can significantly improve the reliability and trustworthiness of e-science computations on the grid.

3.3 Application-Level Checkpointing

While performing large-scale computations on the grid offers many advantages, handling possible failures becomes an important concern. A grid workflow corresponding to an e-science process can usually be decomposed into multiple sub-workflows, which may be executed in different organizations and may take a long time to complete. As the number of organizations and grid resources involved increases, the chance of a failure of the e-science process during the computation increases exponentially. Thus, it is vital that a checkpointing and rollback mechanism is incorporated in the e-science workflow management.

Some grid computing systems implement a process-level checkpoint. Condor, for example, takes a snapshot of the process's current state, including stack and data segments, shared library code, process address space, all CPU states, states of all open files, all signal handlers, and pending signals [Livny M. et al, 1997]. On recovery, the process reads the checkpoint file and then restores its state. Since the process state contains a large amount of data, processing such a checkpoint is quite costly. Also, process-level checkpointing is very platform-dependent, which limits the possibility of migrating the process-level checkpoint to another node in a heterogeneous grid-computing environment.

In grid-based e-science applications, an application-level checkpointing approach can be used to implement a portable and efficient backup and recovery mechanism. At the application level, the program can call a set of checkpointing subroutines to checkpoint a program's data structures and to later restart that program from the checkpointed data. This method is highly portable since it uses no machine-dependent constructs in creating a checkpoint. With this method, the e-science application developer is responsible for writing a program with a structure that is simple enough that the program counter and stack need not be saved. Many scientific applications (potential e-science applications) meet this requirement.

4. CONCLUSIONS

E-science in certain contexts can be thought of as a dynamic distributed computing environment. In this paper, we discussed a solution for placing cooperating and embedding grid services into a workflow to implement e-science process automation, taking advantage of the tremendous amount of computational power and connectivity in a grid-computing environment. We proposed the implementation of grid workflow services with flexible and adaptable behavior to address the issues of dynamism, heterogeneity, reliability, performance, and cross-domain computing in grid-based e-science applications. Multiple grid services can plug in a workflow to carry out complicated scientific computing process.

Nevertheless, more practical and theoretical works still needs to be done in this area to address many other issues including security, privacy control, trustworthiness, scalability, and availability of running e-science applications on the grid. These will become the next phase of our research. At the same time, we plan to develop a workflow portal – a state-of-the-art approach to develop and deploy grid-based e-science applications. More aggressively, the workflow technique can also be extended to other e-society computing applications, although different e-society applications clearly have different requirements.

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INFORMATION SYSTEM ARCHITECTURES FOR HIGHER EDUCATION INSTITUTIONS

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ABSTRACT

Higher Education Institutions (HEI) do not explicitly represent their information systems. This lack of representation induces the dispersion of efforts in adoption and development of information systems. This may be particularly dangerous in the context of competitive pressure and limited budget. The information systems architecture explicit representation and its dissemination by the HEI stakeholders can guide the adoption and development of information systems. This paper will present an architectural representation that specifies the existing HEI information systems types.

KEYWORDS

Higher Education Institutions, Information systems architecture

1. INTRODUCTION

The authors of this paper have been working for many years on the development and maintenance of information systems in Portuguese Higher Education Institutions (HEI). They have followed the development and adoption of information systems in distinct Institutions. They have observed that in many cases the development and adoption of new information systems in HEI is driven by the need to resolve existing particular problems, to benefit from particular systems funding, or by new technology fashions. The purpose of this paper is to promote a high level vision of HEI information systems, closely related with the HEI activities. This high level vision, contributes to a better perception of the relationships between the different systems and their potential overlapped functions. That way, the development and adoption of new information systems should take into account the already existing systems and their relationships. The proposed architecture purpose is to provide a tool to classify all of the HEI existing information systems. This paper proceeds as follow: Section 2 presents the information systems concepts; Section 3 presents the architectural concepts; Section 4 presents our proposal; and Section 5 presents this work conclusions.

2. INFORMATION SYSTEMS

Information systems could be defined as a set of interrelated components working together to collect (or retrieve), process, store, and disseminate information to support decision making, coordination, and control in an organization (Laudon, 2004). This definition does not oblige to a particular technology, neither specifies the nature of their users.

Three aspects frequently contribute to the misunderstanding of what an information system is:

- The first one is the interchangeably use of the terms, information systems and computer based information systems (CBIS) (Ward, 2002), creating the idea that any information system should be a CBIS. That way, some of the information systems are implemented as CBIS without verifying its concrete needs.
- The second one is the proliferation of information systems designations and classifications. In the study conducted by Morais (Morais, 2000) involving thirteen taxonomies of CBIS classification, and hundred and nine designations of CBIS, it is observed that none of the exiting taxonomies permits the classification of all the CBIS. This makes it difficult to have a clear idea of the systems integration in the overall information system.
- The third one is the recursive nature of the definitions. Inside an HEI organization a specific software package as well as all of the software packages existing, are sometimes designated as a CBIS.

Figure 1 presents one of the most well known (Morais, 2000) CBIS classifications. This classification distinguishes three levels of activities for addressing the needs of the organizational interest groups: operational, management, and strategic (Anthony, 1965). Each level of activities is decomposed in the functional areas it addresses: manufacturing, human resources, sales and marketing, finance and accounting (Laudon, 2004).
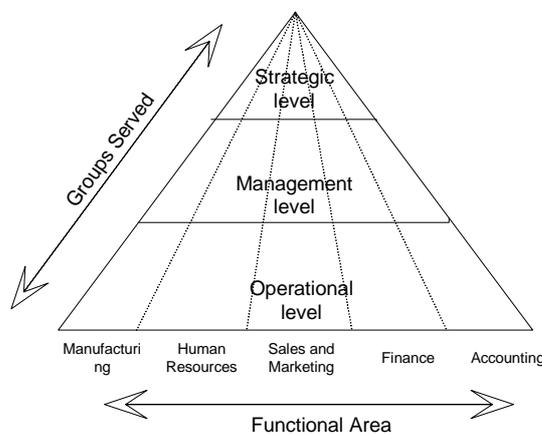
Figure 1. Anthony's CBIS classification
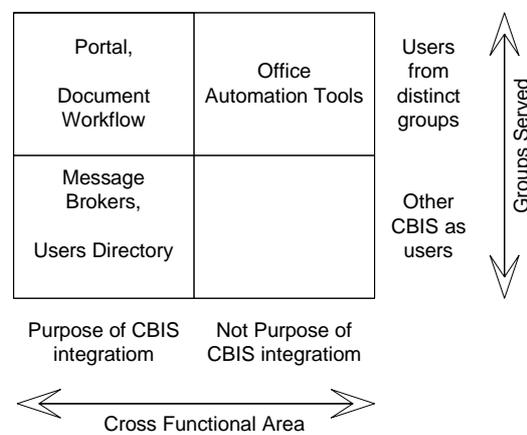
Figure 2. Other CBIS classification

However, Anthony´s classification does not have in consideration some important aspects of today's world. Some of these aspects are the groups served dimension, the use of CBIS by different levels users, or when the CBIS interested group is another CBIS. The new aspects in terms of the functional area dimension are concerned with CBIS integration. Figure 2 presents some examples:

- Portals and document workflow serve users from distinct group levels, and are used to integrated traditional CBIS (Silva, 2003);
- Office automation tools are used by distinct user groups but are not used to integrate CBIS;
- Message brokers (Silva, 2003) and user directories concerns the issue of CBIS integration, having other CBIS as users.

On the rest of the paper we will adopt Anthony's criteria based in user roles related with the organization to classify CBIS, because it is well known and intuitive. We will extend Anthony's classification, in order to include the CBIS groups identified in Figure 2.

- Generic systems - CBIS that have users from distinct groups and are not used for CBIS integration;
- Transversal systems - CBIS that have users from distinct groups and are used for CBIS integration;
- Integrators systems - CBIS that have other CBIS as users and are used for CBIS integration.

However, it should be noted that there are systems, like some enterprise resource planning packages that can be classified by more than one type.

3. ARCHITECTURES

Systems architecture could be understood as a high level logical construction for defining and controlling the interfaces and the integration of all the components of the system. It permits a holistic vision of something that will be created or managed. It could be expressed by a set of architectural representations that reflects distinct perspectives from distinct stakeholders, using distinct techniques that reflect distinct characteristics of the objects being represented. (Zachman, 1987).

In order to create a meaningful architectural representation it is important to clarify which are the stakeholders' perspectives and what are the components and its characteristics.

The stakeholder perspective considered in this paper is the information technology director perspective, which is interested on a holistic perspective of the information system.

The system being represented is a result of the conjunction of all the information systems existing in the organization. A component is a specific instance of an information system type, existing inside the organization.

The characteristics being represented are the information systems types that exist in the organization.

4. HEI INFORMATION SYSTEMS TYPES PROPOSAL

Sections 2 and 3 discuss information systems and architectures regardless of the organization activity area. However, we have the specific purpose to apply them to HEI organizations.

Figure 3. Anthony's CBIS classification and HEI

In section two of this paper, the information systems types were classified in six groups: operational level, management level, strategic level, generic, transversal and integrator. The first two will be divided, to take into account the particularities of the HEI institutions. The pyramid used in Anthony's (Anthony, 1965) classification, extended in the context of HEI, is represented in Figure 3.

Following the proposal done by Oblinger (Oblinger, 2000): manufacturing is replaced by content development, teaching and learning; human resources are substituted by faculty members and staff; and sales and marketing is substituted by marketing and admissions. Moreover, the management level is divided into two distinct groups – academic management and administrative management – that control distinct parts of the operational level (Santos, 1997).

Taking into account these changes, the operational level systems will be divided in four distinct groups, and the management level systems will be divided in two distinct groups.

Operational level systems can be divided in systems to support administrative staff activities, and systems to support teaching and learning activities to students and faculty members. Operational level systems that support administrative staff activities can be further divided into the specific administrative HEI activities, like student's enrollment or certification, and the administrative activities common to all organization, like human resources management (Laudon, 2004). Operational level systems that support teaching and learning activities for students and faculty members can be divided into two groups, one around the content development and management activities, and another related with the teaching and learning activities. The division can be justified in order to provide the reutilization of teaching and learning contents between distinct delivery platforms (Capitão, 2003). Management level systems are divided into academic and administrative management, taking into account the distinct organizational structures and the interests they support. This architectural view is presented in Table 1, which expresses the existing types of information systems in a HEI, their descriptions, and examples.

Table 1. Information Systems Types

Information System Type	Description	Examples
Operational systems to support normal administrative daily HEI specific activities.	Administrative systems used mainly by staff to operate daily functions HEI specific activities.	Student management systems, Students financial aid
Operational systems to support normal administrative daily typic organizational activities	Administrative systems used mainly by staff to operate daily typical organizational activities.	Human resources systems, Financial systems
Operational systems to support management of teaching and learning content	Systems used by faculty members, or staff to classify and save teaching and learning content	Learning content management systems
Operational systems to support delivery of teaching and learning content	Systems used by students and faculty members to access teaching and learning contents	b-learning, e-learning, e-assessment
Administrative management systems	Systems used by senior staff to monitoring and controlling resource usage.	Administrative decision support systems
Academic management systems	Systems used by senior faculty members for monitoring, controlling, and planning curriculums, and to do faculty members' evaluation.	Academic decision support systems
Strategic level systems	Help senior management tackle and address strategic issues and long-term trends, both in the HEI and in the external environment.	Executive support systems
Generic systems	Systems used by distinct users from distinct groups.	Office tools, Parking control systems, Traditional library systems
Transversal systems	Systems that have users from distinct groups and have integration purposes.	Portal Document workflow
Integrators	Systems which users are others systems and have integration purposes.	Message broker Users directory

5. CONCLUSION

This paper promotes a high level vision of HEI information systems in the context of HEI activities. The results of this work can be applied in helping HEI decide about their information systems architecture. Therefore before they start developing or adopting a new information system, they can classify and analyze if it will give support to areas of HEI not yet covered by existing HEI information systems.

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AUTOMATED OFFICE-MANAGEMENT AND INTERACTIVE DATABASE SYSTEMS FOR THE WWW

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ABSTRACT

This paper outlines the provision and development of interactive database systems through the context of the www, providing a tiered-system of permissions, interaction and automation, and illustrated through a particular case-study. Novel developments such as the multiple-view and multiple-edit facilities, coupled with system intelligence and data integrity protocols, ensure the delivery of an efficient automated environment. This provides a solution with the power to cater for the transparent delivery of document and multimedia services to a hierarchy of system users.

KEYWORDS

Automation, Intelligence, Interactive-database, Management-System, dynamic-www.

1. INTRODUCTION

This article concerns the creation of an intelligent www-management system implemented via www-site/internet technologies and implemented using a particular case-study. The study involves the development of an interactive (distributed) database system incorporating: an automated office management protocol (organized by the use of a calendar system), permissions/security protocols, database-integrity (maintenance and backup), a secure administrative section along with service provision (allowing various states of functionality).

The system is built to meet the needs of a scientific professional body, taking into account a hierarchy of possible users and the associated functionality levels required. The case-study has taken a "shop-window" level HTML www-site, and reconstructed it in a dynamic fashion through the use of various server-side technologies.

At the same time, development, maintenance and use of the system are features that have been segregated and refashioned. The active site is now live (http://www.bsr.org.uk) and covers the day-to-day working requirements of the professional body (The British Society of Rheology [BSR]) and the role of its officers. There is a secure administration section, and provisions for the supply of electronic publications, advertising, a media gallery archive, as well as many-sorted data handling.

2. INTERACTIVE DATABASE SYSTEMS

Developed as a multiple-access system, a hierarchical framework is embedded that governs permissions and prioritizes levels of interaction. Users are categorized into "status-levels", governed by a set of rules that determines individual access-permission levels, and dictates the power of interactivity granted. User status levels are derived from a minimal base level, defining the minimum number of permissions, and hence, least access to system functionality. Higher status levels are inherited from this base level, each building a successive, additional layer of associated functionality.

Permission Access Protocol

Permission-Access-levels determine the visibility of, or access to content in the system, thus ensuring maximal security and integrity to data-content. System-governed alternatives as to a viewers experience can either be: *"page-based"*, where a particular page-view may be enabled/disabled, or *"content-based"*, where specific content of a page may be determined via user status.

Global permissions are evaluated to determine data-access levels, based on a particular user-status. Administration-specific permissions are employed for the Administrator user-category. This allows the categorization of Administrators to specific tasks, rendering irrelevant tasks inactive. The system menu is constructed around a combination of such permission types, so that links can either be present/absent, or enabled/disabled.

Hierarchy of Interaction

A multiple-level access system can be used to generate different levels of interaction for different users. For example, an Administrator may wish to append an advertisement, along with its associated attributes. Alternatively, a member may only be allowed to view the advert, and visit its link, if desired. See Figure 1.
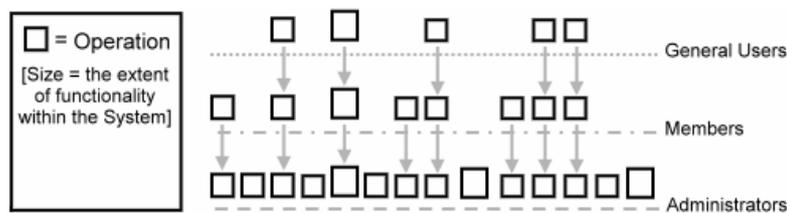
Figure 1. Hierarchy of user-levels and Functionality

3. VIRTUAL OFFICER, AUTOMATION & SYSTEM INTELLIGENCE

The system developed aids those responsible for administration by performing certain tasks in an automated, pseudo-intelligent manner. In the resulting system, there are three main areas of automation introduced: *the Calendar System*, *Functionality Levels* in operating, and through the protocols of *System and Data integrity*.

Calendar System

A Calendar System has been developed based on the principle of a date/time-line and diary system. This implies that actions may be activated at specific dates and times. The System Clock triggers an event to check against the diary, which in turn triggers subsequent events in the system. An example may be represented by a reminder e-mail, being sent on a given date to a specific user, regarding a particular task to be performed.

The Calendar may also operate at a more subtle level, over sorting and categorizing of certain data in the system. Most data-entries have their associated dates (for example, News items/Advertisements). When accessed, the system can categorize such data transparently into either "current" or "passed". News items are visible for a default three-month period, before being transferred into an "Archive repository". If under exceptional circumstances, system administrators may override any such automatic features.

Functionality Levels

A hierarchy of user levels in the system facilitates administrative components to lie alongside those of a more public nature. This, along with the page-content-based permissions system, implies that when a page is displayed with administrator editable-content, intuitive hot-links are displayed adjacent to those items, to enable the rapid editing of that feature.

For example, alongside each "News Item" title on the homepage, the links "Edit | Archive" appear, allowing a system administrator to navigate directly to the maintenance page for that feature. This facilitates

efficient administration/editing navigation, rather than passing through to a separate "News-Editor" page, locating the item, and then manipulating it. The power of this mechanism of adding permissions-based links greatly enhances the usability of the site, improving efficiency, and allowing the user to concentrate on more demanding tasks.

System and Data Integrity

The development of an interactive database system has required the implementation of various levels of backup/mirroring systems. These backup systems require the establishment of both hardware and software protocols, that determine the mode of operation.

To ensure this development, along with the primary system, two distributed backup PC's are used to sustain an interactive service. One system is based on a *local* network with the primary system (fast backup). The second is based at a geographically *remote* location (FTP backup). If the primary system fails, users are redirected via an intelligent software switch to each of the secondary sites in turn (prioritized). The third machine emphasizes the need to have a backup machine on an alternative network to that of the primary (to avoid network failure) as network failure would render both primary location machines inaccessible.

The entire system (files, programs, structure) is mirrored to the secondary systems regularly, over the local-network and FTP, respectively. Concurrency issues are thus introduced [EK2000]. Alterations/updates made by a user to the system on a secondary machine should be propagated back to the primary system (once operational). Therefore, a complete synchronization protocol should be invoked to ensure that the *current version* of the system takes precedence (the "current version" is determined by a file's "modified" date-stamp). This introduces the requirement that secondary machines should be blocked for user access whilst the primary is active, to avoid "accidental" concurrency clashes with the primary data-source. This backup system *has been* effectively enhanced to incorporate multiple backup machines.

4. SYSTEM USAGE AND EFFICIENCY

As with any system, in order to be effective in usage, certain features must be designed such that typically common tasks of appending and updating content must be developed with flexibility and efficiency in mind. Thus, metrics [ENC] are used to gauge and compare the effectiveness of actions performed. The study draws upon two such features developed to address this issue: *Multiple Viewing* and *Multiple Editing*.

4.1 Multiple Viewing

One has need to perform different tasks on different sets of data that demand alternative viewing mechanisms. A simple, summary list of names may typically be viewed in a web-browser window. A list of names with payment figures may be best suited to a spreadsheet format. Names and addresses may be best displayed in a text-document.

This "multiple-view" principle has led to the implementation of a system, whereby the information the system database holds can be viewed in different guises as dictated by user-preference, with dependency upon specific user-requirements. The system developed allows for the viewing of data in either: a *webpage*, *spreadsheet* (CVS or Microsoft Excel formats [MO]) or *document* (Microsoft Word (RTF) [MO]). The latter are implemented with Microsoft ADO to avoid individual application dependence). Dependent on user requirement, each format/application (type) may be invoked, either separately or in combination, thereby providing access to the power of the data-manipulation functionality behind each file/format type.

4.2 Multiple Edit

The Web-based Method

Administrators of the system are able to specifically alter any aspect of the data stored in the system database, via the web-page interface. For example, for this case-study, membership details may be entered or altered; likewise for Publications, Conferences and Advertisements/Announcements. This method is very

precise, with extensive Client and Server-side feedback, data-handling and error-checking routines in place, which aid and instruct the user whilst entering data.

Nevertheless, the disadvantages of this approach are numerous, particularly when multiple records must be edited successively. Then, each record must be entered completely and specifically before the data can be submitted, and that before the next record can commence. This becomes a laborious process and one that is counter-intuitive to the desired efficient working environment.

An Alternative: The Database-Spreadsheet Mechanism

An alternative, novel method is provided, termed the Database-Spreadsheet Mechanism (DSM). This allows for document downloading in spreadsheet format from the system database. Once manipulated as required, this data-spreadsheet can be uploaded to the site once-more, updating the database-table it originated from, using primary keys and identifiers. Consequently, only fields where there is a change in data need be updated.

The DSM has several advantages that make it an effective companion to the "traditional" webpage-based maintenance method. These are primarily introduced through the common functionality offered by spreadsheet packages (such as Microsoft Excel [MO]):

- Multiple-Edit. Many records may be copied-and-pasted in a single operation, and may also be amended simultaneously, using the package's fill-down function. This functionality is very difficult to replicate using web-page editing, and unavailable in packages such as Microsoft Access
- Intuitive interface. Microsoft Excel is now a standard in terms of data recording and summary. Microsoft Access is still an unfamiliar software application tool to many, and web-based editing has the disadvantages mentioned above.
- Data interpretation. One can view charts/tables to meaningful interrogate/summarize data.

5. CONCLUSION

This investigation has lead to the development of an intelligent www-based interactive management system. Protocols and procedures have been established for the usage and implementation of distributed database systems, system-automation, permissions/security hierarchies, concerning database-integrity and a dedicated service provision. The system capabilities and efficiency-features have aided greatly in satisfying the operational needs of the scientific professional body concerned, as well as the "consumer" needs of the rheological community at large (in the provision of online membership data-records, publication, gallery and communication systems). These factors may be assessed in a direct manner, through the financial and viable state of the professional body. They have led to the substantial recovery of a membership base, fully recovering membership fees and establishing a tiered level of status. The novel aspects of this work revolve around the automation, multiple-view, and multiple-edit systems, allowing the effective interrogation/amendment of data, using the most efficient mechanism for the particular task in hand.

ACKNOWLEDGEMENT

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BUILDING MULTI-SERVICES IN PERSONAL MOBILE DEVICES BASED ON PARTIALLY TRUSTED DOMAINS

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ABSTRACT

Services based on personal devices are usually supported by self-contained infrastructures with specific terminals, managed by a supervising organization that ensures a trust domain with overall consistency. Well-known examples are automated banking, mobile communications and transport ticketing. Recent developments in information technology – the Internet and mobile wireless networks – shifted expectations for customers and service providers, creating new opportunities for both.
In this paper we analyze existing self-contained services and identify challenges to multi-services supported by cooperative providers with partial mutual trust, as part of a work in progress that aims to provide models and tools to support their implementation.

KEYWORDS

Multi-service, Personal Device, Mobile Device, Trust, Self-contained service.

1. INTRODUCTION

In the last decade, **personal devices** like smart cards, mobile phones and palmtops have become common in people's lives. Together with mobile wireless networks, they enable information access anywhere with little effort and at reasonable cost. As such, they may play an important role in the effective delivery of large-scale valuable services that need a secure and timely access to meaningful information (Laudon K.and Laudon J., 2002). Figure 1 presents a very simple and abstract model of service delivery, where the user (U) has a personal device (D) that can be used in a terminal (T). The data networks (N) support the information flows with the business servers (S).
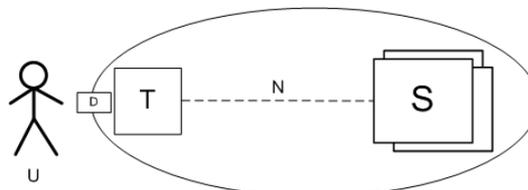
Figure 1. Service delivery model based on personal mobile devices

This model can describe several existing services, for instance: automated banking, mobile communication, pre-paid telephone calls, transport tickets, public identification, health card, toll payments, etc. We call these **self-contained services**. Each example belongs to a vertical business area and has its own

platform of devices, terminals and infrastructure. A supervising organization binds everything together, creating and maintaining a **trust domain**.

In this paper we analyze self-contained services and discuss some technology changes that enable multi-services, which have the potential to provide additional benefits both for customers and organizations.

2. EXAMPLES OF SELF-CONTAINED SERVICES

2.1 Automated Banking

An automated banking user has a personal card that can be used in ATMs – Automated Teller Machines – to perform banking transactions. If the user provides the correct PIN – Personal Identification Number, a connection is established to the bank system over a private and secure network and the transaction executes. The security mechanisms are proprietary and not publicly documented in detail (Zoreda J. and Oton J., 1994).

Multiple banks can share a network, usually supervised by an inter-banking organization. Most of these platforms have become a generalized payment service for debits in retail, utility bills, taxes, etc.

2.2 Mobile Communication

GSM – Global System for Mobile Communications – is a standard for digital, large-scale, wireless networks for voice communication, although data messages are supported through SMS – Short Message Service. GSM is widely used in Europe and in other parts of the word.

A GSM user owns a SIM – Subscriber Identity Module – card that is fitted in a mobile phone. A secret PIN activates the card, allowing the mobile phone to log on the network to make or receive phone calls. The authentication process is performed between the SIM card and the network operator.

User roaming between different networks is necessary because of territorial concessions to different operators and is possible because most trust is placed on both ends: the SIM card and the home network.

The network operators are expanding to provide value-added services based on data transmission. Some basic services, like telebanking, can be deployed over SMS messaging (Guthery S. and Cronin M., 2001), however GPRS – General-Packet Radio Service – brings new data transmission capabilities to existing GSM networks, and UMTS – Universal Mobile Telecommunications Service – and its IP-based protocols are another step forward in this direction (Patil B. et al., 2003). In all these cases, the network operator maintains tight control over which services can be deployed on its platform.

2.3 Urban Mobility

Public transportation may involve many modes: underground, bus, train, and boat (CEN, 2001). A transports network can have many operators, even for the same mode. A transports authority usually supervises the overall transport network. Electronic tickets allow operators to keep accurate data of service usage, necessary to improve the overall effectiveness of the transport network.

Calypso is a standard for smart-card use in this industry (Levy F., 2001) (CNA, 2004), where the user's card is loaded with season or pre-paid tickets at points-of-sale. Ticket can be used across the transports network and are validated at entry points.

Urban traffic problems suggest the need for combined services like park-and-ride, where users are encouraged to park their cars at city outskirts and use the transports.

3. ANALYSIS OF SELF-CONTAINED SERVICES

A well-succeeded service offers a good cost-benefit relationship to the customer and to all the organizations in the value chain. Table 1 compares the self-contained services described previously.

Table 1. Comparison of self-contained services examples

Service	User Device	Terminal	Infrastructure	Supervising organization
Automated banking	Magnetic stripe card	ATM	Secure private network Bank servers	Bank(s)
Mobile communication	SIM Card	Mobile phone	Cellular Network Back-end servers	Network operator
Transportation	Smart-card	Point-of-sale Entry point	Transport network	Transport authority

The main strength of self-contained services is the standardization of their design and technology, which enables economies of scale and a simpler design of devices, terminals and infrastructure.

The supervising organization ensures the trust domain, but usually acts conservatively and focused on current business, making services difficult to extend beyond their original use, as each has its own security policy implemented using specific mechanisms (Anderson R., 2001). This leads to a situation of one device per service, which may be acceptable, but limits the number of services a user can access. For instance, to use all three services in Table 1, the user must carry three technically similar devices: the bank card, the SIM card (inside the mobile phone) and the transport card.

4. MULTI-SERVICES

The perception of customers and organizations towards electronic services has been evolving. The Internet as a large-scale public network presented an open and dynamic business environment. It would be interesting to take these features to device-based services and (Durlacher, 1999) presents some of the opportunities. Customers could use the same device for multiple services, with more convenience and other potential benefits. Service providers could reach customers through new channels not managed directly by them. Supervising organizations of public access infrastructures would have new ways of increasing their return-on-investment, e.g. services other than banking operations on ATMs.

New delivery approaches are necessary to achieve more open and dynamic services that can share resources between different organizations. **Multi-services** is an approach that composes devices, terminals and/or infrastructures of different self-contained services, supporting restricted information and functionality sharing. Figure 2 presents two multi-service alternatives for composing two services (A and B), at the user device level (left side of figure) or at the terminal level (right side of figure).
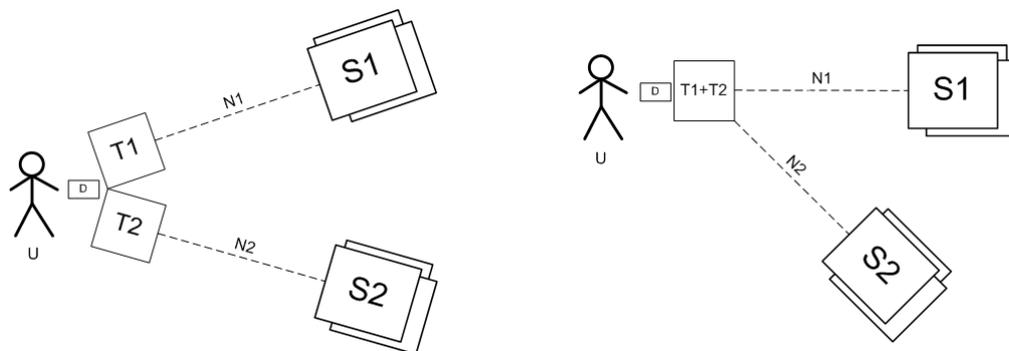

Figure 2. Multi-service using the device or terminal

From the user's perspective, multi-services are not new. There are already several examples of devices that enable access to more than one service, like co-branded banking/credit cards, tele-services on mobile phones, etc. However, from an organizational and technical perspective, these services are managed by a dominant organization, fully trusted by all associated business partners to execute service delivery

operations, e.g. financial transactions, customer registration and information, infrastructure operation, etc. In this sense, they are no different from self-contained services.

The first step of our work is the evaluation of the characteristics and requirements of **true multi-services**, i.e., services supported by cooperative business partners that agree to share information at a restricted level that excludes critical items like private security keys. The next step will be to define an architecture to support such services, including key management and distribution associated with loading of electronic contracts between different providers. Finally the proposed architecture will be validated and evaluated in a **pilot implementation**, with the use of a banking ATM network to load new season tickets in a secure transport card, assuming that the transport operator does not give up control of its security keys for ticket (contract) loading to the ATM service provider. Another possible scenario is the implementation of urban mobility policies on a city card such as park-and-ride, assuming a restricted amount of information sharing between public transport contracts and parking contracts on the card. The evaluation of the pilot will contribute to identify the approach's benefits and limitations.

An important characteristic of many of these systems that must be taken into account is that, due to their widespread use and location spread, they are **almost-never-connected**. This means that users, through their personal devices (cards, SIM cards), interact with local terminals (ticket validator, mobile phones), almost never directly connected to any central server. Therefore the distributed components of the system – personal devices and terminals – must enforce security on local interactions, without relying on remote server checks.

We share many concerns with the **related work** about interoperability and multi-services with the smart-card community (Schwarzoff T. et al., 2003; eESC TB7, 2003) but, rather than working to promote a standard framework for applications using cards or other personal devices, we are mostly concerned with security assurance mechanisms. Existing approaches assume a total trust domain, whereas we want to make partial trust explicit.

5. CONCLUSION

In this paper we presented self-contained services and the need for true multi-services. The problem we face is how to build these multi-services using cooperative self-contained service platforms, sharing information only up to a restricted level, and solving the security issues related with the identification and authentication of users and with the manipulation of electronic contracts.

The goal of our work is to develop models and tools to produce technical assurances that allow the organizations to establish the partial trust relationship between them to deliver the new service. Other expected advantages are the clarification of the organizational roles, opening prospects for more rapid deployment of integrated service delivery.

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EASY_SURVEY: AN INTERNET SURVEY TOOL

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ABSTRACT

This paper presents Easy_Survey, a tool for creating and answering surveys and panels via Internet. Although the area of interest for the authors is Marketing and consumer behaviour when faced with promotions, the tool can be used for any type of survey. The main objective of the tool presented in this paper is to create a web application that allows the management of surveys and to analyze the polled' answers. There are two modules: the administrative tool (new questionnaires, users register, …) and the web application itself (where the surveys are answered).

KEYWORDS

Survey methodology, web application, marketing research, database, data treatment.

1. INTRODUCTION

During the last years more and more applications use Internet as a starting point for achieving different objectives: e-learning, e-commerce, e-business and even e-surveys. The first reference known to the authors related to e-surveys is Pitkow and Recker (1994), this paper presents the results from the first world wide web user survey. Traditionally, surveys are carried out door-to-door, seeking information from certain collectives locally, regionally or even nationwide. Internet can be seen as a tool for broadening the application ratio of a survey or as a tool for freeing the pollsters of the tedious work (Asha, 2002; Fuchs, 2002a and 2002b).

There are issues that should be considered when talking about e-surveys as shown in Guterbock et al. (2000) and Crawford et al. (2002): measurement error, response rate, user satisfaction, …

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The Web survey Methodology page (http://websm.org) is a good place for keeping updated in different aspects related with Internet surveys. It cannot be denied that actually there are powerful commercial tools that perform surveys. If using any Internet browser, and searching for 'survey internet', the number of results is really appalling. When we thought in developing this tool, we wanted to simplify and make faster the collection of data from surveys, there was no economical reason behind the development. The main problem we encountered with commercial survey software was the price, so it was preferable to write a new application, not so powerful, but where we have the control on what to do and how to do it.

The fundamental aim of the tool presented in this paper is to create a web application that allows the management of surveys and to perform a data treatment from the answers of the polled (i.e. users). The project arises for the need to create an application, from a previous study elaborated by the University of one of the authors, which facilitates the previously described process. At the time, this brought a great benefit for both the user and the pollsters.

The application allows the polled to answer themselves the surveys, or they can be supervised by the pollster. So, the tool can be used for doing surveys in a classical way: the pollster and the polled are simultaneously at the same place. Or the application can be used as an Internet tool that allows to reach people that otherwise cannot be contacted. The pollsters are freed of the monotonous work: the field work, so they do not need repeating the same survey again and again, avoiding the monotony of the process and being able to spend this time processing information. Our objectives were:

- The application administrator and users is not required to have a wide computer knowledge.
- Users: application access via login and password, previously provided by the administrator.
- Administrators validation: some sort of authentication is established.
- Only the administrators will be able to realize changes
- Users can answer the surveys at any moment or place.
- The user will be able to determine the number of questions to answer at each session.
- Multiple users can access simultaneously the same survey.
- The answers should be validated and later stored in a database.
- To transform the data and applied a basic statistical treatment.
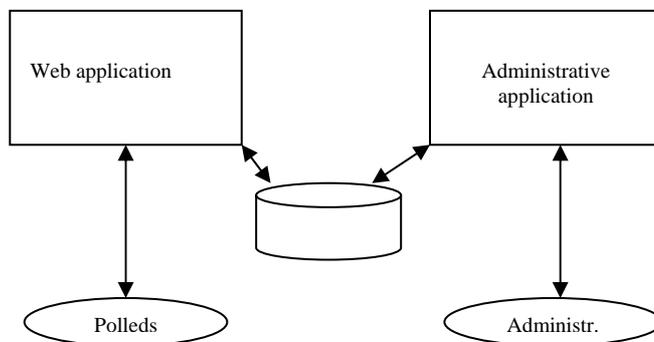
Figure 1. Easy-Survey general diagram

The tool has been tried on a small survey and we hope to test it with a wider work.

2. APPLICATION ARCHITECTURE

We can identify three different modules in EASY_SURVEY:

- **Web application**: users answer the questionnaire(s). Answers validation and database saving.
- **Administrative application**: the administrators and the users are managed. The questionnaires are processed. Files and reports are created, so the statistical results are saved for future reference and in-deep analysis.

- **Database**: the questionnaires and all the relevant information regarding the users are stored. New questionnaires, administrators and users can be created.

Interrelations among the application components are shown in Figure 1.

2.1 Web Application

The web application allows the user to answer the survey. When someone is not registered, the first step is to register the new user. Then, a survey or panel will be assigned. The objectives of this application are:

- Users' freedom of use. The polled decided when and where to answer the survey.
- The interface has been designed as easy-of-use as possible: simple design and on-line help.

Web application parts:

- **Main page**. It is the presentation screen.
- **Access**. There are two possibilities:
    - A registered user: he/she must introduced his/her login and password.
    - A non-registered user: the on-line registration process begins. Once the required data have been introduced, the administrator sends an e-mail confirming the access data (login and password) and the questionnaire that has been assigned.
- **Questions**. The user answers the questions. When the survey is very long, the user can answer just a part of it, stop and resume the session any other time.
- **Validating and saving the answers**. Each time the user answers a question is validated, if it is correct, it is stored in the database and in any other case, the question is formulated again. Each time the answer to a question is validated, it is stored in the database, this way if the Internet connection brakes down, only the last answer will be lost.
- **Log-out**. Once the user has finished, he/she logs out. Nevertheless, he/she can leave the application at any moment.

We have implemented three types of questions:

- Type 1: only one answer is allowed. For example: 'do you like promotions?', answers: 'yes', 'no'
- Type 2: the user can select more than one answer. For example: 'why do you buy this brand of chocolate?', answers: a) I like the taste, b) Good money-value, c) Quality, d) Other.
- Type 3: Several questions grouped under the same heading, where the user will be able to select an answer from each question.

There are html and asp pages. Depending on the type of action to be performed, the user is driven to a web page or other. For example, if the user is not registered, the user will be forwarded to Registrar.html, and in any other case, Acceso.asp will be shown. The web application uses: HTML Pages, ASP Pages (so a dynamic environment is possible), Access 2000 (data and questionnaires storage) and OLE DB for ASP and database communication.

2.1.1 Properties of the Web Application

The questionnaires only consider closed questions: the polled must choose one of the options compulsorily. Although this can be seen as a bit restrictive, it depends on the variety of answers to choose from. This way, the data treatment is easier. The communication between ASP and Access is done using OLE DB. The manipulation of the data contained in the database is done using SQL. It is highly important to use some security mechanism to ensure the proper use of the application:

- Even if a user knows a certain URL, it is not allowed to 'jump' there out of the establish order. User verification is performed in every ASP page.
- Data inconsistency: simultaneous updates cannot take place when updating information.
- Not authorized access: a login and a password are required.

2.2 Administrative Application

The administrative application manages: the administrator, the users of the web application, the questionnaires, the analysis of the surveys. The questionnaires have been designed taking into account the

authors' experience and the recommendations found in the literature (Andrews and Feinberg, 1999). Let's describe briefly each of the components:

- **Access**. Administrator authentification.
- **Menu**. Options: Administrators (edit, modify, introduce or delete), Users(edit, modify, introduce or delete users), Questionnaires (edit, modify, introduce or delete), Questions (edit, modify, introduce or delete questions of a questionnaire. Display of results) and Reports.

2.2.1 Administrative Application Properties

The properties of administrators, users and questionnaires are gathered from the database. All the modifications and new elements are updated in the database. The administrative application has been written in Visual Basic and the communication with the Access database and Excel has been possible using ODBC.

Again, security has been an important issue, so, there are mechanisms that difficult non-authorised access (login and password). As it has been said in the introduction, one of the main objectives was the development of a tool that could be used by people with little or none experience as webmaster. So the tool is provided with a self-installed executable file.

3. CONCLUSIONS

This paper has presented a tool that eases the process of writing and gathering information from surveys. Taking as starting point the tool presented in this paper, we are working on a new improved version. This new software will include more types of questions, greater security mechanisms and it is been developed using only freeware software. We think that it will be really interesting to test the developed questionnaires as proposed in Baker and Crawford (2002).

We are aware that there are commercial tools that are better in many ways than our tool, but when we began this project we decided that our necessity was for something that cost no money and was easy to use and install almost anywhere. Moreover, the experience has been rich and successful. Easy-survey has proven to be easy of use and a great help for the researches that have tested it.

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ELECTRONIC DOCUMENT DELIVERY IN THE FRAMEWORK OF THE EU COPYRIGHT DIRECTIVE

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ABSTRACT

The protection of intellectual property is an old and very important right. Intellectual property embraces multiple fields such as literature, art, music, industrial patents, performances and so on. Every year the lack of application of this right produces an enormous loss of revenue as well as jobs. At the moment, the absence of a worldwide legislation makes it impossible to fight this phenomenon efficiently. In this work we discuss the problem of the Document Delivery Service, i.e. the partial reproduction and transmission of papers extracted from journals, conference proceedings or other collections of scientific articles, performed between libraries on behalf of researchers and students. In particular, we analyze the Document Delivery via Internet in the framework of the European Directive 2001/29/EC of the European Parliament and of the Council, published on May 22, 2001.

KEYWORDS

Internet Document Delivery Service, Copyright, European Union.

1. INTRODUCTION

The rapid technological progress in the last few years and the enormous diffusion of Internet services have created new reproduction technologies that impose integration and/or modification of the existing intellectual property legislation in many Countries. In particular, the European Union has revised the necessity for a common legal framework in order to harmonize the current regulations of Member States. On the other hand, the enormous and rapid growth of the Internet has brought numerous social and economic advantages. The simplicity of web services with their link mechanism and the low cost of sharing information in the net (web publishing) along with the exchange of documents and ideas via e-mail, newsgroups, and electronic forums has permitted scientists a rapid increase in knowledge and collaboration. Today's electronic publishing offers easy on-line access to scientific material for organizations, campuses, and universities. A problem still exists for accessing older publications available only in paper format and covered by copyright license. The question is whether it is possible and on which terms for libraries or researchers, to access these bibliographical fonts. Scientists need to access a large set of bibliographic sources in order to evaluate ideas, compare works, improve algorithms and processes, and so on. In order to support such research activities, the libraries of Universities and other research Institutes need to retrieve these bibliographic materials. For this reason some libraries have started mutual Document Delivery (DD) activities (via surface mail, fax, and recently via Internet) usually between a restricted number of research libraries of the same organization or country (for instance, between universities). In this paper, we analyze the Document Delivery via Internet in the framework of the European Directives 2001/29/EC.

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2. DOCUMENT DELIVERY VIA INTERNET

A Document Delivery transaction is triggered by one user request. For instance, a researcher asks its library for an article, specifying its title, authors, journal, etc. If the library is not able to satisfy this request locally, it checks catalogues to find another library which has the journal/book/proceeding containing the requested article, and sends it a Document Delivery request. Originally, the libraries used to Xerox-copy the article and send it via surface mail or via fax. As such, Document Delivery is one of the most onerous activities of a library since it requires human work for retrieving the requested document, reproducing it and transmitting it, in addition to delivery costs (fax, surface mail, phone, etc). The rapid diffusion of Internet technology has permitted the replacement of the traditional process of copying and delivering via fax or surface mail with the transmission via e-mail or web/ftp servers, thus reducing costs while improving the service both in rapidity and quality (Gennai et al. 2000), (Mangiaracina et al. 2001). It is worth noting that Document Delivery activities are performed only between libraries which act as intermediaries on behalf of final users who require the scientific article for personal usage. One Electronic Document Delivery transaction consists of five steps. The first two steps are the task of the library owning the requested article (the "sender library") and the last three steps are performed by the library that issued the request, in the following referred to as the "destination library".

1. DIGITALIZATION. The sender library receives a request from another library for one scientific article. The first step consists of retrieving the article and converting it from a paper to digital format, using a scanner, generating an image file (jpg, tiff, ...), or its transformation, for instance, into a pdf file.
2. TRANSMISSION. The second step, performed by the sender library, is the file transmission via either i) electronic mail, or ii) file upload (using ftp or http protocols) and an e-mail notification to the destination library containing the file URL.
3. RECEPTION. The third step is the file download (via e-mail/web/ftp). After a successful file transfer, the destination library now has the electronic copy of the paper.
4. VISUALIZATION and PRINTING. The destination library prints the received copy to obtain the article in the paper format.
5. DELETING. The last step is to delete the received copy. This is mandatory because the destination library does not have any right of usage. The final user can obtain the paper freely for scientific use, but the destination library is only an intermediary and cannot store it for subsequent requests.

The accounting of the Document Delivery Service can suggest which journals/books/others are more interesting for its users, and it may start new subscriptions or stop those which are not considered useful.

3. THE EUROPEAN DIRECTIVES

On May 22, 2001, the European Parliament published the Directive 2001/29/EC concerning the harmonization of certain aspects of copyright and related rights in the information society. This Directive updates the copyright protection in order to adapt it to the new digital and networking technologies, and it aims to achieve multiple goals, including:

- to harmonize the rights of authors and other rightholders and to provide the protection of anti-circumvention measures and rights management information, in order to overcome legislative inconsistencies causing restrictions in the free exchange of products and services, and leading to possible segmentation of the internal market;
- to provide a secure environment for facilitating cross-border trade and to develop the electronic commerce and on-line services.
- to respect the cultural and legislative diversities of each State by specifying certain copyright exceptions, which can be applied or not from each Country.
- to receive/acknowledge the "Internet Treaties" (Copyright Treaty and the Performances and Phonograms Treaty) specified by WIPO (the World Intellectual Property Organisation) in 1996, for adapting copyright protection to digital technology.

Actually, the European Parliament tried to find a path between two opposite objectives: to protect intellectual property and to facilitate the spread of knowledge for technological progress. Member States agreed to implement this Directive within eighteen months (i.e., before December 22, 2002). Greece and

Denmark respected the implementation deadline by applying the Directive in December 2002. Italy and Austria implemented it in April and June 2003, respectively. Germany did it in July 2003. The Commission would pursue infringement procedures forcing all Member States to insert the Directive in national law.

4. DISCUSSION

We restrict the analysis only to the aspects related to Document Delivery. For a complete description of the Copyright Directive application in the Member States see (FIPR 2003); this analysis also discusses US problems. However the US Copyright Law and related documents are available in (US Copyright Office).

From the point of view of Electronic Document Delivery we have to analyze Article 5 of the Directive: "Exceptions and limitations" and in particular Comma 2 and 3, which establish some exceptions for library services and research activities. To improve readability, we quote here only the relevant parts of the Directive:

"…

2. Member States **may** provide for **exceptions or limitations to the reproduction right** provided for in Article 2 in the following cases: …

[omissis]…

(c) **in respect of specific acts of reproduction made by publicly accessible libraries**, educational establishments or museums, or by archives, **which are not for direct or indirect economic or commercial advantage**;"

"…

3. Member States **may** provide for exceptions or limitations to the rights provided for in Articles 2 and 3[1] in the following cases:

(a) **use for the sole purpose of illustration for teaching or scientific research**, **as long as the source**, **including the author's name, is indicated**, unless this turns out to be impossible **and to the extent justified by the non-commercial purpose to be achieved**;"

Comments to the Directive application, which are included in the same document, give additional clues for a correct analysis of these Commas:

"(40) Member States may provide for an exception or limitation for the benefit of certain non-profit making establishments, such as publicly accessible libraries …[omissis]…**Such an exception or limitation should not cover uses made in the context of on-line delivery of protected works or other subject-matter.** This Directive should be without prejudice to the Member States' option to derogate from the exclusive public lending right in accordance with Article 5 of Directive 92/100/EEC. Therefore, **specific contracts or licenses should be promoted** which, without creating imbalances, favor such establishments and the disseminative purposes they serve."

These regulations are not mandatory but in our opinion, the application (partial or full) or not of these exceptions could generate some imbalances in the European market. For a better discussion, it is very important to analyze not only the Document Delivery process but also the context in which it is performed. In the Document Delivery process, as described in section 2, the first step (i.e., the DIGITALIZATION) is very critical. We have to consider many factors:

- The electronic copy produced by the scanner is not a perfect copy of the original one. For instance, usually the size will be different from the original article. In general, the copy has low or medium resolution in order to reduce the file size. Then, in contrast with the distribution of articles and e-books in electronic digital libraries, where the delivered copy is indistinguishable from the original, the scanning process should be considered to be a reproduction system such as photocopy and Xerox copy.
- The electronic format is suitable for distribution (also massive) via network, and this represents the critical point of the Electronic Document Delivery service. However, in contrast with music or movies, scientific documents are interesting only for a small number of specialist researchers.

In the context of the library world a guarantee is provided by the intermediation of the destination library, which acts as a trusted partner, giving to the user the article printed on paper and deleting the electronic copy. We believe that ad-hoc agreements should be signed by the libraries (taking part in the DD service) in order

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[1] Right of communication to the public of works and right of making available to the public other subject-matter

to guarantee this behavior. The main benefits arising from the use of the network is the reduction of costs and delivery time. A fast delivery is an added value which is fundamental for the final users.

Lastly we must note that there are techniques (based on cryptographic algorithms) for ensuring the protection of electronic documents, which are already in use for e-books. The Digital Rights Management Systems (DRMs) are software tools for controlling the licenses and access to the contents (single or multiple uses). To control the access to one document, specific software for e-publishing is needed, which can selectively control the access to a resource. However, the use of these systems introduces an additional cost due to the software license and to the elaboration of the document.

While Document Delivery via Internet has been expanding until this year, now, with the application of this Directive some libraries come back to delivery via fax and surface mail, afraid of breaking the new regulations. This condition brought the service a step behind, and deleted the advantages of fast and low-cost delivery. However, for a full comprehension, it is very interesting to consider a technical comparison between delivery via fax and via Internet. Although very different, both transmission systems operate in a similar way. The fax enables one to transmit an image file, which reproduces the original document, over the phone line. Once it arrives at the destination number, if there is a fax device the file is again converted and printed on paper. In this case the recipient receives a single copy of the document. However, if the recipient uses a computer with a fax server (i.e., a program which answers as a fax) or a device for integrated messaging, the file is received in electronic format without any conversion to paper. This case is fairly analogous to a transmission via Internet: the recipient receives an electronic copy of the document and is in charge of its printing and deleting. Therefore, there exists a "de facto" equivalence between Document Delivery Service via fax and via Internet.

5. CONCLUSION

As mentioned before, the European Parliament provided a core of mandatory regulations and a certain number of exceptions which, in order to respect the diversities of each Member State, can be applied or not. Although the intent is honorable, in our opinion, the effect of the application or not (partial and full) of these exceptions and directives should be relevant. In many countries a very animated discussion on the subject is still going on. If scientific and technological progress is considered a fundamental objective for Europe and in general for all of society, more attention must be given to an important theme such as scientific research. In particular, we recognize the lack of a clear directive concerning Document Delivery between libraries, which deserves a different treatment with respect to on-line services for document delivery devoted to private or commercial users. We have to consider that technological progress keeps increasing the number of scientific articles and then indirectly it feeds the publishing industry, creating a virtual circle.

In conclusion, an important challenge has arisen: how is it possible to preserve copyright protection while facilitating the access of researchers to the intellectual patrimony. In order to avoid possible differences in the European internal market, a uniform regulation should be applied. In the absence of specific regulation for Document Delivery Service, ad-hoc agreements should be signed between libraries and publishers, in order to negotiate fair compensation.

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INVESTIGATION OF DOCUMENTS PERSISTENCY ON THE WEB

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ABSTRACT

This article presents a study dealing with the appearance and disappearance of Web resources. Through two complementary approaches we presented a quantitative overview of these phenomena according to various criteria. For example, we study the reasons of documents unavailability or the distribution of the more or less availability according to the topics evoked by the documents. We measured, for example, that documents related to some topics are more persistent than other or that the increase of the web is not the same in the different topics.

KEYWORDS

Internet, information availability, search engine, web measure, reusability

1. INTRODUCTION

One of the characteristics of Internet is its capacity to store different kind of contents related to various topics and to make them available from almost all places of the planet. Each day, news contents appear whereas others disappear. Even if we have the feeling that the overall quantity of the web information increases, it is difficult to know and to understand the reasons of this more or less availability. The objective of our study is to have a more precise vision of this informational dynamic and to analyze this phenomenon according to various sets of themes.

In a first approach, the dynamic of the information loss is evaluated starting from a fixed set of Web pages by checking their availability regularly. We can thus check if the loss of availability moves in the same way for the various topics. In a second approach, assorted sets of themes are associated with keywords. With regular interval, these keywords are provided to a search engine that provides URLs. Then, we compute for each topic the rate of new URLs provided by the search engine and the rate of URLs that disappeared compared with that of the previous period.

A clearer vision of these phenomena can be interesting in several connections. From a theoretical point of view it makes possible to better take into account the impact of the human behaviour on information systems. Indeed, it seems logical to think that mechanisms of loss and creation of resources do not intervene randomly, and that they seem to be directly related to the cognitive and social human behaviour. From a more practical point of view, this kind of evaluation can be interesting in an economic context. Indeed the follow-up of a temporal evolution of the rate of resources loss or creation for each topic can gives a helpful

indication of topics on fashion or of emerging interest. This article is segmented as follows. After having detailed our method, we present the various results obtained and before concluding, we present a state of the art with some studies or tools close to our work.

2. LOSS OF RESOURCES

For the first part of our study, we developed a program allowing testing a set of URLs that belongs to rather general topics representative of the Web content. Approximately 200 URLs were selected in each of the 16 topics of the Google search engine directory. Thus, we tested daily the availability of almost 3000 links over 97 days. In the general case, each time a user downloads a web page, the server gives in its HTTP response, a status-code that describes the success or the failure of the request. By testing this code, it is possible to know if a page has disappeared or if the web server has not been able to find it in a limited time. Table 1 gives the significance of some of these codes. (See also RFC 2616 for more details).

We can observe that, in most cases (93.63 %), we correctly obtain the requested document. However, in 6.37 % of the cases (addition of all the errors), the document is non-existent or inaccessible. These cases can be consequences of diverse problems. Most of errors are "404 Not Found". It means that the document corresponding to the URL is non-existent. Thus, the majority of accessibilities appear to be related to the design of Internet sites and are, for example, the result of a lake of Web site update or referencing. These results can be different depending on documents topics and visible on the error rate but also on the type of causes. We can compare, for example, the shopping and computers topics that have enough opposed results (see table 1). For example, the quantity of error 403 (prohibited access) is higher in the case of the "shopping" category. This can be explained by the use of secured procedures for online payments that are largely used on shopping web sites. Thus, the accesses are more often restricted. Another great difference relates to errors 404 which are more frequent in the computers category. This dissimilarity is logical since computers related contents have often a short life and thus the documents are more frequently changed. It is, in consequence, more probable to find unreachable links than in others topics. Moreover, individuals rather often create computers-oriented web sites whereas professionals generally manage shopping sites.

Table 1. Distribution of the HTTP status code

Status code	Meaning	General	Shopping	Computers
Error 403	Forbidden access	8.2 %	19.62 %	1.26 %
Error 404	Page not found	54.3 %	46.46 %	74.90 %
Error 500	Web server error	1 %	1.30 %	0.22 %
Error 503	Web server unavailable	22.5 %	27.85 %	12.79 %
Error 504	Time out	13.5 %	4.76 %	10.84 %
	Other Errors	0.5 %	0 %	0 %

The figure below presents over the tested period the percentage of inaccessible documents according to the selected topics. The segmentation of the set of themes can be debatable and it would be interesting further to consider this study with various forms of segmentation (thematic or other). In this first version of our work, we begin to use the standard segmentation of the Google directory.

We also computed the evolution of the error rate in order to qualify its trends that seem to be linear (from 0 to 6.7 % over 97 days) with a correlation coefficient of 0.84. One interesting experiment not did yet could be to analyse this trend according to the different topics.
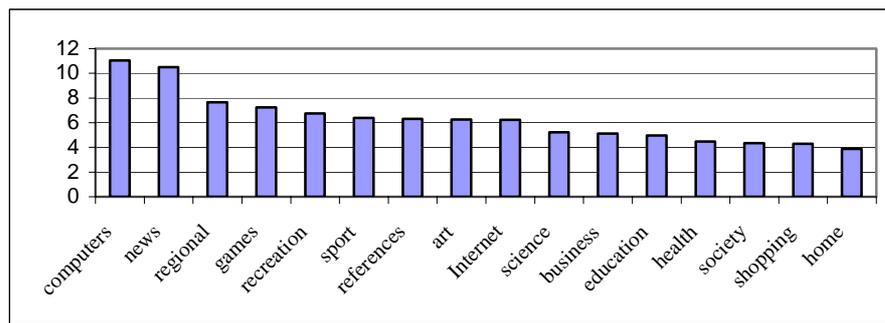
Figure 1. Percentage of error per topic

3. CREATION AND LOSS OF RESOURCES

Unlike the previous study where we evaluated the real availability of documents on the origin Web server, we are rather interested here in the evaluation of the Web as search engines present it. When a surfer launches a request on a search engine, a certain amount of answers are provided but only some of them are presented to the user. The ignored URLs correspond to pages highly similar to others already presented or to pages where the level of relevance is considered as too weak. It is interesting to see that the level of ignored pages is near 50 % in average but can be very different from one topic to another (29 % education, health 37%, society 38 %, news 43 %, sport 48 %, business 50%, computers 60 %, and games 75 %).

Each day, our program gathers the URLs answering the various requests (fixed keywords for each topic). The comparison with the results of the day before makes it possible to find the URLs which appeared or which disappeared daily. We see that the level of appearances and of disappearances is relatively equivalent over the time. Indeed, we can see that about 4 % (maximum of 8 % and minimum of 0 %) of the contents moves daily (2 % of new URLs and as many disappearances). In order to have a more precise overview, we studied the evolution from the starting situation and by group of topics having similar behaviours regarding to the rate of appearance or disappearance. The graph below presents, for each day, the number of pages appeared (or disappeared) compared to the first day of test. The lower curve presents the topics (education, computers, recreation, regional, sciences), the intermediate curve (shopping, Internet, games, home, references, health) and the upper curve (news, art, business, society, sport). Comparing the trends from the figure 2 and the figure 1 reveals that topics that growth faster are not always the same that those disappearing less rapidly. For example, the "news" category has a high level of unavailability (figure 1) but is also in the group that grows the faster (figure 2). This is probably due to a higher dynamic of changes of these resources.
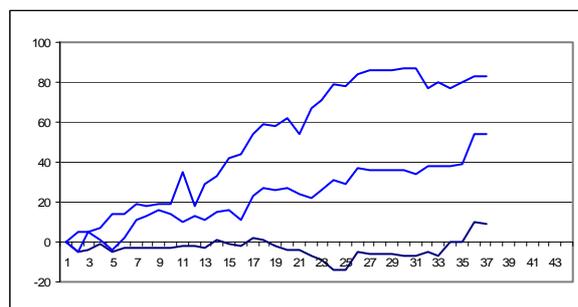
Figure 2. Compared evolution of 3 groups of topics

If we postulate that the search engine database gives a reasonable overview of the web content, we can say that the Web continue to expand itself over the time in almost all the fields but with different speeds depending on the topic.

4. STATE OF THE ART

The accessibility of online documents was the subject of several studies or tools. Many tools use the capacities of the HTTP response headers (RFC 2616). For example, the link-checkers (Link Checker) make possible to check systematically if links are broken or not. They can verify the availability directly from a set of links or by extracting all the imbedded links from an HTML page. There are also many tools or sites which offer statistics of access to Web sites (ISP, xiti, INABIS 2000). In particular some of these tools allow a count of errors when reaching resources. With these results, we can make precise statistics on the accessibility of documents from one or few servers. But these analyses cannot be generalized at a national or international level. From a more general point of view, a lot of initiatives or studies aim at measuring the web in order to build resources or connection maps (CAIDA, NLANR, NIMI). These works can be helpful in order to have a best understanding of the Web growth.

Some other studies were undertaken to know the evolution of the various search engines databases. The following site (Show Down) provides some statistics regarding this aspect. In particular, we can find a report on the dead links given by some popular search engines. The results show a tendency to dead links reduction. Indeed, on average, in the major search engines (Northern light, google, hotbot, fast, excite, altavista), the percentage of dead links was 16.6 % (sept 99), 9.3 (nov 99) and 5,8 (nov 2000). Even if we cannot take into account the invisible part of the Web (not referred, dynamic...), the search engines make possible having an overview of the web evolution. On average, the indexed documents increase from 0.1 billion in 97 to 0.5 in 2000, 1.5 in 02, and 3.5 in 03. (Google, AllTheWeb, Inktomi, Teoma, AltaVista) (Search Engine Watch.).

5. DISCUSSION

This study enabled us to have a first overview of the information availability dynamic on the Web. We also may stress tracks of future works or open questions. As an example, even if we saw that the topic is a key parameter that explains the more or less availability of Web resources, we highlighted the importance of the thematic segmentation. Another aspect to be taken into account is to well dissociate the availability of the information as reflected by search engines with the reality of the availability of the Web server. Regarding the reasons of the variations of the resources life duration, we highlighted several possible causes. First of all, there are technical reasons dealing with update or servers failures that influence the level of broken links. Except these problems, it is clear that some topics are more disposed to change than others. Since the life duration of some resources is variable, it can be interesting to replicate it. Some technologies as Peer to peer networks (Kazaa, E-mule, Napster, etc) have shown that the availability of data is directly linked to its level of replication. Other replications based techniques as proxy-caches can have a huge impact on the information availability. In the active mirror, (Lancieri, 2004) the most popular Web contents are recycled, based on phenomenon of implicit cooperation among users. In this case resources life duration can be extended as long as they remain popular. In such strategy of resources reuse, it can be useful to estimate how long native resources can be accessible.

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Show Down, Search engine show down Web site www.searchengineshowdown.com

Search engine watch web site: www.searchenginewatch.com

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NLANR, The National Laboratory for Applied Network Research (NLANR); http://www.nlanr.net/

NIMI, National Internet Measurement Infrastructure; http://www.ncne.org/nimi/

YOU, ME AND THE OTHERNESS: SOCIAL CONSIDERATIONS IN TECHNOLOGICALLY MEDIATED INTERACTIONS

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ABSTRACT

Communication is a social act that has functions and purposes beyond the exchange of any content. Technologically mediated communications (TMC's) restrict elements of the communication act that contribute to the 'social dimension' of human-to-human communication. In the context of an increasing reliance on TMC's, we have seen the emergence of a particular set of social structures and beliefs which impact on human-to-human communication. Therefore, if we examine these influences, we are in a position to make judgments about the ways in which technology parameters constrain 'social communication', both within the 'ways' of the device and beyond in society, through the creation of communication 'norms'. This would, subsequently, require the need for alternative designs to be found for the development of TMC's.

KEYWORDS

Context, Content, Mediated, Communication, Interaction, Natural Language, Human-Computer Interaction,

1. INTRODUCTION

> **you** **1**. the ordinary pronoun of the second person. **2**. anyone… [other than me].
>   (Macquarie Dictionary, 2001)
> **me** **1**. the objective case of the pronoun *I*.
>   (ibid)
> **otherness** **1**. "…an ambivalent phenomenon encompassing both beneficial and
>   uncanny elements: the fascination of novelty and the threat of the
>   familiar, the possibility of innovation and the danger of loss."
>   (Münkler, 1998)

Communication is a social act that has functions and purposes beyond the exchange of any content. Winograd and Flores in their insightful book '*Understanding Computers and Cognition: A New Foundation for Design*' cite that "…the world is encountered as something already lived in, worked in and acted upon before we start thinking and speaking about it. World, as the background of obviousness, is manifest in our everyday dealings and every possible [interaction] presupposes it. That which is not obvious is made

manifest through language. That which is obvious is left unspoken, but is as much a part of the meaning as what is spoken"(Winograd & Flores, 1986, pg: 58).

Technologically mediated communications (TMC's) restrict elements of the communication act that contribute to the 'social dimension' of human-to-human communication. These elements are encountered as people try, for example, to include emotion into their mediated interactions through the use of emoticons – those peculiar groups of symbols mimicking a face smiling or sighing. And there is also a broader debate concerning aspects of 'social atomization'- see Durkheim, Weber, and Marx for foundation principles - which support the concept that TMC's provide a less-rich communications environment for humans to interact within than face-to-face interaction. Yet, the increase in the sheer scale of recent social organization, probably one of the most significant trends of our times, is a growth made possible, at least in part, by modern technologically mediated communication tools.

In this context of an increasing reliance on TMC's, we have seen the emergence of a particular set of social structures and beliefs which impact on human-to-human communication. So much so that the breaking down of social groups into individuals or 'elementary communication units', may leave untouched a host of sociological problems, which concern not just the properties of the individual parts but their complex relationships; just as breaking down a person into atoms and electrons such as DNA, loses sight of the whole person.

Therefore, if we examine these influences, we are in a position to make judgments about the ways in which technology parameters constrain 'social communication', both within their use and operation , the 'ways' of the device, and beyond in society, through the creation of communication 'norms'. For example, the inherit lack of ephemerality in many mediated interactions such as SMS and email may interfere with communicative spontaneity, creativity and candor, thereby reducing what may be conceived as the pleasure of human-to-human interaction.

This would, subsequently, require the need for alternative designs to be found for the development of TMC's to: (a) determine communication norms that maintain human-to-human interactive 'richness' and; (b) allow 'inclusive' social structures to develop, reducing the possibility of otherness within mediated interactions.

This paper uses a critical research methodology (Ngwenyama, 1991) to investigate current technologically mediated communication tools and the design directions that established them. Further, the format of our paper is in a 'conceptual mode' rather than any current research model, such as Action research. The first section of this paper looks at the present structure of technologically mediated communication technology; the second section offers comment on face-to-face human interaction and some of its peculiarities; the final section proffers some observations on ostensibly important social issues for technologically mediated communication tools.

2. DISCUSSION

> "It is remarkable that human communication works at all, for so much seems to be
> against it; yet it does. The fact that it does depends principally upon the vast store of
> habits which we each one of us possess, the imprints of all our past experiences"
> (Cherry, 1957, pg:12)

Communications research has been undertaken for centuries. It was a primary subject studied by both the Greeks and Romans in their historical debates on the art of rhetoric, which centred around the communication of meaning, appropriate media/mediums and conceptual understanding,. Subsequently, a working definition of 'medium' is not all that hard to pin down. Essentially it can be described as including "…some material artefact that is experientially used in a particular way and [that it] conveys what may be called broadly an expressive activity"(Ihde, 1982, pg:60). A medium then is something that facilitates the conveyance of an expressive activity by the expressor to the recipient. This could be graphically shown as:
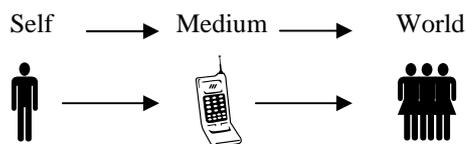

Figure 1. An example of a mediated environment

Ihde (1982) identifies that mediated communications presents two opposing dimensions within their exhibition; Amplificatory and Reductive. The *Amplificatory* dimension is primarily the capacity of a medium to manifest us to each other in spite of vast geographical distances, whereas the *Reductive* dimension can be described as the perception of the sender to the receiver through the medium is – compared to a global perception – a reduced presence and lacking in the perceptual richness of the face-to-face situation.

In a non-mediated environment, deliberate interaction with the world is direct. A perceptual situation is totally available – I see your gestures, hear your intonation, feel your expressive presence. This also can be graphically represented as:
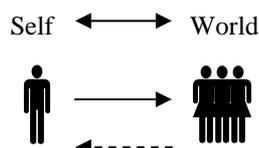
Figure 2. Non-mediated Environment

Some of the most influential technologies, such as radio and television, were developed to provide knowledge at or over a distance. However, it certainly appears that current technological innovation is directly centred around the use, and to some extent abuse, of the telephone. It might be prudent here to identify that SMS is not technically a telephonic communication in the true sense of the words; it is more a textual interaction similar in nature to an electronic version of the Post-it® note. Certainly this is a semantic issue; one in which the item's related identity has not caught up with the item's function, much the same as we say computer to mean all the components associated with a personal computing device (i.e. screen, keyboard, etc). However "…the telephone is not new technology, yet its diverse role in society, its evolution as both a business and household instrument since its inception in 1876, and the vital part it continues to play in our changing society and in the rapid expansion of the Information Age, focus it as a technology of central relevance to studies of gender, interactive media and information technologies."(Moyal, 1992, pg:51)

Several questions arose when researching the development of the telephone as a mediated communication tool. One of which is: why are all new communication technologies geared towards the telephone network? And in an attempt to answer this question, a proposition was proposed that it may be simply due to a telephone network already being in existence. This is quite within keeping with recent technological developmental trends - which have little to offer in the way of creativity, choosing to innovate on existing development rather than launching out in search of better ways of performing what have become communication norms – in that it cannot be superseded only improved upon.

Certainly, starting from the question: what is so good about the telephone that has made it the 'tool-of-choice' for most people to communicate over distance, may lead to exhaustive dissertations on the value and function of the telephone phenomenon in our society, and the subsequent reproduction of several studies already well established, (Moyal (1992), Caals (2003), LaRose (1998)) for example. However, for the sake of brevity and a clear research directive, this paper will not partake in this research direction.

However, questions, such as: "Have the recent developments of email, chat and SMS overtaken the need for voice communication technology?", may lead to the proposition that speech, although now accepted as a primary medium in human-to-human communication over distance, may ultimately be superseded by immediate, short text messages such as SMS and chat, which offer a certain 'distance' to the sender and at times, a safe anonymity.

Much of what we send through mediated communications is essentially content. The term "just give me the facts…" springs to mind here. Subsequently, there is a large amount of communication 'redundancy' accounted for in SMS, email and chat and, to some extent, even telephony – both fixed line and mobile. In this instance, the term redundancy implies some kind of repetition, or additional signs used to establish interactive success.

A statistical theory of communication put forward by Fano (1961) has, as part of its aim, the setting up of a measure of redundancy in human interactions, such as Morse code, and this redundancy may be identified at two levels: Syntactic and Semantic. Cherry (1957) cites that *syntactic* redundancy "… implies [there are] additions to a text: something more is said or written than is strictly necessary to convey the message"(pg:116). Whereas *semantic* redundancy "…uses knowledge about semantic relations among the attributes to find pairs of semantically similar rules, then removes the rule with the lower confidence or

support"(Ganchev & Livingston, 2000). Both these rules are currently not applied to our existing mediated communications devices. So much so, that SMS and chat have developed their own language – chatese, which, for all intents and purposes, is quite successful.

The further question of: "Why do we need redundancy in our interactions at all – whether syntactic or semantic?" could now be asked. Cherry (1978) cites that "…because of the various disturbances from the external environment, the uncertainties of accent or handwriting, and the inadequacies of language itself… [the] latter requiring the we expand our phrases and sentences until we are content that we have "conveyed our meaning"; we may need to express a thought in several different ways… to confirm its successful reception"(pg:117).

It is quite possible then., that there is a quantity of interactive knowledge that cannot be conveyed in a content-style format, thereby proposing that these perceived 'redundant' addendums within our interactions may be in fact the communication's context – that information which is conveyed without cognisant permission, and that we use to identify the legitimacy, timeliness, location and social appropriateness of the communication's content.

Sylvie Mozziconacci's recent experiments into the classification of emotion and/or attitude in vocal interactions identifies just that. Dr. Mozziconacci's investigation produced a series of systematic perception experiments which managed to classify the optimal values for the acoustic parameters needed to generate synthetic diphone-speech which can express a very limited but effective range of emotion or attitude. She cites that the "…interpretation of the whole spoken message by the listener involves much more than prosody alone. The inference of meaning occurs in a specific situational context, in a given language, between people of specific personalities, gender, cultural and educational backgrounds. It involves a particular semantic content, prosodic variations, as well as correspondence or mismatch between the previous elements of the communication"(Mozziconacci, 2001, pg:323). The content of the interaction will subsequently be changed in meaning or perhaps even misunderstood, should the context of the interaction be missing or ill-conceived.

2.1 Face-to-Face Communication

Spoken communication involves more than just conveying the literal sense of words and sentences. "In fact…", Dr. Mozziconacci adds, "…it contains within its content, some form of contextual information..."(pg: 324). This context not only carries information on word stress, phrasing and emphasis, but it is additionally thought to be strongly related to speaker specific characteristics, and factors such as expression of the speaker's emotions and attitudes(Mozziconacci, 2001).

So, what makes face-to-face interaction different from mediated interaction? It would appear that face-to-face interaction has several interesting features that set it apart from other interactive methods; an important one being the number of modes that a person can employ to convey a single thought: facial expressions, various types of gestures, intonation and words, body language, etc. Face-to-face human communication is also a dynamic and rich interaction, that exhibits the greatest range of possibilities for linguistic and non-linguistic information to be transferred. These include sensory information, facial and body language, intonation, words, etc. Certainly it can be argued from a technologically focused view that this richness adds more noise and complexity to the interaction, which may ultimately interrupt the communication. However, this in turn can open up an even broader discussion on technologically mediated communications (Cox, Turner *et al.*, 2003).

Questions such as: "In this technological age, is it possible that technologically-mediated communication tools have superseded face-to-face communication in value and convenience?", may stem from the commonness of the technology and the amplificatory /reductive aspect enabled by mediated communications. Certainly there would be times that any of us have used a mediated communications technology such as email or the telephone to effectively hide behind. Creating a distance between yourself and the receiver of some critical comment can be useful at times; as the initiator of the interaction has no need to be in the physical presence of the interaction's receiver – distancing ones self from the physical, intellectual and emotional reaction - together with a sense of being in control of when to terminate the discourse.

So, why are there times that I feel fulfilled/understood/accepted in a face-to-face conversation more than I do in a mediated interaction? and 'what is it that makes us need face-to-face interaction?'. Perhaps it is all of the above; the facial expressions, the various types of gestures, the intonation, the body language – the perceived richness of the interaction. If this be the case, then our mediated interactions need to incorporate

this important contextual information as well, thereby enabling us to interact in a rich environment across distance. However, it must also be recognized that there will be times when communicators will wish to be distanced from the interactions object – to effectively hide their context for the sake of personal sanctuary and even communicative effect – and the technology must enable such occurrences.

2.2 Social Issues

> "Language performs an essentially social function; it helps us to get along together, to communicate and achieve a great measure of concerted action. Words are signs which have significance by convention and those people who do not adopt the convention simply fail to communicate"(Cherry, 1957, pg:67).

It maybe that a vivid point of convergence between language and social organisation arises at the level of 'speech acts' (Drew & Heritage, 1992). In *How To Do Things With Words*, Austin (1962) developed the view that in the production of an 'utterance' a speaker performs an action, and aspects of his analysis were developed in a more systematic and technical way by Searle (1969). And because activities or speech events are built out of particular component actions (i.e. grammar, volume, gender, socialisation), speech acts can be argued as being central to the analysis of all types of interactions, and are hence important to consider in the subsequent development of TMC's.

Certainly, when we think about the development of mediated communication devices we might well think about the 'norms' that we bring to bear in terms of communication and what we want mediated communication tools to do. A particularly useful perspective is to be found when we explore these issues with particular regard to those communities we deem as having 'dis-ability'. There is a long standing critique of the way in which technology can be designed, from the R&D stage onwards, to the way in which people are actually disabled (see especially Goggin & Newell, 2003).

It would also appear to have been the creation of a new social order or class system where there are 'haves' and 'have nots' within the technologically mediated communications world. It is now possible to be described as being 'technologically disabled' – a class of people who do not have a mobile phone or access to other technologically mediated communication tools (i.e. email, chat).

In looking at the world through different perspectives, we are particularly mindful of what would happen if the whole world was deaf or blind? In the case of Deaf users (that is predominantly those who are pre-lingually deafened and use sign language as their first language) then much of their desire with regard to electronic communication is via the use of video telephony. Indeed, because much of the communication is via visual cues, it could be argued that this particular community could be particularly well served by specific forms of mediated communication because amongst other things, emotion can be and is conveyed by signs. In terms of blind people, it is possible to imagine the use of tactile information in far more sophisticated ways than has ever been conveyed before. Of course, there is also the increasing use in forward-thinking movie cinemas to move to personal vocal descriptions of what is being shown for blind people and this could certainly be utilised in non-tactile ways as well.

So often we think of such creation of communication tools in terms of non-disabled communication norms. We bring norms to bear on the whole populace and yet it is quite clear that mediated communications can be enormously enabling. Especially if we are routinely to 'build in' such abilities, as opposed to creating disability, via the norms that we either consciously or unconsciously bring to bear.

3. CONCLUSION

Although new technologies oft take different or novel substantive forms and do provide functionalities that did not previously exist, how and what they do are choices employed, consciously or not, by their creators. "Mediated communication tools are ontologically complicated in that they are responsible for shaping human behaviour, for enabling and constraining action, but they are also shaped by their human creators, which suggests that the relationship between technology design and social action is recursive" (Harrison & Zappen, 2003, pg: 14).

It would also appear that human-to-human interaction is not a perfect process and that our communicative actions, mediated or not, involve risk: a risk of miscommunication. Indeed, some have argued that it is the desire not to be misunderstood that provides much of the energy for communication *per se* (Wallace (1962)). What maybe needed to develop human-to-human interactions over distance that contain all the richness and context of the non-mediated environment (see figure 2) is the disregarding of existing models of mediated communications and re-developing the problem of contextually rich interactions over distance from a different standpoint - that of the user of the mediated communications tool rather than the technological ability of the tool itself.

When the process of design of technologically mediated communication tools includes the user for whom the technological artefacts are created, it becomes possible to create technology systems that serve a different set of social needs and interests; in this case, those related to the enhancement of democracy, community and the disempowerment of otherness.

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DESIGN OF WEB-BASED VIRTUAL COMMUNITY SUPPORTING ADOLESCENTS WITH CHRONIC ILLNESS

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ABSTRACT

Web-based conference systems are being used to enhance communication between health care providers and their patients. While the web has long been used to provide information to patient information, conferences allow interaction between patient and provider, empowering the patient to take a central role in maintaining his/her own health and well-being. The authors are developing a virtual environment for a research project aimed at supporting transition to adulthood for adolescents with spina bifida. The experimental environment consists of a web-conference for dialogue between the adolescent and a team of school counselors and health care providers, goal-setting and goal-tracking function, calendar and journal-writing functions, and free-form discussion among the adolescent's peer group. This paper describes the design of the environment, the theories on which it is based, and how the design supports the goals of the ongoing research.

KEYWORDS

Computer-Mediated Communication, Virtual Communities, eHealth Web Design

1. INTRODUCTION

The increase of internet-based consumer health information is rapidly changing the practice of medicine (Breugel, 1998). Healthy Transitions Network web site is designed to promote inter-generational exchange among persons with spina bifida to improve the independence, health, and well-being of adolescents. Young people with chronic illness are often isolated from support communities. Adolescents living with spina bifida often lack the contact with adults needed to pattern their behavior and prepare them for adulthood. The current project is aimed at providing youth with mentors, expanded peer community, and professional support.

Many studies of adults with chronic conditions have emphasized the importance of teaching self-management skills to patients, including disease-specific information, technical skills, and problem-solving skills (Weitzman, 2003). These skills empower patients and families to identify their problems, and provide techniques to help them make decisions, take appropriate actions, and alter these actions as they encounter changes in circumstances or condition. There is widening support for patients taking an active role in personal health care decisions and taking responsibility for gathering information and maintaining health records. Studies have demonstrated that patient-held records are accurate well-maintained, and associated with improved health outcomes (Maly, 1999). Interventions based on the health site are aimed at three aspects of care: 1) medical management of the condition; 2) creating and maintaining new meaningful life roles regarding work, education, family and friends (especially important for transition to adulthood); 3) coping with the emotions of having a chronic condition (D'Alessandro, 2000).

The researchers of the current effort have identified two prominent theories informing the project. The two theoretical models are the Wagner model of chronic illness care and Social Learning Theory. The Wagner model identifies the essential elements of a health care system that encourages high-quality chronic

disease care; these elements are community, the health system, self-management support, delivery system design, decision support and clinical information systems (Wagner, 2003). For the population of youth with spina bifida, the model suggests that the lack of community support, self-management support, and decision support contribute to lower than optimal outcomes. The design of system support for this population must address the need for community, support for self-management and assistance in guiding decisions about patient care.

The Social Learning Theory has its base in the work of Albert Bandura. His theory states that those with high self-efficacy expectancies (the belief that one can achieve what one sets out to do) are healthier, more effective, and generally more successful than those with low self-efficacy expectancies. This theory suggests that an environment designed to improve self-efficacy will contribute to better outcomes (Bandura, 1977). New models for chronic care delivery systems recognize that families' information needs must be met if productive interactions with empowered patients and proactive practice teams are to occur. Work with self-management programs for adults with chronic conditions suggests that interactive strategies to promote self-efficacy and self-monitoring are superior to traditional, unidirectional flows of information (Von Korff, 1997).

The study design consists of a three-year clinical trial comparing a population participating in the web-based environment with a cohort receiving standard care. The populations will consist of 30 adolescents with spina bifida whose families have Internet access. Baseline measures will include family demographics, an index of complexity and severity of child's condition, health related quality of life questionnaire, index of health information access, index of physicians' and school counselors' familiarity with adolescent's medical condition and an index of Internet use. Formal outcome measures will be collected biannually and will include hospitalizations, school nurse visits, school absences, and caregiver missed workdays. In addition, focus group analysis will be conducted to assess qualitative aspects of the experience.

2. BODY OF PAPER

The web designers supporting the Healthy Transitions Network set out to build an online virtual community consistent with the goals of the base research objectives. The environment consists of conference area for each adolescent. Each adolescent is paired with a mentor - an adult with spina bifida. The conference participants also include the adolescent's care providers, school counselor, and family members. The environment allows the mentor to define goals for the adolescent and provides a means for participants to rate progress toward those goals.
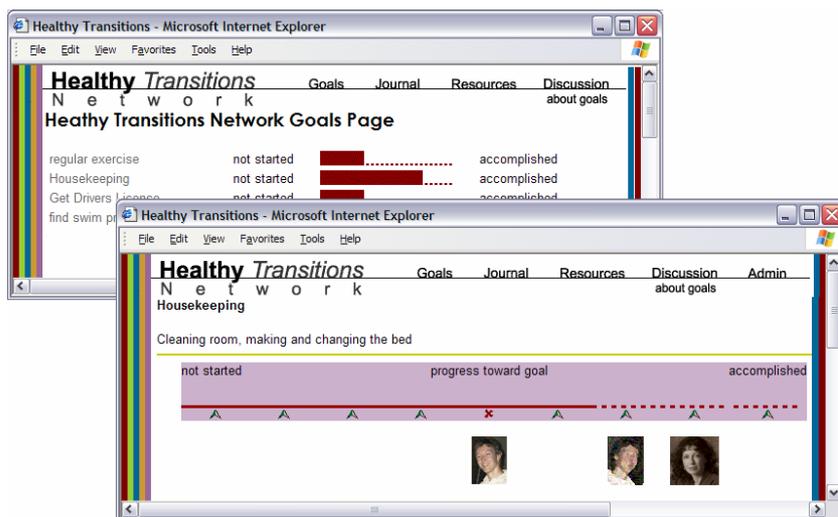

Goals are established by mentors. Perceived progress toward a goal can entered by any team member at any time. The individual progress ratings are indicated by the team member's image below a horizontal bar graph. The average rating is displayed to indicate progress toward goal accomplishment. Adolescents can view feedback at any time.

The goal-setting feature of the environment is consistent with Social Learning Theory in that it focuses attention on the goal, ensures that the participants remember the goal over time. The ongoing discussion puts

the mentor in a modeling role, and the feedback summary provides a motivation to achieve the goal (Bandura, 1997).

Design aspects of the environment informed by the Chronic Care Model include discussion areas to allow adolescents to form a peer group and virtual community, a reference section allowing health care providers to post relevant information sources, a calendar and journal feature to support participant's self-management of their care, and discussion area for dialogue between the adolescent and his/her care givers. There are two levels of community supported by the environment. The adolescent engages in dialogue with his/her support team of care providers and mentor. The environment also provides a dialogue space for informal exchange among the adolescent's peer group (all the youth participating in the project).
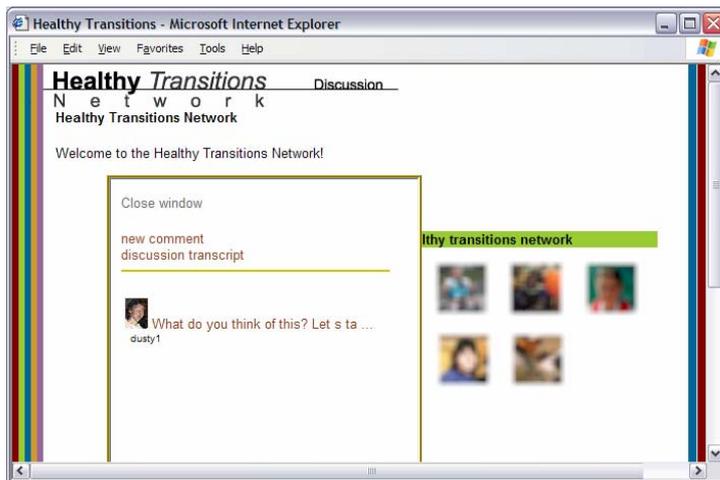
The image of each participant in the community is included to provide an opportunity to visualize the peer group. Clicking on the image opens an email form for direct, private communication. Messages posted to the peer group discussion area are visible to all participants in the project.

Both the chronic Care Model and Social Learning Theory put a high value on self-management support and self-observation. The web environment supports this concept with a calendar and journaling feature.

The adolescent is encouraged to maintain a calendar to record appointments and planned events. The journal provides an opportunity for recording thoughts, feelings and personal observations. These records form the basis for deepening the relationship and support between the adolescent and mentor.

The site also provides mechanisms for gathering baseline and outcome data through the use of questionnaires, surveys and online focus groups. The data gathered through the environment are passed to researchers who will compare the findings with those of the control group.

3. CONCLUSION

Experience with a series of online focus groups supported by this same web environment, for adults with spina bifida has shown that this form of communication and exchange is highly valued. Participants with like life issues and, in many cases, mobility impairments, were eager to share their experiences, exchange stories, and to help one another. Experience with a government demonstration project aimed at improving wellness among chronically ill children, by coordinating among their care providers, provides a model of successful outcomes; coordination of care produced fewer hospitalizations, emergency visits and missed school days (Liptak, 1983). The combination of the ease of use of the online support environment with active care coordination promises to be a powerful direction for improving health and for creating greater social support networks. Web-based support and wellness communities will continue to be increasingly important to managing growing health needs.

During the development of support systems, technologists and systems architects rely upon implicit theories to inform design decisions. Typically, designs are built to reflect perceived information flow or declared data definitions. The current project serves as an illustration of an alternative to traditional application design. The design of the Healthy Transitions environment is driven by the same theory that drives the research agenda. The result is that system designers and researchers base their work on a common theoretical framework ensuring consistency between the objectives of the research and form of the supporting environment. The reaction of study participants and the researchers will determine the success of this design approach.

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THE EFFECT OF SIGNALS ON MULTI-LEVEL TRUST IN DIFFERENT RETAIL FORMATS

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ABSTRACT

Research on consumer-firm relationships from a multi-level and multi-disciplinary perspective is scarce. This paper aims to study the role that the main quality signals the retailer sends to the market play as factors that engender consumers' trust. Besides, the proposed model considers three interrelated levels of trust –with the store brands, the personnel and the firm- and is tested separately for different retailer formats –hypermarkets, supermarkets and other formats-.

KEYWORDS

Signals; trust; brand; personnel; retail format; multi-level relationships.

1. INTRODUCTION

Most of the studies on relationships between the firm and the consumer use a socio-psychological perspective and focus on trust as a key variable in relationships (Doney and Cannon, 1997; Mayer *et al.,* 1995; Singh and Sirdeshmukh, 2000). However, some marketing authors, in order to enrich the understanding of consumer behaviour in their relationships with the firm, adopt an economic perspective and study quality signalling in consumer-firm relationships (Mishra *et al.,* 1998; Rao *et al.,* 1999; Singh and Sirdeshmukh, 2000). Following the agency theory, and if applied now to the relationship between the consumer and the firm, the adverse selection problem can appear when the consumer has to choose the "best" firm to establish the relationship with, and, because of a lack of information, has difficulties to distinguish the true quality of different products or services (Kirmani and Rao, 2000; Mishra *et al.*, 1998; Singh and Sirdeshmukh, 2000). In this situation, the signals that firms send to the market may help consumers to choose the "best" firm for the exchange because they try to credibly reveal the firm's true skills and the product's quality (Kirmani and Rao, 2000; Rao *et al.*, 1999; Singh and Sirdeshmukh, 2000).

Moreover, in consumer relationships, the other party of the dyad may be a brand, an employee or the firm, three parties that interact with each other when offering a global image to the market. Nevertheless, literature has usually analysed only one type of relationship (Macintosh and Lockshin, 1997). Firstly, *brands* can also be considered "partners" in relationships with consumers (Fournier, 1998). It is obvious that consumers seek brand attributes (e.g. reliability) or experience similar feelings (e.g. intensity, interdependence) towards particular brands to the ones referring to people or organisations (Fournier, 1998). Secondly, the study of *interpersonal* relationships is key due to the fact that frequent and affective interactions are interpersonal, with the firm's employees (in this paper, salespeople, cashiers, the customer service department and, in general, any employee who may be in contact with consumers sometime). The third level alludes to the relationship with the *firm*. This type of relationship has been considered shorter and weaker than the interpersonal relationship. Thus, the consumer has tried to personalise the relationship with the firm in order to obtain the positive benefits of the interpersonal one (Iacobucci and Ostrom, 1996). In certain contexts, as the retailing one, it is difficult to separate the different relationship levels with consumers because they establish relationships not only with the personnel, but also with brands and the firm almost simultaneously (Dodds *et al.*, 1991). Given the previous reasoning, the goal of this paper is to study consumer-retailer relationships from a multi-level and multi-disciplinary perspective and for different retail formats (hypermarkets, supermarkets and other formats).

2. MODEL AND RESEARCH HYPOTHESES

As for the relational variable in the proposed model and adapting the definitions by Mayer *et al.* (1995) and Singh and Sirdeshmukh (2000) to multi-level relationships, trust is going to be considered here as the emotional security that makes consumers think that the other (a brand, an employee or the firm) will fulfil their expectations of results or behaviour (expectations of brand quality, of contact with the personnel or of the overall relationship with the firm). One of the processes to engender trust suggested by Doney and Cannon (1997) for industrial contexts, but also useful for consumer markets, is the transference process, which implies the transference of the consumer's trust in a "proof source" to a firm or person the consumer has little or no direct experience with. Following this process, the consumer's trust in a certain store brand (the store's image is implicit in the quality of the brand with its name) contributes to the formation of (it is transferred to) the overall trust in the store. Likewise, the experience of contacting a particular employee can be associated with the general results of the relationship with the store. In consequence:

H1: Relationships between trust levels. The consumer's trust in the store brands (H1a) and the consumer's trust in the personnel (H1b) positively influence the trust in the store.

According to studies by Mishra et al. (1998) and Singh and Sirdeshmukh (2000), firms' signalling investments can overcome the consumer's adverse selection problem and, in this way, I propose that signals may engender consumers' trust in the firm. The main mechanisms (signals) consumers may use to infer product quality before deciding which store to buy from are the warranty (the warranty of refunding the product price or replacing the product in case of dissatisfaction during a trial period), the firm's reputation, advertising, the store belonging to a national or international distribution group, comfortable surroundings and a professional layout, after-sale customer service (for example, complaint handling) and the product packaging (see reference literature for signals in San Martín et al., 2003). Following the information economics, the credibility of the signals is linked to the vulnerability of consumers' sanctions: if the promised quality is false, the firm will lose its reputation and will put its future incomes at risk. Although some signals may be more probably related to one kind of trust, in principle it is going to be considered here that the retailer's signals could affect the three trust levels. For example, the store belonging to a national or international distribution group may signal not only the quality of the brands the store sells with its name (trust in the store brands), but also that the personnel share common values and corporate culture with consumers (trust in the personnel) and that the firm makes an effort and continuously invests to satisfy consumers' needs (trust in the store). The second hypotheses reflects the previous reasoning:

H2: Relationships between signals and trust. The retailer's signals positively influence consumers' trust in the store brands (H2a), in the personnel (H2b) and in the store (H2c).
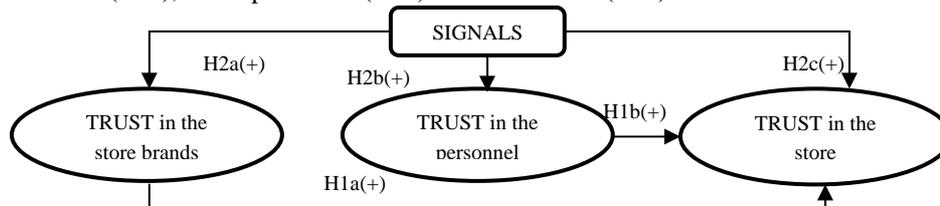

Figure 1. Proposed model of the relationships between signals and trust. Hypotheses

3. METHOD AND RESULTS

The set of proposed variables was measured for the relationship between the consumer and his/her usual retailer mainly for the buy of food considering three relationship levels: the store brands, the personnel and the store. Data was collected using a questionnaire given to Spanish buyers in November 2002. 368 valid questionnaires were received out of a total of 450 administered (response rate = 81.7%). The sampling error was equal to 5.1% (confidence level of 95%). In-depth interviews with the people in charge of different stores helped to identify the signals they use to engender consumers' trust. The first question in the questionnaire was the retail format in which the consumer buys most food. 191 consumers correspond to hypermarkets (hyper) (Auchan, Hipercor and Carrefour), 121 to supermarkets (super) (mainly Sabeco and Spar) and 56 to other retail formats (ORF) (discount stores and markets, mainly Dia and Lidl). As for the socio-demographic characteristics, most buyers are women and, as opposed to buyers of hypers and supers,

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the buyers of ORF are younger, with less monthly income, students and single homes. The model variables were measured by multi-item scales, which consisted of 5-point Likert questions (from *strongly disagree with* to *strongly agree with)*. Although the scales have specifically been created for this study, many items have been adopted from previous research. After validating the trust scales and due to the fact that all signals were significantly correlated to at least one trust level, all variables were part of the global model estimation. In order to enrich the results and because the role played by different retail formats has not been studied extensively (Bhatnagar and Ratchford, 2004), the proposed model was tested separately for the three different retail formats: hypers, supers and ORF. The three structural models were analysed using Lisrel 8 (*path analyses*). Figure 2 shows significant relationships and fit indices.
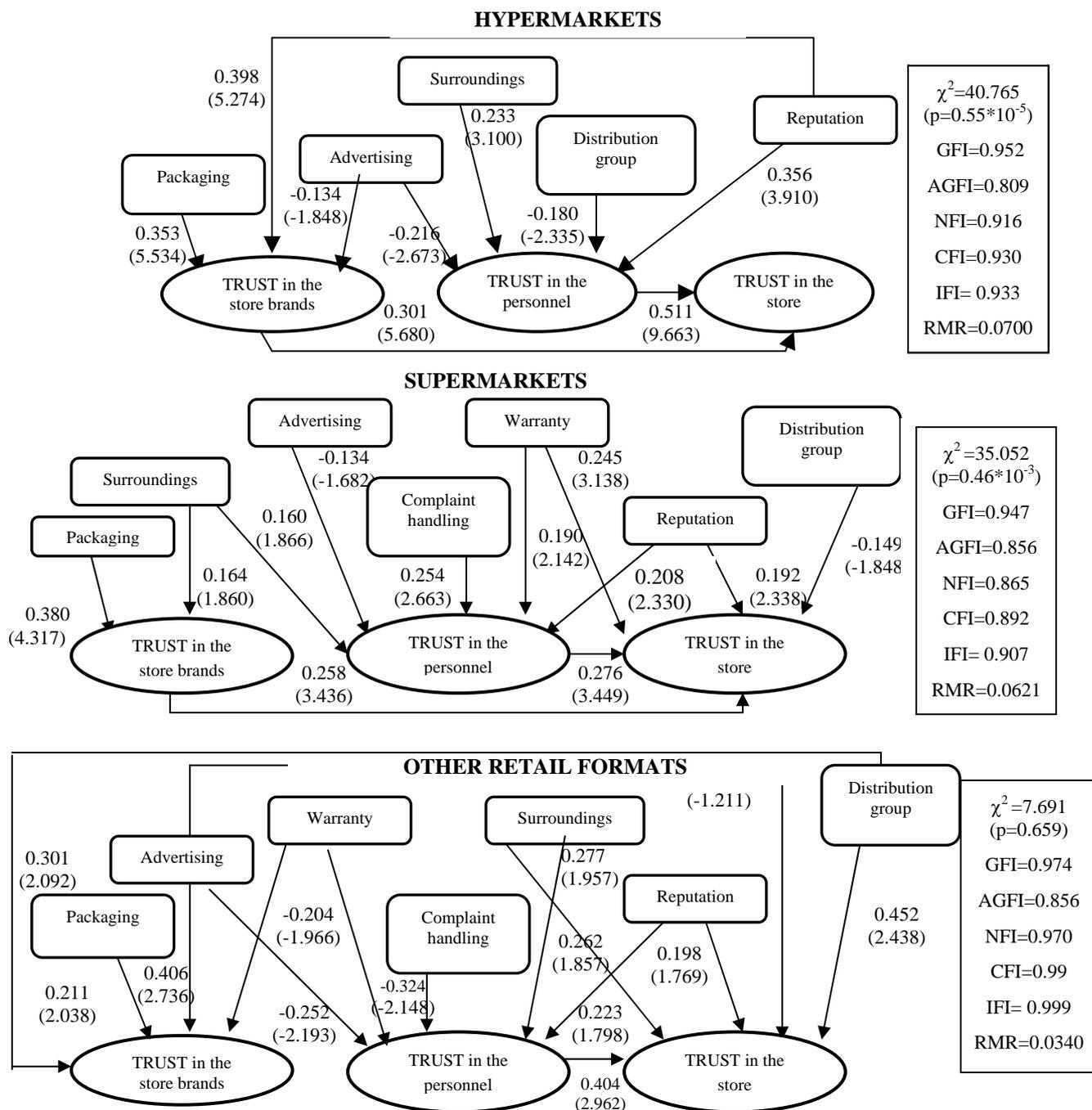
Figure 2. Results of the final estimated models (only with significant relationships)

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4. CONCLUSION

One of the most important implications of this multi-disciplinary and multi-level study is the transference process of trust in the store brands (H1a) and in the personnel (H1b) to the trust in the store, so H1 is completely supported. These effects are bigger in the case of hypers than in the other two. The relationship between trust in the store brands and trust in the store is not significant in the case of ORF, maybe because these two kinds of trust are clearly lower for ORF than for hypers and supers. H2 is also supported. In the three cases, the product packaging generates trust in the store brands, comfortable and nice surroundings reveals as an important signal and reputation especially engenders trust in the personnel and in the store. However, advertising and promotions show a negative impact on trust, except in the case of the trust in the store brands of ORF (thus, advertising transmits information about the store brands sold in discount stores). It seems striking that, contrary to what it is the aim, the investment in advertising made by hypers and supers produces a negative result. This negative perception of retailer's advertising and of the belonging to a chain may be due to the belief that they could imply a higher price or to consumers' lack of confidence in advertising. Notwithstanding the similarities, there are noticeable differences among formats. None of the signals considered in this study helps to generate general trust in hypers. Besides, complaint handling does not engender trust in hypers, whereas the relationship is positive for supers and negative for ORF. While the belonging to a distribution group negatively influences trust in the case of hypers and supers, it seems to be positive for ORF. Lastly, the warranty does not seem to be connected with trust in hypers, it is positively related to trust in the personnel and trust in the store in supers and it seems to have a negative influence on trust in the store brands and in the personnel in ORF. The negative impact of warranty and complaint handling on some trust levels of ORF could derive from the lack of offering a good warranty and of adequately solving complaints. One *direction for further research* is to investigate the effect of signals on trust in the case of e-commerce of "hybrid" commerce. In the Internet context, the lack of an interpersonal relationship level can make brands more important. Additionally, it would be desirable to complete the model with more variables, to make a longitudinal analysis and to consider the buyer's personal characteristics. Finally, although the purpose of signal sending is to generate a positive response, some possible negative effects of signals could be studied.

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THE LITTLE DIFFERENCE — GENDER INFLUENCE ON ICT ADAPTATION AND USE IN HIGHER EDUCATION

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ABSTRACT

The use of new information technology impacts individuals as well as the whole organization. Between genders, there seems to be some differences towards approaches into use of information technology. This paper illuminates some preliminary findings from an ongoing study about impacts of the new educational technology in educational organization and individual work. Main question in this article is how do approaches toward technology differ between genders and how crucial are the differences? Empirical findings are discussed and analyzed using methodology provided by grounded theory. In this article similarities and differences with previous theory are discussed. Findings do suggest that there seems to be some differences in a way how men and women use technology and for what purpose.

KEYWORDS

Impact Research, Gender, WBT, ICT, Grounded Theory.

1. INTRODUCTION

Information and communication technology (ICT) is being used widely in modern society. Information systems do cover almost the whole scale of different dimensions of modern society. Information technology has undisputedly been the greatest influencing factor in organizations for over 30 years and throughout that time there has been little evidence that developers of user applications are able to predict or plan organizational outcomes (Eason 2001). ICT is an unseparatable part of today's educational organizations, as well as most commercial organizations.

There are also a great variety of users. They vary from young to old, from computer literate to users with lesser skills. Users can also be divided based on gender. This paper focuses on different approaches towards ICT usage based on gender. Objective of this paper is to discuss whether gender has influence on the form of effects new ICT in education mediates upon implementation or not, and to illuminate some interesting findings from an ongoing study about effects of ICT in higher education. This paper does not try to give full answers, nor to present comprehensive discussion about the subject, but instead take into focus general observations encountered during research progress. The modest objective of this article is to offer some observations about differences in behavior between genders and to provide some ideas about how to cope with these.

2. ABOUT THE STUDY

The study is based on interviews which took place during spring and autumn 2003. Interviewed persons were all working for the same organization. They were chosen based on their background as a former, or present user of web based course tools (WBT). The goal was to try to reach for as heterogenic group as possible. Although it is possible to reach saturation point already after 15 interviews where no new concepts emerge, recommendation being around 20 interviews (Sandberg 2000, p. 13), whole 20 were needed. In total 20 persons were interviewed, out of which twelve were women and eight men.

Original interviews consisted of six different themes and these were discussed quite freely during the interview. For this article, interesting findings about different approaches towards technology between genders from the first of six themes are discussed. The themes discussed during interviews were as follows: 1) Personal user history of web based course tools; 2) Ways of using web based course tools; 3) User experiences of web based course tools; 4) Web based course tools influence on individual work; 5) Changes caused by web based course tools, and 6) Future.

The method used for analysis of interviews is grounded theory. It can be presented either as codified set of propositions or in a running theoretical discussion, using conceptual categories and their properties. Interviews were analyzed using open coding (e.g. to form classifications) and then using axial coding (e.g. to form main and sub categories). The third phase was selective coding, in which the goal was to integrate the core process into all produced classes. The last phase was to combine produced new concepts and knowledge into previous knowledge. (Järvinen 2001, p. 65-67; Glaser and Strauss 1979, p. 31.)

3. STRUGGLING WITH STEREOTYPES

For a long time men have been associated with technology, and women have often been depicted as more passive users (Van Slyke et al. 2002, p. 83). It has also been noted, that too many women seem to think that computers will play no role in their lives as professional adults (Leister 1993, p. 292). These stereotypes are quite common — even worldwide — and are hard to get rid of. But can we really claim that women are passive towards technology, and do not see any concrete benefits in taking information technology into use?

When studying differences between men and women in adaptation and usage behavior of ICT, there seems not to be found very crisp and clear differences. Although there has been previous research, which supports presumption that there are gender differences in computer usage (Leister 1993, p. 292; Venkatesh and Morris 2000, p. 129; Hakkarainen et al. 2000, p. 110), differences seem to be mainly found in differing attitudes towards ICT usage than actual use (Wood et. al. 2002, p. 298).

When considering adapting ICT into use there seem to be noticeable differences between genders. Venkatesh and Morris (2000, p. 129) suggest that men are more focused in their decision making regarding new technologies, while women are more balanced in their decision making process. In other words, while men only consider productivity-related factors, women consider inputs from a number of sources including productivity assessments when making technology adoption and usage decisions. Wood et al. (2002, p. 298) on the other hand suggest that females in the university setting are quite comfortable using computers in a "task-oriented" way, although do not feel as comfortable with computers nor are interested in computers just in their own right, like men are.

Gender, along with other factors, seems to be influencing social life in different dimensions. Gender seems to play important role in willingness to obtain skills necessary for success in information society (Leister 1993, p. 292). There are also obvious differences in approaches towards learning ICT skills. For example, Davies (1984, Quoted in Carter and Jenkins 1999, p. 3) observed that female students show a tendency towards working more consistently, and stamping out difficulties before they became real problems, whilst male students show more of a tendency to refuse admit that there is a problem, often ignoring the issue until it has become much more serious. This difference could be explained through differing learning patterns between genders (Carter and Jenkins 1999, p. 3).

4. GENDERING BIAS AND DIGITAL DIVIDE

Adapting ICT into use in higher education appears to be slow change process, with no radical indications. ICT usage in teaching and learning is widespread but part of a blend, where more traditional forms of education are still utilized. ICT is serving as a complement to already existing instructional tools. Characteristic for ICT usage is also the fact that instructors are gradually doing more, but with no reward for their efforts. (Collis and van der Wende 2002, p. 7-8).

Common stereotypes suggest that technology is very male dominant area, but this study does not give any implications to that direction. Quite contrary, when it comes to use of new methods to improve individual work processes or to achieve greater efficiency, women seem to be more open to try new ideas. This was

quite obvious, when tracking down possible candidates for interviews. A little bit surprisingly there seemed to be more women involved into development of one's teaching methods than men. Also the age among interviewed did vary, youngest being 25 and oldest 57 years old, average being 42. When it came down to ICT skills, all interviewed did see themselves possessing at least satisfactory skills, some even better. The heterogeneity of users was also quite evident.

When analyzing interviews of this study, the way how women had made decision to adapt new technology seemed to be decision, which was made after very thorough thinking. The fact was that all women did have pedagogical studies behind them, and they were in many ways interested about improving their working and teaching methods. Such a simple and clear motive behind men's decision in taking new technology into use was not that clear but it implies that most significant factor is more concrete solution for a technical problem. Difference between men and women could be expressed in a form of question. Women could ask:" What good for my work process could follow from using this technology?" while men could ask:" How do I resolve this problem using technology at hand?" In general, this could imply that women seem to plan and make decisions for longer time scale than men. On the other hand this can be interpreted also as a different thinking pattern. Although there does not seem to be major differences in a way how men and women actually use technology, there seems to be clear distinction in approaches toward technology. For women the exploitation of highly developed interactive communication seemed to be most the important factor, while men seemed to be oriented to more technical details.

According to Yin (1994, p. 31-32), in case studies one should aim to make analytical generalizations. In this study there seems to be noticeable difference *for what purpose* the technology is being used, as well as in *favored functions* offered by technology. This difference can be presented in a form of x- and y-axis, as Fig 1. illustrates. X-axis presents functionalities favored and consists of two polarities, which are technical functions and communicational functions. Y-axis presents purpose, for which technology is considered. Here also two polarities are represented, which are general interest, or "general good" and specific problems. In general, men seem to be populating mostly upper right corner, while women seem to populate lower left corner.
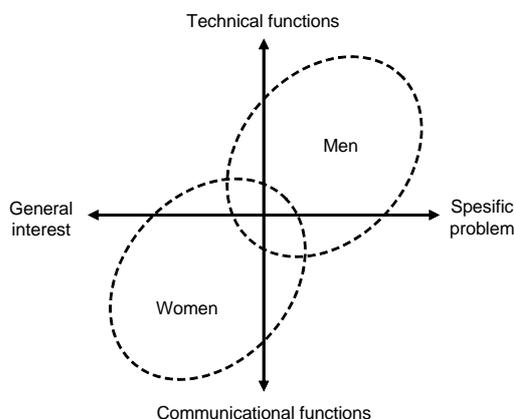
Figure 1. Differing interest areas between genders

Interviews showed that people adapt and use technology in different ways. Reasons for adapting new web based ICT tools into use did vary between interviewed. Most important reasons for adapting new ICT and work processes seemed to be interest for subject matter, to try new things, to pursue new benefits, to solve a problem at hand and to utilize web resources in education. In general, most important factors seemed to be either pure curiosity, or simply utilitaristic approach to technology. There were no real borders between different disciplines in adapting new technology into use, although there might have been some special requirements for the actual ways of technology use in teaching though.

Almost all of the interviewed had at least some pedagogical studies behind them, only two men did not have any pedagogical background. This could be interpreted meaning that pedagogical knowledge might have something to do with eagerness to enhance ones teaching and working methods. In many cases other ICT applications were used along WBT, or even preferred over WBT, but this was related to goals.

When studying these finding one must also take into account the environment, where study was conducted — higher education has its own characteristics. Apart from this, these findings do give some implications for future research on the use of ICT, but with certain conditions. According to Lee and Baskerville (2003, p. 241), it is possible to develop a theory that is generalizable in a case study within the case setting, but they also note that a theory may never be generalized to a setting where it has not yet been empirically tested and confirmed. Their message is simple, there is only one scientifically acceptable way to establish a theory's generalizability to a new setting: Theory must survive an empirical test in that setting. On the other hand, Lee and Baskerville (2003, p. 235-237) see analytical generalization as a well founded way to make generalizations. Findings presented here do offer an interesting starting point for further studies on ICT usage and adaptation.

5. CONCLUSION

Gender seems to be a factor that has notable role, when judging whether or not to take unfamiliar ICT into use. This is due to the fact that women seem to approach this question from more general viewpoint, while men seem to be more oriented towards problems at hand, and struggle how to solve these. There seems to be differences in thinking patterns between genders, although this study does not offer enough material for making this type of statements — only suggestions for further study. Instead, what is obvious is the differences in favoring different attributes offered by ICT. Another characteristic difference between genders is the decision making process. Clear distinction between genders can not be made in this particular study when it comes down to computer literacy. In general, women appear to be at least as computer literate as men, and are able to utilize ICT in their own work. There are some exceptions in both groups, though.

Gender stereotypes do not seem to offer solid starting point for adaptation process and utilization of ICT in its fullest potential. There seems to be the "little difference" between genders in a way of thinking and approach towards ICT. This should be considered when planning implementation of ICT. Whether differences are inborn or originate though cultural socialization process is another question. Difference is reality, and when taken into account, allows us more easily to understand complexities of social life behind technology.

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A KNOWLEDGE MANAGEMENT FRAMEWORK FOR LOCAL GOVERNMENT AGENCIES AND SMALL & MEDIUM BUSINESS

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ABSTRACT

In this paper a Knowledge Management Framework able to generate and make available to decision makers information and knowledge tools for the analysis of the market dynamics is presented. The proposed solution covers the whole process of the Knowledge Management, characterized by the integration of distributed informative resources with heterogeneous content. By collecting data from Local Government Agencies and Small & Medium Business, this framework presents a Cooperative Architecture's Information System where each actor acquires new added value services outsourcing from other ones. The core of this cooperation is realized with Web Services technologies. The whole knowledge discovery process is based on Data and Web Mining techniques.

KEYWORDS

Knowledge Management, Data Mining, Cooperative Systems.

1. INTRODUCTION

In recent years, Information and Communication Technologies have profoundly transformed the ways in which the society produces and exchanges information as well as the time required to do so. This innovation is taking on a primary role in the economic development of more advanced countries and is creating new social behaviours.

Today, the analysis of huge amounts of data coming from geographically distributed sites can be problematic for both private and public organizations. The aim is to produce added value knowledge in order to orient and support strategic decision-making. For example, the knowledge about the availability and characteristics in the public sector of its unemployed human resources may be of great value to the private sector. For the private sector, the access to this information can be crucial in determining the viability of developing and addressing investment strategies in a given geographic area. Hence, the efforts to search for relationships among information coming from different sources are incremental and continuous since this process can produce new knowledge through the collection, organization and furnishing of information. The added value of the proposed framework is to extract, to process and to model huge amount of data in a distributed and heterogeneous content environment of data resources, coming from both the World Wide

Web and the Local Government Agencies and Small & Medium Businesses, by combining a Cooperative Architecture with Data and Web Mining techniques.

The proposed prototypal framework uses Knowledge Management [7],[1] to bring the correct information to the right person at the right time. Knowledge Management is an incremental and continuous process whereby existing knowledge is collected, organized and furnished to users.

2. THE KNOWLEDGE MANAGEMENT FRAMEWORK

The purpose of the framework is generating and making available to decision makers information and e-Knowledge services to support them in the decision-making process. By integrating Data & Web Mining techniques [4], the framework is able to extract, to select, to process and to model huge amount of data in a distributed and heterogeneous content environment of informative resources, coming from both the World Wide Web and the Local Government Agencies (LGAs) and Small & Medium Business (SMBs), in order to discover rules and patterns unknown a priori [9].
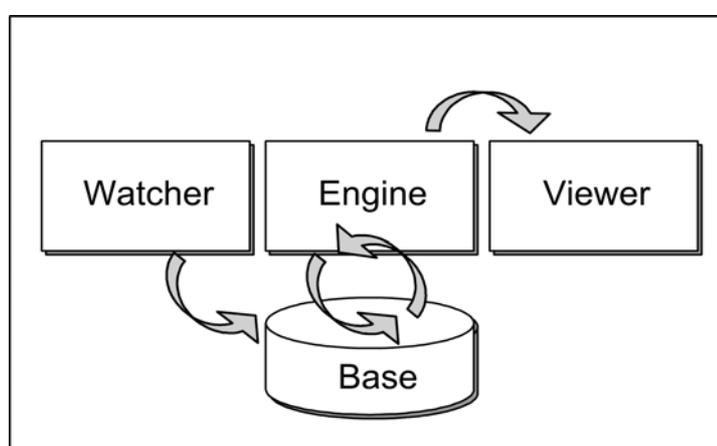
Figure 1. The Knowledge Management Framework

The main components of the framework, developed with Java technology, are shown in Figure 1:

Watcher: This component has the task to automatically extract structured and unstructured data coming from the World Wide Web, LGAs and SMBs. It is able to discover information about the content of web pages and the navigation behaviour of the user by implementing Web Content Mining e Web Usage Mining techniques [2],[5]. To collect structured data from LGAs and SMBs Information System it makes use of Web Services technology.

Base: This component represents the database of the system. It is a repository of raw data coming from the Watcher and of knowledge data elaborated by the Engine. For a standard representation of data, metadata and mining models the Base uses the Common Warehouse Metamodel (CWM) of the Object Management Group [8]. The CWM is designed to maximize the reuse of Object Model (a subset of UML) and the sharing of common modelling constructs where possible.

Engine: This component is the core of the framework. It works on raw data stored in the Base and provides the e-Knowledge services by covering the whole process of the Knowledge Discovery in Databases (KDD) and in Text (KDT) [3]. Each e-Knowledge service realizes a choreography of complex Data and Web Mining operations built on libraries of well-known algorithms.

Viewer: This component represents the single access point for Knowledge Sharing and has the task to show the knowledge depending on the characteristics of the decision maker. It provides the e-Knowledge services through human and machine interfaces by using Portlet and Web services technologies.

To integrate sources of heterogeneous information, such as databases, documentation and web sites the framework is build on a private network constituted by LGAs and SMBs using "Cooperative Gates". These interfaces, based on Web services technology, transform LGAs e SMBs legacy Information Systems in Cooperative Systems able to cooperate among them (Figure 2).

A Cooperative Architecture's Information System consists of numerous components distributed over large, complex computer and communication networks that work together, requesting and sharing information, constraints, and goals [6]. In this way the framework knows each change in each Information System and periodically updates the Base component.
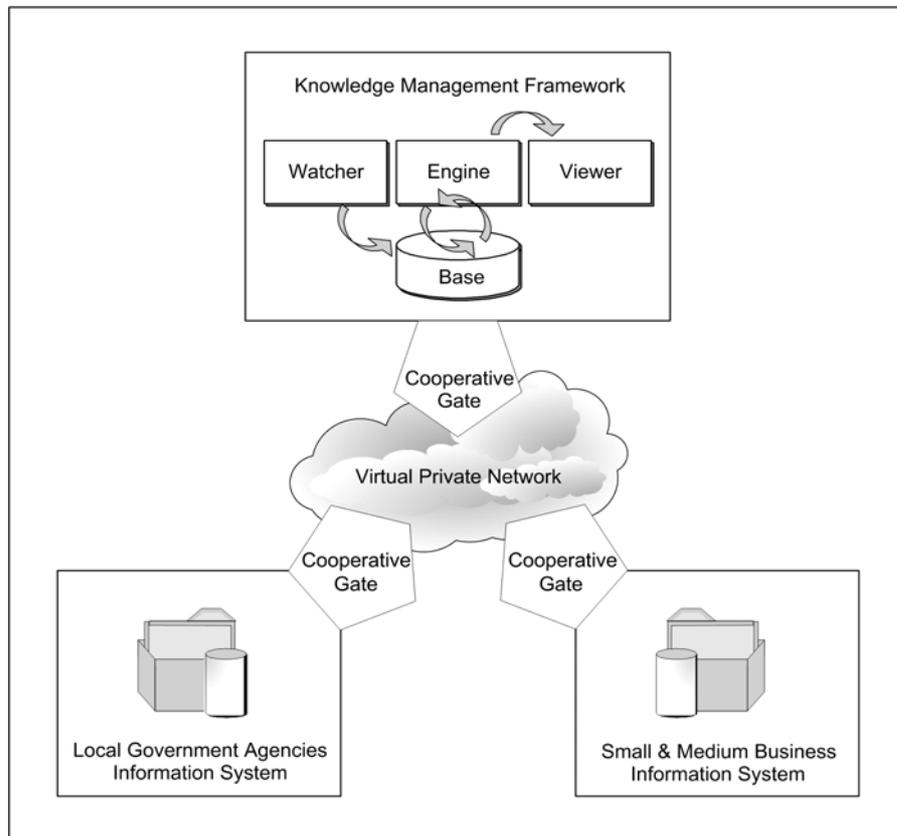

Figure 2. Cooperative Architecture of the Knowledge Management Framework

3. CONCLUSION

The framework represents a web-based Knowledge Management tool able to provide added value services to Local Governments Agencies and Small and Medium Business. It can drive decision makers into strategic planning. As remarkable results, the framework provides a single access point for Knowledge Sharing and is able to collect, integrate, elaborate and store heterogeneous information coming from World Wide Web, LGAs and SMBs.

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INTELLECT TRANSMISSION SUPPORT BASED ON ORGANIZATIONAL INTELLECT MODEL

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ABSTRACT

To establish the intellectual identity of the organization, it is important for every organization to revitalize creative activity inside and attract intellectual interest from outside the organization. This paper proposes a framework to support attraction of outside interest by transmitting the organizational intellect. We have developed models of organizational intellect and a support environment for creation and inheritance of organizational intellect based on the model. This paper proposes concepts to design attractive information for the outside in terms of intellectual activity, and a support system to transmit organizational intellect based on those concepts.

KEYWORDS

Knowledge management, Organizational memory, Ontology

1. INTRODUCTION

The variety and growth of intellects in an organization are major sources of high competitive power for an organization [Nonaka 95]. Regarding the growth of organizational intellect, it is important for each organization to exchange intellects not only internally, but also externally [Wenger 02].

This study is intended to develop information systems to support both internal and external exchange. This paper specifically addresses the latter: it proposes a framework to support attracting intellectual interest from the outside by transmitting the organizational intellect effectively.

2. OVERVIEW OF INTELLECT EXCHANGE SUPPORT

This study explores the following important issues that support information systems:

(A) Revitalization of activities for creation and inheritance of organizational intellect

- **Supply of guidance:** Most organizations have criteria, patterns, and styles for selecting and crystallizing organizational intellect. This study refers to them as "Norms" [Jonassen 00]. Guidelines for organizational activity meeting these norms directs organization members to the desired process of creation and inheritance of organizational intellect.
- **Increase of organizational intellect awareness:** Organization members must become aware of the relationship among people, intellects, and vehicles. That clarifies answers for questions in daily organization activity such as: *Who knows the intellect well? Who should collaborate? Which vehicle is useful to obtain the intellect?*

(B) Transmission of organizational intellect to the outside

- **Selection of intellects to transmit:** Based on an understanding of organizational intellect, the organization establishes the purpose of the transmission and defines its scope.
- **Conversion to presentation:** The organization finds the most suitable style to the intellect one wants to transmit. The intention of the transmission should be reflected in the style.

Figure 1 shows an overview of this project focusing on (B). The dual loop model (DLM) and intellectual genealogy graph (IGG) form a foundation to provide organizational intellect awareness information for both inside and outside entities in light not only of the intellect itself, but also its formative process.

DLM implies the organizational norm. This model represents a process of change of intellect in an organization both from the viewpoint of each member's activities and organizational ones [Hayashi 01]. This model serves as a guideline for the creation and inheritance of organizational intellect.

IGG is a model that represents chronological correlation among persons, activities, and intellect in an organization as an interpretation of activities of organization members based on DLM [Hayashi 02]. IGG is generated from activities with vehicles, which support transmission of intellect among people, for example, text, figures, and so on. An IGG records activities related to intellects in the organization aside from their existence. Such information forms a foundation to answer questions in daily activities

A site map is a model describing the structure of intellects to transmit. It comprises a content level and a presentation level. The content level model is a subset of an IGG, which is extracted with the intention of transmitting the organizational intellect. The content level model is transformed into the presentation level one in order to allow display on a WEB browser and so on.

Based on these models, this project is intended to develop information systems to support both (A) and (B) as mentioned above. To support (A), it is crucial to prompt the members' spontaneous activity by providing organizational intellect awareness information based on IGG, as well as to direct their activity by presenting guideline on the activity along to DLM. On the other hand, to support (B), it is crucial to prompt the organization to grasp a comprehensive view of its own organizational intellect by also presenting IGG to enable the organization to prepare its best materials for transmission. Moreover, it is important to prepare a mechanism for conversion from the content of transmission to its presentation.

To discuss these matters entirely is beyond scope of a brief paper. We leave the details of support for (A) to [Hayashi 01]. This paper specifically addresses support for (B). The following chapter shall examine the model and support functions for organizational intellect transmission.
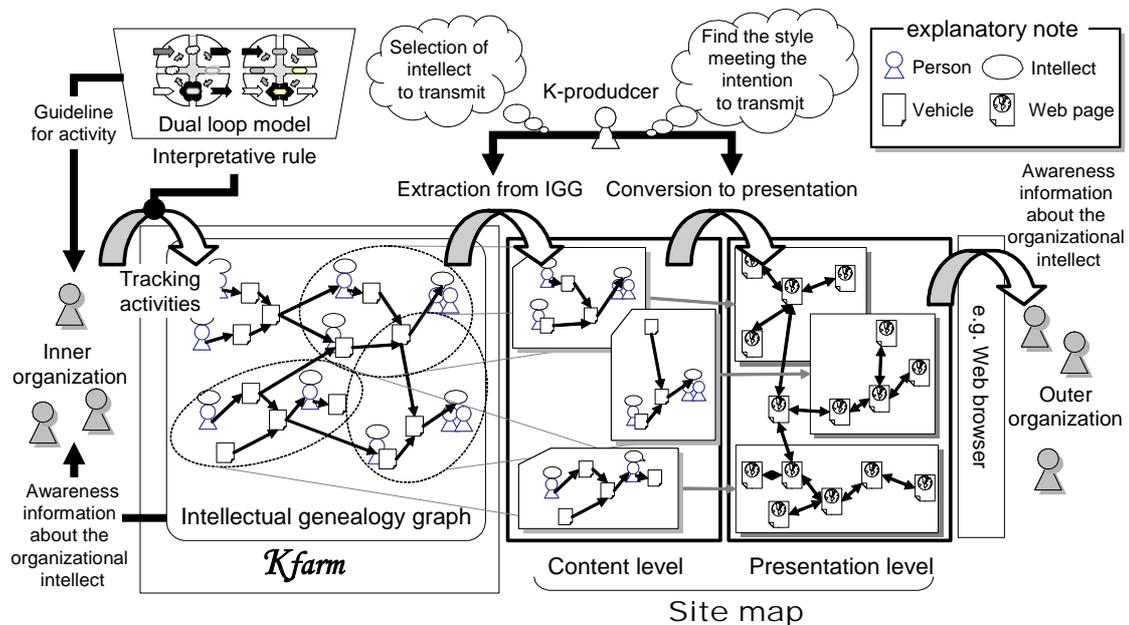

Figure 1. An overview of intellect exchange support

3. ORGANIZATIONAL INTELLECT TRANSMISSION SUPPORT

Before turning to a closer consideration of the model and support functions, a few remarks should be made concerning an outline of design process for organizational intellect transmission model. Sections 3.1 and 3.2 present further discussion of the model and support functions, in respectively.

Figure 1 shows that a site-map consists of content level and presentation level. It lists tasks that designers carry out in the site-map design process.

During the content level design process, designers select an organizational intellect that will be transmitted to the outside. The following are design tasks.

- **Understand the status of organizational intellect:** Referring to IGG, a designer understands the development processes of persons, intellects and vehicles in the organization.
- **Select subjects to transmit to the outside:** The designer selects persons, intellects, vehicles and activities that are expected to attract intellectual interest from outside the organization.
- **Set up a purpose of the transmission:** The designer clarifies the intention of the transmission. The intention implies how the organization would like the outsider to understand the intellect.
- **Have a perspective for transmission:** An IGG represents relations among persons, vehicles, activities, and intellect in the organization. To extract an attractive structure from IGG, the designer selects necessary relations according to the purpose.
- **Prune away superfluity for transmission:** Organizations can not always transmit all items in the structure. The designer removes items that the organization can not publish to the outside.

On the other hand, in the presentation level design process, designers decide how to display the organizational intellect to the outside. This is similar to common tasks undertaken during website design. Here are tasks for that design for presentation level.

- **Select a presentation template according to the transmission intention:** The designer selects a template that defines the presentation style. Then, the content level model is converted to the presentation level model by the site conversion module.
- **Coordinate the presentation of the organizational intellect:** The designer coordinates the presentation: text addition, layout arrangement, and so on.

3.1 Concepts for Organizational Intellect Transmission

This study proposes a framework to describe the relation between the presentation level, which is embodied as web pages, and the content level, which describes meaning and intention of the presentation level, from the aspect of creation and inheritance of organizational intellect.

Table 1 summarizes concepts to describe the presentation level model and the content level. To allow discussion of how the content level model describes information from the aspect of creation and inheritance of organizational intellect, we shall concentrate on the *Attractive frame*, *Theme*, and *Site pattern*.

- *Attractive frame*: A unit of organizational intellect awareness information is called the *Attractive*

Table 1. Site map model concepts

Level	Concept		Explanation
Content level	*Description*		Description of a person, an intellect, a vehicles and an activity in IGG
	Attractive frame		A network of *descriptions* to be transmitted to the outside This is extracted from IGG with the organization's intention.
		Subject	A *description* of a person, an intellect, a vehicle or an activity that is presented as a subject of an *Attractive frame*
		Related items	*Descriptions* presented together with the *Subject*
	Theme		Description of intention of an *Attractive frame*.
		Subject	A person, an intellect, a vehicle or an activity that is a noteworthy item in the *Attractive frame*. It corresponds to the *subject* of the *attractive frame*.
		Purpose	Expectant effects of the *attractive frame* on the outside.
		Perspective	Necessary relations to display the *Subject* attractively according to the *purpose*.
	Site pattern		Pattern of extraction of an attractive frame from IGG.
Presentation level	*Page*		A web page that expresses a *description*.
	Cluster		A network of *pages* that corresponds to an *attractive frame*.
	Cluster top page		A *page* that corresponds to the *subject* of an *attractive frame*.

frame in the content level. An *Attractive frame* comprises a *subject* and *related items*, as shown in Table 1. Extracting an *Attractive frame* as a part of IGG is helpful for the outsider to see the organizational intellect and for the organization to maintain transmission information.

- *Theme*: *Theme* describes how the organization expects the outsider to recognize the organizational intellect. The *Perspective* implies notable relations in IGG according to the *Purpose* in order to realize the expectation. A *Perspective* that is set according to the *Purpose* indicates a policy to select *Related items* in the design process as well as a record of the intention of the selection after the process.
- *Site pattern*: *Site pattern* is a framework to describe the pattern to select *Related items* according to the *Purpose* and the *Perspective* of the *Theme*. For example, when the organization would like to attract an outsider to competency of itself, it is effective to transmit the intellect and activities related to the formative process of the intellect.

3.2 Support Function for Organizational Intellect Transmission

This study aims to design and develop an organizational intellect transmission support environment based on the concepts mentioned in the previous section. Here are necessary functions for the environment.

- Lead designers into coordinating content and intention of transmission
  The concepts mentioned in the previous section are provided as a basis of Site map design for designers through the environment. Those concepts facilitate designers' recognition of the importance of coordinating transmission content and intention.
- Provide the lines of thought in Site map design by Site pattern
  The site pattern describes noteworthy relations in IGG according to the *Purpose* and the *Perspective* of the *Theme*. Based on the description, the environment provides for designers with the candidates for *Related items* as reference information.
- Convert the content level to the presentation level
  The site conversion module converts the content level model, which is represented by RDF and OWL, to the presentation level, which includes web pages represented in HTML. The base unit of mapping between the content level model and the presentation level model is *Description* and *Page*. This mechanism facilitates the semiautomatic generation of a presentation level model and provides the content level model as metadata of the site map in standard form.

Figure 2 shows a site-map model generation image. Web page (C) on the right of Fig. 2 shows the
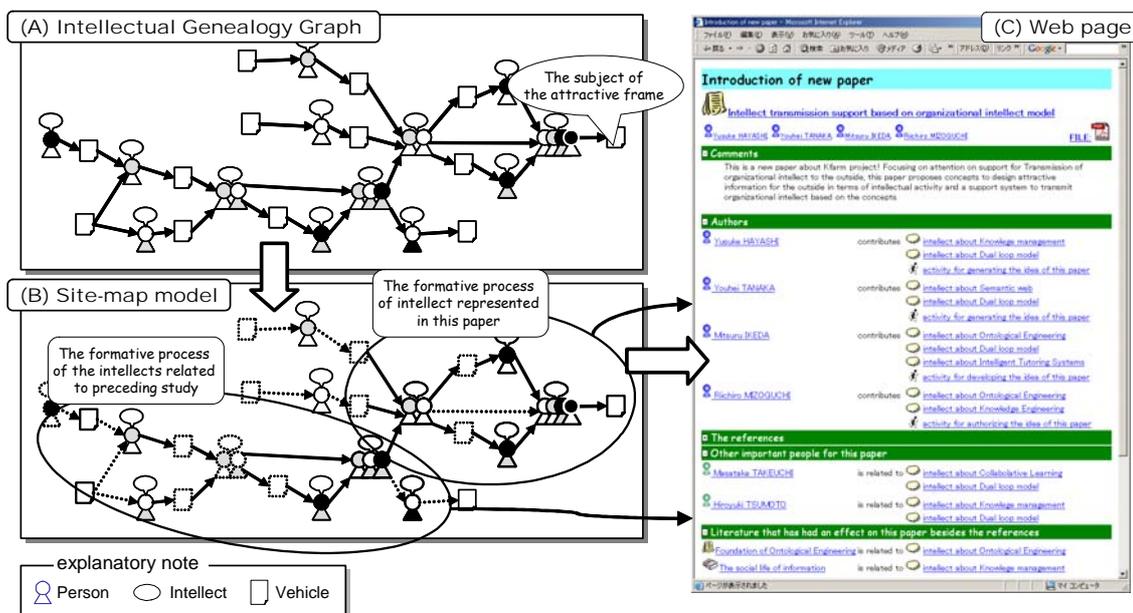

Figure 2. The generation of a site-map model

presentation level of the site-map model resulting from generation. It displays a new paper just submitted to an international conference and the hyperlinks to those people, intellects, vehicles, and activities that are related to the intellect of the paper. The hyperlinks in the web page are set based on relations in the IGG (A).

Figure 2(A) shows all nodes and links that are retrospectively accessible from the subject paper in IGG. Arrows indicate direct links among people, intellects, vehicles, and activities. A typical directed link means, for example, that a destination intellect is derived from a source one. The relations reflected in the hyperlinks are selected by the designer according to the perspective. In this case, the perspective specifically addresses the organization members' contribution to the subject paper. Tracing the links retrospectively from the subject in IGG, the designer prunes away confidential and irrelevant nodes to secure the sight map and render it to be easily understandable by outside entities. Figure 2(B) shows broken lines, which indicate that the links have been pruned away. The remaining nodes are important activities or intellects in the formative process of the subject. This extraction can reveal relations that are not described clearly in the vehicle. Finally, this model is converted to a web page by the site conversion module as a presentation level model.

4. CONCLUDING REMARKS

This paper discusses organizational intellect transmission support. That support is intended to activate intellect exchange and growth of mutual understanding among organizations. This study will also accumulate site patterns and develop a support environment using standard web technologies.

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USABILITY MODELS ON INSTITUTIONAL PORTALS: A CASE STUDY AT THE UNIVERSITY OF BARI

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ABSTRACT

This work illustrates the test results of 2 heuristic evaluation tests on the Web Portal projected and realized in the Economics Faculty at the University of Bari. The heuristic-based evaluation method of web usability found itself on the individualization of various typologies of existing errors in the interaction between system and users.
The First Test was made on the existing Web Portal with the aim to discover existing errors, the second one was performed on the new version of Web Portal and it helped to analyze the permanence of the errors, showing, at the same time, a drastic reduction of the usability problems and a consequent increase of the Portal's ergonomics. The high number of improved interventions confirms the goodness of this methodology but it underlines that the range of corrective choices cannot enjoy some of the optimal solutions to avoid costs of reengineering.

KEYWORDS

Web-learning, e-learning, usability, heuristic.

1. INTRODUCTION

In the Economics Faculty of the University of Bari, as in most part of academic environments, it's present the demand to spread, through the Net, didactic and administrative informations and support tools of aid to the didactics as mementos, suggested bibliography and test results.

On September 2003 Faculty Council has deliberated to submit the Web Portal management to the Informatics Research Group that has decided to submit the Portal to an heuristic-based evaluation test finalized to improve it with the goal to be able to deliver services in a more intuitive way.

Once corrected the errors through a new Portal realization, the group has lead a following heuristic-based evaluation test with different encouraging results to continue the research with new strength to some better opportunities.

2. METHOD

Behaving usability analysis the group lead the heuristic evaluation applying some typical methodologies described below, preferring the heuristic-based method to others like evaluation tests, automated sessions, practice communities.

To do this, the group has followed some concrete reasons:

- The availability of four Usability Engineers inside the research group;
- Brief time to reach appointed goals: three days for every evaluation. this is particularly meaningful if compared with the useful time to obtain results through tests on a selected group of users.
- The quality of the results reached. Literature points out a survey of 70% of the total errors, raised in a Web Portal structure, through the use of four experts, as well as an advantageous costs benefits analysis on the use of this methodology.

Usability Engineers aimed to individualize portal errors and deficiencies in line with methodological literature brought by Jakob Nielsen and Rolf Molich and consistent in:

- System Condition visibility
- Relationship between ICT system and reality
- User's control and freedom
- Standards and coherence
- Errors' prevention
- Recognition rather than storage
- Flexibility and employment's effectiveness
- Aesthetics and minimalist planning
- Users' potentiality to recognize the errors, to diagnose and to solve them
- Help and documentation

The research group has integrated the above list with the specifications enunciated by Mark Pearrow; they underline requirements that, putting aside from considerations of ergonomic character, aim the attention on the semantics of the furnished message and on the demonstrated potentialities of the information furnished by the media. They are: chunking and environmental perception, use of the inverted pyramid writing style,emphasize aloft the important information, unjustified employment of functions, pages scanning feasibility, reduced maintenance of download and answer times

The analysis step has been preceded by a brief in which the usability engineers has defined the essential characteristics of Web Portal target-user, the possible sceneries of use for the Portal and the objectives of the research. The analysis bases have been the result of the surveys' average conducted in this phase by each of the usability engineers.In this step they used a paper created by Wendy W. Naughton Usability & Technical Documentation Group, Xerox Corporation compiled for the UPA Conference in July 1995 and opportunely modified.

First part of "Screen Information" in which the usability engineer will synthetically describe the interface and mark the name of the system and the designer.

Second part of "Compliance Checklist" where the experts have graduated the relevance of the factors: language and phrases familiar to user, facilitates users decision making and task processing, provides an easy exit for the user, supports undo and redo functionality, prevents user error, provides error messages that indicate the error and recovery processes, provides visual cues for easy task processing, allows swift and easy processing for experienced users while supporting novice users, organizes rarely used dialog information to promote visibility of all important dialog elements, provides visual help cues that are easily accessed and consistent (help button) assigning a 3 level critical scale (low, medium, high).

Every expert has proceeded in autonomous way visualizing the portal apart to the colleagues. Considered that there were 27 pages to be analyzed, as meaningful sample in relation to the Portal layout, the right time to complete the evaluation has been decomposed in six 2 hours sessions, all the process was done in three days. Every expert has analyzed the site following a common checklist and compiling a newspaper, for every Web page, with usability problems recordings. The model used for the evaluation has been structured on the scheme made by Xerox Company in 1994, opportunely modified. A complete scheme, articulated in 23 pages is available to http://www.economia.uniba.it/iadis2004/systemchecklisteconomia.doc. The method to estimate the dangerousness level of the errors is based on the frequency of the errors found, to which has been assigned a severity score. This kind of score has allowed the research group to assign a priority to the

suggested changes at the end of the evaluation. The severity score articulates on four levels: severe, high, medium, and low.

3. EXPERIMENTATION RESULTS

Once esteemed and assigned the Web Portal score, the research team proceeded to a moderate discussion on the violation areas founded and the consequent data aggregation.

3.1 Quantitative Measurements

The data design has been as important as the harvest for a correct elaboration. A table have been created to show the amount of violations founded for every heuristic rule (Tab.1), placed side by side to a table of the severity score (Tab.2) to show the amount of errors founded for every level.

Table 1. Amount of violations founded for every heuristic rule

Usability errors	Number of errors
System Condition visibility	26
Relationship between ICT system and reality	25
User's control and freedom	3
Standards and coherence	27
Errors' prevention	61
Recognition rather than storage	64
Flexibility and employment's effectiveness	83
Aesthetics and minimalist planning	90
Users' potentiality to recognize the errors, to diagnose and to solve them	35
Help and documentation.	162
Chunking and environmental perception	64
Use of the inverted pyramid writing style	83
Emphasize aloft the important information	20
Unjustified employment of functions	2
Pages scanning feasibility	27
Reduced maintenance of download and answer times.	2

Table 2. Severity score of founded errors

Severity score	Percentage on total
Severe	8.9%
High	11.3%
Medium	63.5%
Low	16.2%

Conducting the analysis the group has complete control of the problem thanks to the phase of experimentation that has produced some quantitative indexes. In particular:

- Total lack of system state visibility, there wasn't a system to help user on Portal navigation; lack of errors only in the index page, note that index page didn't have the necessity to supply a path for the user. From first Portal structure was wrongly deduced that every page was found in the root of the site. A possible problem solution, in this case study, resides in the adoption of "breadcrumbs", better if based on server side technology to notify the page position to the user.
- Total lack of system state visibility was due to a confused structural pages organization. It has emerged immediately the requirement of a reorganization close to the Faculty interest focuses.
- I Natural language and the system association with the real world, particularly with the reconstruction of mental mapping, were entirely absent. There were a double non redundant menu into the homepage and not repeated in the sub-pages. The casual information organization was involving an extreme difficulty to retrieve pages and a training period to get used with the unusual logical organization. The right solution needed the reorganization of menu links and the insertion of a right menu in every page.

- User control and freedom were respected. Procedures of authentication were absent and, generally, dynamic pages and script in javascript were absent too. The navigation happened just through browser allowing the user to self complete the operations he prefers.
- Code Validation Standards (XHTML and CSS) and accessibility (WCAI) were very far from the portal state of the art. Code resulted "dirty", images lack of labels and the portal was correctly visible only using Internet Explorer 5.0 and following browser.
- As above, the lack of advanced functionality didn't involve the necessity of errors' prevention. The high number of errors relief was referable to lost links, with consequent visualization of "error 404".
- Recognition and the information savings were impossible to be realized inside the Portal. The experts group often met non coherent images and bad functions, so they decided to insert some explanatory labels through the tags "alt" and "longdesc". "Tooltip" tag was discarded because of usability and compatibility cross-browser reasons..
- Graphic layout was lack of images' quality, first of all the colour association and graphic coherence.The possibility to get informations about web navigation or site's access was totally absent. The auspicious solution was the realization of a full FAQ section.

The group underlined the inadequacy of the contents management method, to be specific, there was a heavy translation in html code of hundreds of pages long documents (as the student's curriculum guide). The group decided to make downloadable the complete documents and set in html code just an abstract of all this using the technique of "inverted pyramid" contents presentation. The high number of located errors lead the research group to decide for a total remaking of the portal. The remake was made in January 2004, then the evaluation group proceeded to a new analysis showing that the number of the errors checked is drastically decreased. The suggestions made by usability engineers have been approved. Most part of the errors currently visible on the Web Portal are due to writing style and informations positioning inside the page; actually the errors' typology founds itself upon the heterogeneous content management policy, frequently portal's pages are managed by a large number of technicians employed on content publication. A drastic and further reduction of errors will be possible through a training plan, for staff members, focused on content management methodologies.

4. CONCLUSION

The present experimentation has confirmed the goodness of the heuristic-based evaluation method. Many errors have been individualized and then corrected. The choice to conduct an heuristic analysis doesn't allow to draw away from software engineering typical standards; more, the heuristic-based method is applied in time limited project context. A control solution during the planning step and a sharp specification of required usability rules will be a good way to manage for the quality improvement of the project. Keeping in mind the high number of errors cheked, will be evident that heuristic-based analysis, can become a necessary completion to a web portal planning considering, last but not least, the estimated cost limit.

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DESIGNING IN THE E-SOCIETY: THE EXPERIENCE DESIGN FRAMEWORK

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ABSTRACT

This paper describes the evolution of the authors' Experience Design Framework (EDF). The EDF has been developed at Birmingham Institute of Art and Design, over the past two-years and aims to help organizations design accessible, usable rewarding and engaging user experiences. The business case for experience design is outlined and a survey of qualities of the user experience (from the literature) supports the adoption of a five-factor design framework. The five-factors (Agents, Tools and Methods, Qualities, Elements and Principles) are described with their concomitant design points. The paper concludes by contextualising the EDF in terms of usability engineering approaches and briefly describes its use in development projects.

1. INTRODUCTION

Pleasure, enjoyment, positive emotions, hedonic values have recently been applied to the user experience. The emphasis on the positive leads to some interesting questions about the user experience: For example, Should the education experience be a joy? Is pleasure important in game playing? What happens when all products are pleasurable? If the computer is a theatre, is it a tragedy or comedy? Is self-actualisation less rewarding, if it is easy to attain? Is familiarity or unfamiliarity pleasurable? Can pleasure be guaranteed? Is the pursuit of pleasure, rewarding or healthy? Is one person's pleasure another person's pain? This paper describes the consequences of the shift in user experience design developments and applies them to a practical framework for experience design.

2. THE EXPERIENCE DESIGN FRAMEWORK

Patrick Jordan's 'Designing Pleasurable Products; an introduction to the new human factors' (Jordan 2000) makes a case for pleasure as the ultimate quality of the user experience. Jordan illustrates the evolution of the user experience using a model based on Maslow's hierarchy of needs. Bonaface (2002) develops this hierarchal model with safety and well-being, at ground level, with functionality and then usability (first and second floors), leading up to the apex of pleasure.

Jordan (2000) outlines the concept of pleasure, in terms of four component parts. 'Socio-Pleasure' arises from interaction with others or from a product that represents a social grouping; 'Pyscho-Pleasure' from the satisfaction felt when a task is successfully completed or from a product that makes a task more pleasurable. 'Physio-Pleasure' is derived from the senses; and 'Ideo-Pleasure' is derived from entities such as books, art and music or the values that a product embodies.

Dejan (2002) points out that pleasure is a complex concept. Apparently unpleasant aspects of the user experience, such as difficulty, challenge and fatigue can all be pleasurable in certain contexts. Jordan (2000) states that 'Games are an example of a product type that are designed primarily to promote emotional enjoyment through providing people with a cognitive and physical challenge.' He goes on to say that 'well-designed games can engage players in what they are doing. Instead of having the feeling that they are sitting in front of the television controlling animated sprites via a control pad, they may feel that they are playing soccer at Wembley Stadium or trying to escape from a monster in some fantasy world'.

Csikszentmihalyi (1991) describes the concepts of optimal experience and flow common to the experience of game playing:

"A sense that one's skills are adequate to cope with the challenges at hand, in a goal-directed, rule-bound action system that provides clear rules as to how well one is performing. Concentration is so intense that there is no attention left over to think about anything irrelevant, or to worry about problems. Self-consciousness disappears, and the sense of timing becomes distorted. An activity that produces such experiences is so gratifying that people are willing to do it for its own sake, with little concern for what they will get out of it."

Dunne's (1999) "aesthetics of use" and Laurel's (1991) concept of engagement (from Aristotle) describe a similar phenomenon.

'Engagement … is similar in many ways to the theatrical notion of the "willing suspension of disbelief", a concept introduced by the early nineteenth century critic and poet Samuel Taylor Coleridge'.

Engagement in relation to learning in proposed by Quinn (1997). He suggests that engagement comes from two factors – 'interactivity' and 'embeddedness'. Jones *et al* (1994) describe engaged learning tasks as 'challenging, authentic, and multidisciplinary. Such tasks are typically complex and involve sustained amounts of time… and are authentic'. Jones *et al* (1995) go on to suggest six criteria for evaluating educational technology in the context of engaged learning:

Access
Operability
Organization
"Engagability,"
Ease of use
Functionality

The authors developed an Experience Design Framework (EDF) (Jefsioutine and Knight, 2003) to integrate accessibility, usability, and engagability within a user-centred design framework. The framework is based on Rothstein's (2002 rationale for designing for experience. He states that:

"In sum, it is during this late phase, when a technology is well-understood and implemented in a variety of competitive products, that the need to understand user experience becomes critically important. Many of today's technologies are in this late phase. The combustion engine, for example, is extremely well-understood and implemented, as are electronics for the consumer market. These technologies, and many others not mentioned, are embodied in a vast assortment of products that are technically reliable and robust, no matter who manufactures them. Given this condition, it should not be surprising that the ability to understand and design a desired user experience has become a major concern for manufacturers and design consultants worldwide. It is the one factor they still control to differentiate their products, communications, and services."

The framework has undergone some initial evaluation and modifications through student design projects and within a European funded project to promote design in the West Midlands.

The framework (Figure 1.) advocates the key principles for designing for usability developed by Gould and Lewis (1985), but integrates a number of more recent models for designing the user experience. The methods section draws on Kälviäinen's (2002) topology of methods for understanding consumer taste. The attributes section integrates accessibility and engagability from the evaluation criteria for educational technology recommended by Jones et al (1995). The next stage in developing the EDF involves further investigation of the concept of engagability and developing tools and methods to support the EDF. It is envisaged that this work will build on the strengths of designers and researchers and offer business speedy and cost effective solutions. It is likely that many traditional UCD methods such as user testing and participatory design workshops will be adapted within the EDF as well as newer methods such as scenario-based design and persona research.
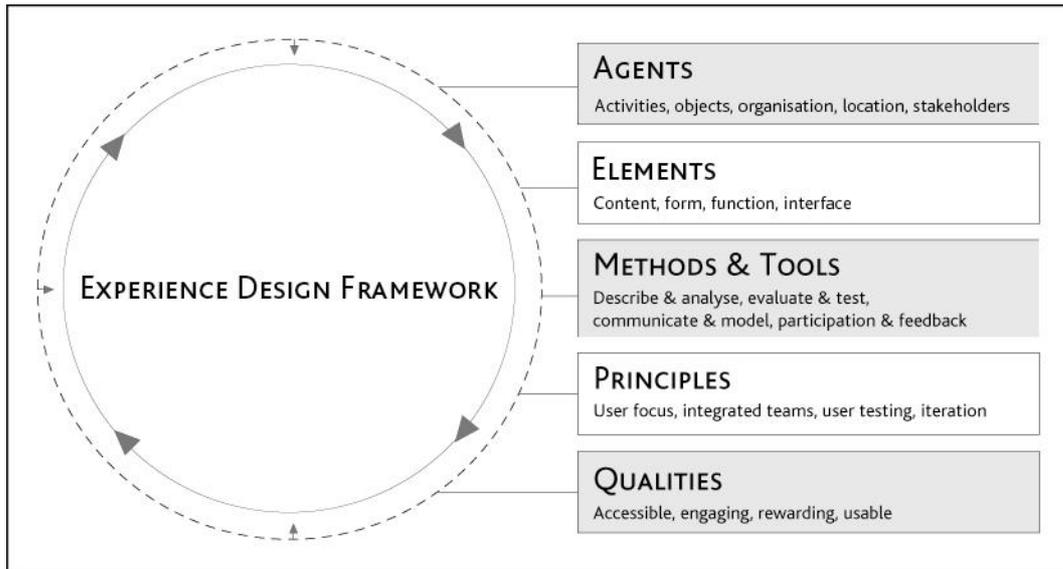
Figure 1.

3. CONCLUSION

Nielsen (1994) suggests that usability engineering can be achieved through the employment of a limited number of techniques. His 'Discount Usability Engineering' for example advocates the following methods:

User and task observation
Scenarios
Simplified thinking aloud
Heuristic evaluation

The EDF facilitates a similar approach but accommodates a wider selection of methods, tools and considerations aimed at a more holistic understanding of the user experience. The EDF has been applied to a number of internal and external products and has been refined through practice. As an approach it has also flagged up areas of weakness in available methodology and has been useful in directing our research. Areas for further research have become apparent through the application of the EDF in practice such as the development of further tools for understanding users emotional responses to products. The development of the EDF illustrates the way in which research and commercial activities at User-Lab compliment each other, both in directing agendas and focusing activity.

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THE EVOLUTION OF CONFLICT DURING INFORMATION SYSTEMS DEVELOPMENT: A RESEARCH PROPOSAL

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ABSTRACT

Substantive IS research has been directed to understand the relations between users and IS professionals during the IS development process. Part of this research has focused on conflict between the different people involved in IS projects. However, IS research is silent regarding the different types of conflict that can occur during the IS process: task content conflict, task process conflict, and relationship conflict. Furthermore, longitudinal studies investigating the evolution of conflict over time appear to be very scarce, especially in the IS field. Therefore, this paper presents a proposal for research that attempts to address the previous issues by the use of a case study methodology.

KEYWORDS

IS development, conflict, requirements analysis.

1. INTRODUCTION

The study of the relationship between users and system developers has been given substantive research attention in the Information Systems (IS) literature (e.g., Beath and Orlikowsky, 1994). This relationship is essential for the systems development process since a conflict within the IS development group (for example, between users and IS professionals) has been identified as an impediment to effective IS implementation (Snead and Ndede-Amadi, 2002). However, despite its importance, only a few studies have examined conflict within the framework of IS development (Barki and Hartwick, 2001).

The literature in psychology, organizational behavior, IS, and communication has provided different definitions of conflict. In an attempt to integrate past research Barki and Hartwick (2003) defined conflict as "a dynamic process that occurs between interdependent parties as they experience negative emotional reactions to perceived disagreements and interference with the attainment of their goals." (p. 21). However, IS research does not distinguish between types of conflict (e.g., Barki and Hartwick, 1994, 2001; Robey, Farrow, & Franz, 1989; Robey, Smith, & Vijayasarathy, 1993), and therefore, organization behaviour studies may shed light on this issue. According to Barki and Hartwick (2003), three different types of conflict emerge depending on the focus of the disagreement, interference and negative emotion. These types of conflict are based on the following foci: task content, task process, and relationship (Barki and Hartwick, 2003). Task content conflict focuses on what should be done in a task (Janssen, Van de Vliert, & Veenstra, 1999; Jehn, 1995, 1997; Jehn & Mannix, 2001; Jehn, Northcraft, & Neale, 1999). Task process conflict concentrates on how the task should be carried out (Dyck, Bruning, & Driedger, 1996; Jehn, 1997; Jehn & Mannix, 2001; Jehn et al., 1999), and relationship conflict gives attention to personal values, views and preferences (Duffy, Shaw, & Stark, 2000; Dyck et al., 1996; Janssen et al., 1999; Jehn, 1995, 1997; Jehn & Mannix, 2001; Jehn et al., 1999). The distinction between types of conflict is essential because different types

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of conflict are believed to vary differently over time (Jehn and Mannix, 2001). As a result, some expectations can be extended from the organizational behaviour literature to assess their applicability within the IS field.

Although one study has analyzed conflict over time during the IS development process (Robey et al., 1989), an overwhelming majority of past research in IS has employed cross-sectional studies when examining conflict (Barki & Hartwick, 1994, 2001; Robey, 1994; Yeh & Tsai, 2001). This is surprising taking into account that longitudinal studies are more suitable for investigating dynamic processes, such as conflict, as well as for identifying the sources and consequences of such processes (Pinsonneault and Kraemer, 1993, Jehn and Mannix, 2001). As a result, recent research has called attention to this issue (Barki & Hartwick, 2003)

To sum up, two major gaps are identified in the IS literature with respect to conflict: (1) the lack of differentiation between the different types of conflict, and (2) the lack of longitudinal studies that examine the dynamic nature of conflict and its evolution over time.

2.   RESEARCH QUESTION AND HYPOTHESES

The above discussion about the shortcomings of previous studies on conflict in IS development research suggests some opportunities for further research. The proposed study seeks to examine a research question that corresponds to the problems discussed. However, the research questions is framed within the requirements analysis stage of the IS development process, that is:

   o   How do the different types of conflict vary over time during the IS development process?

The rationale for selecting the requirements analysis stage is twofold. First, there are practical problems associated with a study that seeks to understand conflict during the whole IS development process. For example, IS projects often take place over long periods of time (Haag & McCubbrey, 2004), and this study has a three year time frame. Second, requirements analysis is one of the IS development phases where the users and IS professionals most strongly need to collaborate with each other (Byrd, Cossick, & Zmud, 1992; Guinan, Cooprider, & Faraj, 1998). This high interaction between users and IS professionals may provide richer data on the dynamic nature of the different types of conflict.

Four hypotheses are developed from the research question relating to the stage of the requirements analysis. The first concerns conflict at the beginning of the requirements analysis process. Conflict is a dynamic process and as such, is expected to change over time (Robey, 1994). For example, task process conflict, task content conflict, and relationship conflict are likely to be low at the beginning of the interaction between individuals working together (Jehn and Mannix, 2001). This is because individuals need to engage in a socialization process to learn about the goals and the norms of the environment, and the people they are working with (Mortensen and Hinds, 2001). Thus, individuals participating in the requirements analysis process, such as users and IS analysts, need some time to know and learn what their goals are in the task, how the goals should be carried out, and the personalities of the rest of the people involved in the task. As a result, little conflict is likely to occur at the beginning of the requirements analysis stage:

Hypothesis 1: Task process conflict, task content conflict, and relationship conflict are likely to be low at the beginning of the requirements analysis stage.

When the early stages of the requirements analysis phase are over, conflict is more likely to occur. However, the evolution of conflict is dependent upon the level of performance of the team within which the conflict occurs (Jehn and Mannix, 2001). For example, high performing teams may encourage task process conflict because it promotes discussion about issues such as duty and resource delegation, and the level of responsibility of each team member (Jehn and Mannix, 2001, Jehn et al., 1999, Jehn, 1997). Furthermore, this type of conflict allows teams to focus on the process of the task, and is likely to increase over time until the task is accomplished (Jehn and Mannix, 2001). This is because individuals need to manage and organize the deliverable documents just prior to milestones and deadlines (Gersick, 1989). Thus, Jehn and Mannix (2001) found that task process conflict increases significantly for high performing groups over time. The same process seems to occur within the requirements analysis stage. Thus, teams that are performing well may encourage discussions about the appropriateness of the procedures to accomplish the required tasks. Consequently:

Hypothesis 2: For high performing groups the occurrence of task process conflict increases over time.

With respect to task content conflict, past research argues that it is likely to occur most often during the middle phase of team interaction (Jehn and Mannix, 2001). For example, according to Amason and Schweiger (1994) teams that engage in task content conflict are more likely to make high quality decisions. However, at some point task content conflict needs to decrease in order for a consensus to take place (Amason and Schweiger, 1994). Therefore, it seems that potential negative effects of task content conflict may relate to the time at which the conflict occurs (Jehn and Mannix, 2001). As a result:

Hypothesis 3: High performing teams experience higher levels of task conflict in the middle stages of the requirements analysis phase than at the beginning of end of requirements analysis.

The evolution of relationship conflict is more complex to analyze. Relationship conflict highly depends on the dynamics and structure of each team (Jehn, 1995, Jehn, 1997). Although past research has found in general that relationship conflict increases over time (Jehn and Mannix, 2001), it is expected that its occurrence varies among teams with different performances (Gersick, 1989). Thus, Jehn and Mannix (2001) found that high performing teams showed low levels of relationship conflict during all phases of team interaction. The same is likely to occur in teams conducting the requirements analysis. Therefore:

Hypothesis 4: High performing teams experience lower levels of relationship conflict during all phases of the requirements analysis stages.

3.   PROPOSED METHODOLOGY

A case study methodology is appropriate for this research for three fundamental reasons. First, a case study approach is often used when the researcher has little control over behavioral events that focus on a contemporary setting (Yin, 1994). Thus, in an IS development environment there is a variety of interactions between IS professionals and users that imply behavioral events that the researcher cannot control. Second, a case study approach is particularly suitable for this study because it provides the opportunity to investigate conflict as it occurs over time (Yin, 1994). Finally, a case study approach is appropriate when little is known about a topic (Yin, 1994).

The cases study's major objective is to test the proposed hypotheses. The case study will take the form of a multiple case design, with two case studies. Two case studies are suitable for the objectives of this research study since they are not expected to represent a critical, unique or revelatory case. Furthermore, this design follows a replication logic and therefore, it enhances confidence in the validity of the results (Yin, 1994). The sample for the study includes two business organizations with similar demographic characteristics and with similar IS projects (e.g., duration, budget, and size) in order to "reduce extraneous variation and clarify the domain of the findings" (Eisenhardt, 1989, p.537). Moreover, the case studies' primary unit of analysis is the group (e.g., the IS development team), but team members will be examined as subunits of analysis. The rationale for an embedded design is that it can provide richer data to further complement and explain the findings.

The case study will use multiple sources of evidence: interviews with members of IS teams (including users and IS professionals), direct observations, e-mails among the team members, and any type of formal documentation of the requirements analysis stage. This approach for data gathering converges multiple lines of inquiry and enhances construct validity (Benbasat, Goldstein, & Mead, 1987; Yin, 1994).

The analysis of the cases will take two forms. First, an analysis within each case will be held in order to seek unique patterns of each case before generalizing the patterns across the two studies (Eisenhardt, 1989). Second, analysis across cases studies will be conducted. This analysis will look for similarities and differences between the two cases (Eisenhardt, 1989).

4. CONTRIBUTIONS AND LIMITATIONS

This study attempts to fill two major gaps in the IS literature regarding conflict. Thus, the IS community will benefit from a differentiation between the different types of conflict that can occur during the IS development process. This differentiation is paramount because different types of conflict may have different outcomes (Jehn & Mannix, 2001). For example, it is possible that task-related conflict may be beneficial, whereas relationship conflict may be harmful for team work (Pelled, 1996). Furthermore, the timing at which conflict occurs may also have an impact on the outcomes of that conflict.

This study also has implications for practice. First, if task process conflict increases over time for high performing groups, practitioners need to encourage discussion and debate about responsibilities among team members as well as about the management of deliverables, milestones and deadlines. Second, it is likely that teams with accepted levels of performance experience greater task conflict at the middle stages of the IS requirements analysis than at the beginning or end of that analysis. In this case, team members need to generate discussion at certain times during the IS requirements analysis and make efforts for consensus before the end of the process. Finally, if relationship conflict is low for high performing teams during the IS requirements analysis phase, practitioners need to employ tactics aimed to keep this type of conflict low. For example, they could encourage socialization in order to help team members to get to know each other and decrease their personal differences.

The proposed research has a major limitation: the case studies are based on a theoretical sample, not a statistical sample. That is, the findings from the case studies are based on two particular IS teams and therefore may not be generalizable outside of the study. Future research could replicate the study in order to enhance the external validity of the findings. However, despite the mentioned limitation, the proposed study still makes contributions to both the research and practitioner communities.

REFERENCE LIST

References can be obtained upon request from the author.

A NEW ARCHITECTURE FOR CRAWLING THE WEB

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ABSTRACT

This paper presents a Web Crawler Architecture for the extraction of useful knowledge from the web. The proposed solution covers the first step of the Web Mining process, dealing with automatic retrieval of all relevant documents and ensuring at the same time that the non-relevant ones are fetched as few as possible. The architecture makes use of Information Retrieval techniques to extract keywords from documents, in order to combine them to enlarge the set of web pages to examine.

KEYWORDS

Information Retrieval, Web Crawler, Web Content and Structure Mining.

1. INTRODUCTION

With the huge amount of data available online, the World Wide Web is considered as a popular and interactive medium to disseminate information today. At the beginning, the web was an instrument primarily used by universities and research communities; nowadays it represents a tool of easy access and insert of information [4]. At the current rate of growth for the web, 50 million new pages daily [3], we expect that a search engine will be required to deal with perhaps 100 terabytes of the data in 2005. Moreover, the information available on the web is extremely distributed and heterogeneous: symbolic text, images, audio, video, objects, metadata, and hyperlinked data. So, the main problem that plagues the totality of the search engines is the impossibility to recover all web documents and to return relevant information in the following phase of the user interrogation [5]. These factors give rise to the necessity of creating intelligent systems that can effectively mine the web for knowledge. To achieve this goal, *Web Mining* can be broadly defined as the discovery and analysis of useful information from the World Wide Web. Web Mining can be viewed as the use of data mining techniques to automatically retrieve, extract and evaluate information for knowledge discovery from web documents and services [12]. The proposed architecture makes use of Web Content Mining and Web Structure Mining techniques [11], [12] to retrieve information from the web. After this first phase of document collection, the architecture uses Information Retrieval techniques to extract keywords from each document [10]. Finally, these keywords are combined among them to enlarge the set of web pages to examine. This is made possible by using an already existent remote search engine. As final result, this architecture is able to provide added value services useful to private and public organizations, such as e-Business and e-Government ones. Recent and popular web crawler systems, such as Alta Vista and WebCrawler, are able to scan millions of web documents and to store indexes of words, but they are not

specialized in information retrieval about a single concept, such as E-business or E-government. Our contribution is to create an architecture that allows optimizing the first step of the Web Mining process. As there is a continuous and explosive growth in the information available on the World Wide Web, the aim of our architecture is to reduce the time of crawling and to improve gathered data quality.

2. THE WEB CRAWLER ARCHITECTURE

The purpose of the proposed architecture is to extract information from the web through Information Retrieval techniques that constitutes the first step in the Web Mining process [8],[9]. The architecture represents a Focused Crawler [6], as it is designed to only gather documents on a specific topic, thus reducing the amount of network traffic and downloads. It can also be seen as an Incremental Crawler [7], as it retrieves web pages already examined whose content could has previously been modified.

In accordance to a specified service to provide, the administrator of the system creates a high interest URL list. Documents to examine will be semi-structured, such as html and xml pages, and not structured, such as simple text. After the crawling of these documents, the most interesting keywords come extracted through Information Retrieval algorithms and, opportunely combined, represent the input for the remote search engine. The real aim of the last operation is to enlarge the set of documents in the field of interest with the URLs returned by the search engine. This is useful to discover new and more relevant information. As search engine, Google tools, the most performance ones, have been used. In the next figure, the Web Crawler Architecture is shown:
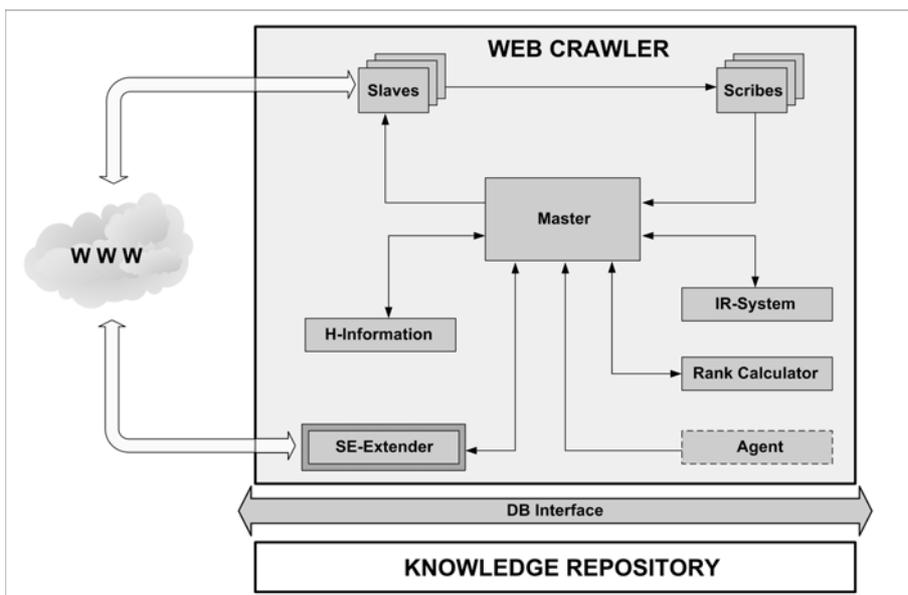
Figure 1. The Web Crawler System

The main components of the Web Crawler have been developed with Java technology. They are:

Slave: This component accedes to the web with the scope to crawl the pages associated to the URLs indicated from the *Master*. Each *Slave* has given an own set of pages. In this way, different *Slaves* can operate at the same time to render more efficient the access to web sites, reducing the answer times and avoiding simultaneous accesses to the same site [2]. The resources retrieved from the Web are html and xml pages, pdf, rtf, doc and ps files.

Scribe: This component receives the Web pages crawled from the *Slaves*. Each *Scribe* corresponds to a *Slave*. In order to execute a next step of Web Content Mining, the *Scribe* parses the entire page, by capturing different information according to the type of the examined document. For example, in the case of html and xml pages, the *Scribe* parses them and considers all the tags of the body. Some information, such as titles and metatag contents, are considered not so important in order to avoid problems of spamming information [5].

Furthermore, the *Scribe* extracts from each document all hyperlinks that will be useful for the next step of Web Structure Mining of the Master.

   Master: This component is the core of the architecture and allows different functions:

- It sends to the *Slaves* several URL pages to capture from the web on the base of the information coming from the *H-Information, Scribes* and *SE-Extender* components. It opportunely balances the workload to assign to the various *Slaves,* avoiding the risk to execute simultaneous accesses to more pages of the same site.
- It receives from the *Scribes* the information extracted from URLs. This information is examined to verify that it is not already present in the *Knowledge Repository*. In positive case, this information will be sent through the *DB Interface* to the *Knowledge Repository* for the storing, otherwise it will be not considered.
- It receives from the *IR-System* the keywords of the retrieved documents and, in accordance to well defined rules, decides which of them to combine through the use of logical operators (and, or).
- It sends the keywords combined by the *IR-System* to the *SE-Extender* that will have the task to interrogate the remote search engine. As result of the interrogation, it receives an URL list.
- It sends to the *Rank Calculator* the URL list received from the *SE-Extender* in order to know which URLs could be crawled. The *Rank Calculator* gives back a new list that contains only URLs having a ranking value higher than a fixed threshold.
- It sends to the *H-Information* component the first level URLs returned from the search engine. These URLs are useful to widen the starting list of the *H-Information* for the services to supply.
- As a final operation, it makes use of Web Structure Mining techniques with the scope to detect further useful pages. To achieve this goal, it analyses links that *Scribes* have previously extracted from all retrieved documents and controls if a high number of these links are directed to web pages still not gathered. In this case these new pages will be crawled.
- It re-executes the whole process of the web crawling in base of information coming from the *Agent* component.

   H-Information (Human Information): This component represents an interface for human interactions; it allows the system administrator to create a list of high interesting web sites that will be completely crawled. This list will be increased by the URLs received from the Master, at first probably unknown by the system administrator.

   IR-System (Information Retrieval System): This component has the task to extract the more meaningful keywords from text document stored in the *Knowledge Repository* by the *Master.* To achieve this goal, it makes use of Information Retrieval techniques [1]. In a deepest description, all the terms in each document comes analysed, but only a part of them is indexed; words that occur with a high frequency are eliminated before the indexing process. A list of these words, called *stopword* list [1], is consulted for each word encountered during the document indexing. To reduce the set of words to include in the index, plurals are converted to singulars. Furthermore, *stemming* technique is adopted to reduce all words with same root to a single form by stripping the root of its derivational and inflectional affixes (i.e. suffix, prefix, and infix). That is, all words are transformed to their canonical form. Finally, the most common words of all examined documents are useful to cluster documents in the Knowledge Repository and to widen the search on the Web through the search engine. Vector techniques are adopted for the clustering operation.

   SE-Extender (Search Engine Extender): This component has the task to interrogate the remote search engine, such as Google, with the aim to widen the amount of information to retrieve. *SE- Extender* receives from the *Master* the keywords to give as input to the search engine and returns to it a URLs list. In the experimental setup, we used the Google API [2]. However, the component is planned to adopt in the future an own search engine.

   Rank Calculator: This component has the task to calculate a ranking metric for URL returned from the search engine. This algorithm resumes some characteristics of well known PageRank algorithm [2]. Our algorithm recursively defines the importance of a page *A* to be the weighted sum of the importance of the pages that have links to *A*, by considering the number of outgoing links of each page. The system assigns to the URL list created by *H-Information* a value equal to 1, the maximum possible value, because of the importance of these pages for the service to supply. In this way, if a page is not linked from none retrieved document, it comes ignored because its ranking value results shorter than the fixed threshold.

   Agent: This component has the task to start the re-execution of the whole process of crawling according to needs of updating the *Knowledge Repository,* for example after well defined time expiration.

DB Interface (Database Interface): This component is the only one that manages the access to the *Knowledge Repository*; all the components of the proposed Web Crawler have to interrogate the *DB Interface* in order to insert, select or update information.

Knowledge Repository: This component represents the database of the system and contains the information acquired from Web Crawler. Moreover, it clusters information in order to prepare them for the successive steps of analysis through Data Mining and Web Mining algorithms.

3. CONCLUSION

The proposed Web Crawler architecture is an efficient retrieval system of information from the Web, useful for providing e-Knowledge services for e-Government and e-Business organizations.

The primary goals are to retrieve quality information from the web trying to reduce the acquisition of non relevant documents for the service to provide.

As scalability, through the component of the Master, the architecture is able to manage the access to web sites by reducing the necessary time for crawling and, at the same time, by avoiding an overload of them.

Moreover, the system automatically re-executes the whole process of crawling through the *Agent* component, in order to refresh information stored in the Knowledge Repository.

As a future development, there is the possibility to implement both an own search engine and a component able to administrate the DNS, in order to reduce times of access to the Web.

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ENTERPRISE PRIVACY MANAGEMENT AND PRIVACY MANAGEMENT SYSTEMS

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ABSTRACT

The paper discusses the evolving concept of enterprise privacy management in an era of growing electronic commerce and global business. The need for privacy management is reviewed and privacy is distinguished from security management. The role and nature of an enterprise privacy management system is discussed along with issues relating to how such systems may evolve.

KEYWORDS

Privacy, Personal Information, Security

1. INTRODUCTION

Within the modern world of global business, rapidly expanding electronic commerce, and widely available low-cost technology, there is an ongoing, evolving, and increasing concern by firms, governments, and individuals about security and privacy issues. Scholl and Hollander [Scholl, 2003] have identified new security and privacy risks for US companies which are the result of legislative acts including HIPAA (Health Insurance Portability and Accountability Act of 1996), GLB (Gramm-Leach-Bliley Act of 1999) and the USA Patriot Act of 2001. Jensen [Jensen, 2003] explores the mix of issues that privacy options, legal jurisdiction differences, and the GLB law have created for insurance companies. In the world of global business and electronic commerce, a confounding issue is the relatively different perspectives that exist internationally. Smith [Smith, 2001] presents an interesting comparison of US and Europe in terms of legal and society perspectives and makes a case for a new approach in the US to issues relating to privacy.

Privacy as a concept within the commercial arena has a different meaning whether viewed from the perspective of the customer or the firm. Customers are concerned about both the authorized and unauthorized use of personally identifiable information (PII) and may not see a distinction between them if a negative effect is perceived. Firms are increasingly recognizing that security and privacy are related but distinct concepts. Consequently, security management and privacy management are evolving as different business management concepts. Security can be viewed as the prevention of *unauthorized* access to customer information while privacy is concerned with what is done via *authorized* access to customer information [Janowski, 2003]. The two concepts are obviously related and often confused. While privacy management is dependent on adequate security management, security management alone does not adequately address all privacy management issues.

Security management is typically not concerned with the misuse of customer information within the company. The total risks of inadequate privacy management are significant and are not adequately covered under the general rubric of security management. There are a wide variety of potential privacy risks to the firm but three general types are commonly identified as the most relevant. These are brand and reputation erosion, legislative penalty, and lawsuits [Schunter, 2002]. Brand and reputation erosion risk is based on trust and the potential impact of the loss of trust on the part of customers. A firm which is felt by customers to have violated a real or perceived customer trust relationship can expect to lose customers. Legislative

penalty risk is based on increasing number of laws that are being passed around the world which prescribe penalties based on the violation of rules about the collection, retention, and use of PII. Lawsuit risk is of growing concern to firms. Lawsuits relating to the use of PII expose companies up to significant potential damages. In countries like the US where punitive damages are often not legislatively capped and are awarded by juries, there is a potential for very large damage awards. The latter two types of risk also can affect brand erosion since the publicity surrounding government fines and lawsuit awards may have an even greater impact on the brand and reputation erosion than any direct costs from fines and awards.

An additional growing business practice that is adding to the risks faced by companies is outsourcing business operations and, in come cases, entire business processes. This added risk factor is well illustrated by the widely publicized case of an off-shore outsourcing entity who threatened to post the confidential patient records of a US hospital on the Internet unless they paid the debts of an intermediate outsourcing company. The hospital management was not aware of the existing 3-tier outsourcing arrangement and was confronted by the lack of convenient legal recourse. While this situation was resolved satisfactorily, it should serve to alert companies to the privacy risk issues associated with outsourcing.

2. PRIVACY MANAGEMENT POLICIES AND SYSTEMS

The recognition of the importance of privacy management is leading to the development of a segment of the software industry that is focused on providing privacy management services and products to companies. The involvement of firms such as IBM and Hewlett Packard suggest that privacy management is viewed as a growth area. This general area has become identified with the term Enterprise Privacy Management (EPM). While still evolving, it is clear that the marketplace evolution is directed at the creation of products designed to support enterprise-wide control of PII. The role of an enterprise Privacy Management System (PMS) can be seen from Figure 1 which depicts a generalized view of how a PMS might be utilized within the organization in collaboration with a firm's Security Management System (SMS). Drawing upon the above discussed distinction between security management and privacy management, the general concept of the SMS does not address all the issues relevant to privacy management.
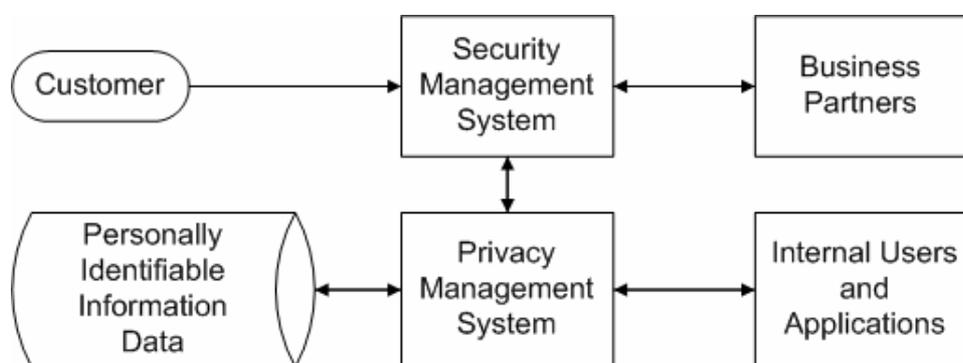
Figure 1. Enterprise Security and Privacy Management

The role of the PMS is thusly differentiated from that of the SMS and together they are intended to provide a comprehensive approach for the protection of PII from threats outside the company via the SMS and from within the company via the PMS. The role of the PMS is complementary to that of the SMS in the nature of the threats that each system combats differ. The PMS needs to be based upon a comprehensive policy for managing PII that will serve the dual related roles of inspiring trust among customers and preventing inappropriate use of customer information. The Gartner Group advocates a privacy management policy based upon the cornerstones of customer communication, enabled internal processes, and enforced compliance (Janowski, 2003). Such an approach assumes that the firm will have well defined privacy policies that explicitly define how specific PII is used inside the firm. The essence of the Gartner model is shown in Figure 2.
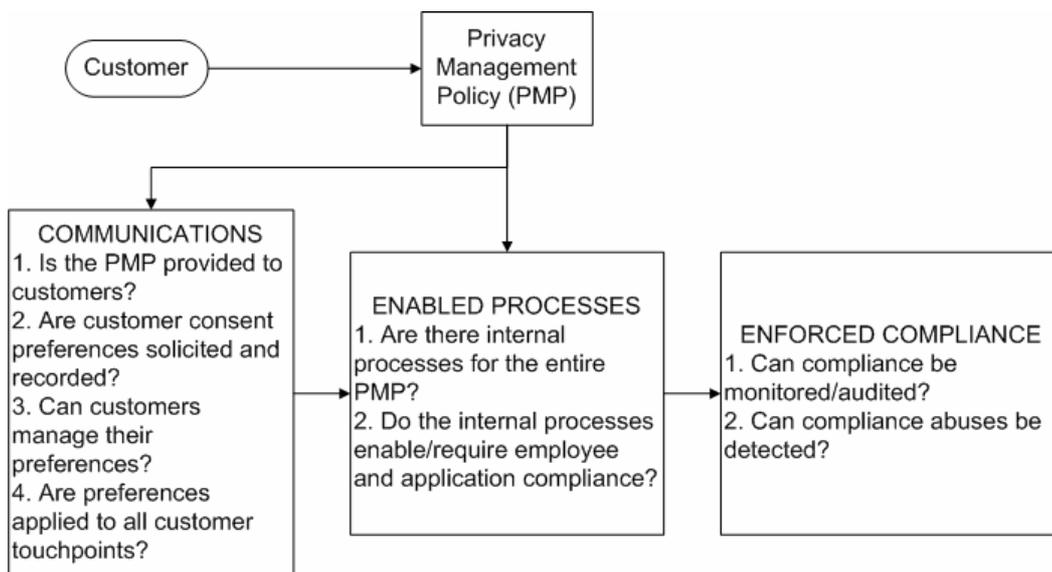
Figure 2. Gartner Privacy Management Policy Model

While conceptually simple, the implementation of an PMS is not a simple matter of *plug and play*. The difficulties of developing and managing an PMS appear to be somewhat daunting especially in an environment where there is a wide variety of customer preference settings as might be required in a global marketplace with many potential PII *touchpoints* within the company. It is also clear that any real PMS will require the utilization of appropriate technology. This can be seen in one basic example of privacy management that has occurred in the US. In October, 2003, the national *Do-Not-Call-List* for telemarketers went into effect. Failure to comply with this list has significant penalties. As of February, 2004, this list contained 57 million phone numbers and US government estimates were that this system had resulted in blocking about 80% of telemarketing calls [Lester, 2004]. While not popular with many businesses, the system is proving popular with the public. What is not known at this time is the cost of compliance for the firms implementing the system. The popularity of this system is increasing the pressure for comparable *Do-Not-Mail* and *Do-Not-Email* lists .

The actual implementation of a PMS by a firm that will enforce the privacy management policies of that firm will usually be composed of some combination of controls provided in (1) applications, (2) middleware, and (3) databases. There are currently limitations in all three areas which does not conveniently allow each to serve as a comprehensive PMS. Attempting to use applications as the nexus for privacy management is difficult even while being the most common approach. In organizations with a large application portfolio, it will undoubtedly prove difficult to reliably coordinate the design of each specific application with privacy management policies. In particular, this will create significant additional maintenance work to assure compliance of existing applications with evolving privacy management policies. ERP systems have become a cornerstone of the back office operations for many companies and generally provide a degree of data reliability and control that is superior to less integrated legacy systems. While it is true that the data integrity and user access controls within the ERP system can assist in the implementation and compliance with an enterprise privacy policy, current ERP systems are not able to provide a complete privacy management solution. ERP systems are designed to promote a high degree of data integrity and compliance with business process designs. In so far as these objectives coincide with the firm's PII usage policies, the ERP system is an aid to EPM. The ERP system also does not provide support for privacy management issues deriving from legacy systems, outsourcing, and customer touchpoints unrelated to transaction processing.

Middleware based controls hold much promise for providing a true enterprise privacy management system since a middleware solution can reside between the applications and the PII residing in a database. However, this is an software arena that is still in the early stages of evolution. There are relatively few products that have the focus of protecting PII for all types of data and applications. Some products, such as the IBM Tivoli Access Manager, are being developed and utilized as a component in enterprise-wide privacy

management [Ashley, 2002]. It is certainly possible that such systems will evolve into more complete solutions. There are questions of whether middleware based solutions will be cost effective and compatible with a wide variety of applications and databases.

Controls to support privacy management policies at the database level have much intuitive appeal. Database PII controls would alleviate the need for complex middleware products and simplify both the development and maintenance of applications. However, at the present time, widely used database systems such as Oracle do not provide the range of controls necessary to allow the database itself to become the primary component in a PMS. There is also some question as to whether adding more complex control options in the database system is practical from the points-of-view of both database administration and database performance.

The evolution of a view of privacy management from that of a single application to an enterprise policy imposes great back office operational challenges for the firm. The relative simplicity of the past in which electronic commerce security issues merely dealt with privacy statements and providing encrypted customer data exchanges will soon become a memory. Moving to a comprehensive view of managing PII within the enterprise is considerably more daunting and is still in the early stages of development.

The recent emergence of the role of CPO (Chief Privacy Officer) in for-profit firms, government agencies, and non-profit organizations coincides with the general concern about PII. While HIPAA may have been the genesis for the creation of many CPO positions, it is likely that the role of the CPO and the PMS will grow in terms of the variety of PII issues that are considered and managed. The ongoing challenge to firms will be to develop dynamic enterprise privacy management policies that ameliorate business risks and to develop and maintain an enterprise PMS that will enforce those same policies.

3. CONCLUSION

All evidence points to an increasing need for public and private organizations to develop a more comprehensive or enterprise perspective relating to the management of customer personally identifiable information. The fact that security management only partially addresses privacy issues is giving rise to the concept of Enterprise Privacy Management and the Privacy Management System. Currently, organizations do not have standard approaches to the development of the PMS. It will become necessary for firms to be more proactive in privacy management for PII and to take advantage of ongoing efforts to evolve the concept of the PMS so that enterprise privacy policies can actually be enforced.

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SIDE-EFFECTS OF THE E-SOCIETY: THE CAUSES OF INFORMATION OVERLOAD AND POSSIBLE COUNTERMEASURES

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ABSTRACT

In this paper, we review the state-of-the-art regarding research on information overload in organizations, a major problem of the e-society. We review scientific studies from the last thirty years in order to compile the most relevant causes of information overload and possible countermeasures. We summarize our findings from business related research in a conceptual framework that can be used to measure information overload empirically in order to assess the extent of overload or the effectiveness of countermeasures.

KEYWORDS

Information overload, cognitive overload, decision quality, communication, e-society

1. THE CONCEPT OF INFORMATION OVERLOAD

One of the dominant traits of an e-society is its abundance of easily accessible information which frequently leads to an overabundance that can be labeled as information overload. In this paper, we examine this dominant trait of an e-society by looking at past findings regarding information overload causes, symptoms and counter-measures. By doing so, we would like to highlight the main causes of information overload and discuss effective strategies to avoid overload.

Research on information overload relevant for the realm of management has mainly been undertaken in the areas of accounting (e.g., Schick et al., 1990) management information systems (MIS) (initially highlighted by Ackoff, 1967), organization science (e.g., Galbraith, 1974; Tushman & Nadler, 1978), and marketing or more specifically consumer research (Jacoby, 1984; Keller & Staelin; 1987, Malhotra, 1984). The main focus of these disciplines is the question of how the performance (in terms of adequate decision making) of an individual varies with the amount of information he or she is exposed to. Researchers across various disciplines have found that the relationship between performance and provided information can be represented as an inverted U-curve (Schroder et al., 1967). An individual correlates positively with the amount of information he or she receives up to a certain point. If further information is provided beyond this point, the performance of the individual will rapidly decline (Chewning & Harrell, 1990), the information provided will no longer be integrated into the decision making process and information overload will be the result (O'Reilly, 1980). The burden of a heavy information load will confuse the individual, affect his or her ability to set priorities, or makes prior information harder to recall (Schick et al., 1990). Hence, information overload occurs at the point when the decision maker integrates less information than actually available into the decision (see Malhotra et al., 1982, Russo, 1974 or McKinnon & Bruns 1992). Several authors distance themselves from this definition and claim that overload occurs at the moment when the information

processing requirements exceed the information processing capacity (Galbraith, 1974, Tushman & Nadler, 1978) and thus introduce the time factor as a decisive element for information overload.

2. A FRAMEWORK TO UNDERSTAND AND RESEARCH INFORMATION OVERLOAD

In order to provide a more complete (and less fragmented) picture of the research conducted on information overload, the framework of figure 1 visualizes the most important topic clusters of the information overload discourse and their relationships.
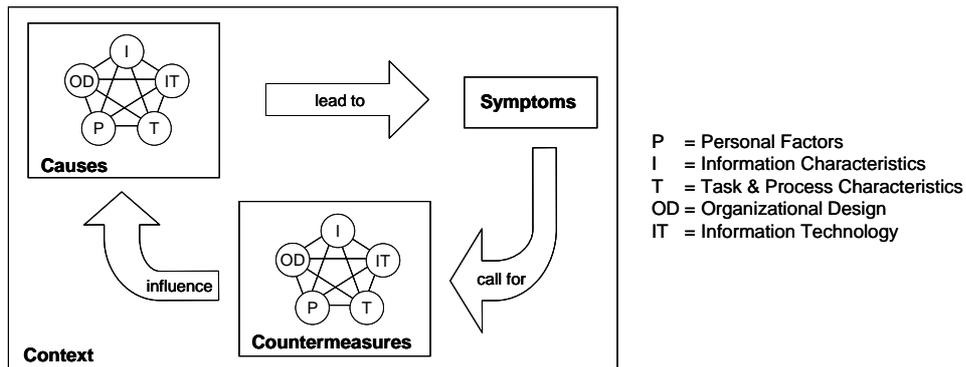

Figure 1. A conceptual framework to structure research on information overload

The framework does not represent a logic of linear causes and effects, but rather a system of circular, interdependent relationships. It stresses the fact that any countermeasure that is aimed at a specific overload cause can have significant side-effects on other causes. Although this aspect is frequently acknowledged in current overload literature (e.g., Bawden, 2001), it has scarcely been explored empirically (for an exception, see Evaristo, 1993). Specifically, empirical overload research has so far not examined the effect of certain (new) information technology applications on the quality of information (see Wang et al., 1998), on the motivation of the individual, and on task parameters. We discuss two main elements (the causes and countermeasures) of the framework and the relevant literature in next section.

3. CAUSES AND COUNTERMEASURES OF INFORMATION OVERLOAD

Based on literature from the last thirty years (starting with the emergence of an e-society), we have listed and categorized the major causes of information overload and we have reviewed the countermeasures that have been discussed in the literature. The main reasons for information overload at organizational and interpersonal levels can be related to five constructs, namely whether the occurrence of overload is due to *personal factors* (e.g., experience, sender behavior, attitude etc.), due to the characteristics of the *information* that needs to be processed (e.g., its complexity or ambiguity), due to the *tasks* that need to be accomplished (e.g., their urgency or fragmentation), due to the *organizational setting* in which an individual operates (e.g., its filtering support and lateral communication), or due to the use of *information technology* (e-mail, intranets, etc.). Table 1 gives an overview of the various causes of information overload as they have been discussed in the literature. Usually, information overload emerges not because of one of these factors, but because of a mix of all five cause categories. They all influence the two fundamental variables of information overload: the information processing capacity (IPC) and the information processing requirements (IPR).

Table 1. Causes of information overload

	Causes of Information Overload	Reference
Personal Factors	• limitations in the individual human information processing capacity	Herbig & Kramer, 1994
	• Decision scope and resulting documentation needs	Kock, 2001
	• motivation, attitude, satisfaction	Muller, 1984
	• personal traits (experience, skills, ideology, age)	Owen, 1992; Hiltz & Turoff, 1985; Muller, 1984; Schneider, 1987; Swain & Haka, 2000
	• personal situation (time of the day, noise, temperature, amount of sleep)	Owen, 1992; O'Reilly, 1980
	• Senders screen outgoing information insufficiently	Van Zandt, 2001
	• Users of computers adapt their way of interacting with computers too slowly in respect to the technological development	Maes, 1994
	• Social communication barriers break down	Schultze & Vandenbosch, 1998
Information Characteristics	• intensity of information (number of items of information)	Bawden, 2001; Herbig & Kramer, 1994; Jacoby et al., 1974; Jacoby 1977, 1984; Malhotra, 1982; Schneider, 1987
	• uncertainty and ambiguity of information	Schneider, 1987; Sparrow, 1999; Tushman & Nadler, 1978
	• diversity of information (number of alternatives)	Bawden, 2001; Inselin, 1988; Schroder et al., 1967
	• novelty of information	Schneider, 1987
	• complexity of information	Schneider, 1987
	• dimensions of information increase	Schroder et al., 1967
	• information quality, value, half-life	Sparrow, 1998, 1999
	• over abundance of irrelevant information	Ackoff, 1967
Task & Process Parameters	• tasks are less routine	Tushman & Nadler, 1975
	• complexity of tasks and task interdependencies	Tushman & Nadler, 1975
	• time pressure	Schick et al., 1990
	• task interruptions for complex tasks	Speier et al., 1999
	• too many, too detailed standards (in accounting)	Schick et al., 1990
	• simultaneous input of information into the process	Grise & Gallupe, 1999/2000
	• innovations evolve rapidly - shortened lifecycle	Herbig & Kramer, 1994
	• interdisciplinary work	Bawden, 2001
Organizational Design	• centralization (bottle necks) or disintermediation (information searching is done by end-users rather than by information professionals)	Schneider, 1987
	• accumulation of information to demonstrate power	Edmunds & Morris, 2000
	• group heterogeneity	Grise & Gallupe, 1999
	• new forms of teamwork due to information and communication technologies (e.g. groupware)	Bawden, 2001; Schultze & Vandenbosch, 1998; Speier et al., 1999
Information Technology	• push systems	Bawden, 2001
	• e-mail	Bawden, 2001
	• intranet, extranet, internet	Bawden, 2001
	• rise in number of television channels	Edmunds & Morris, 2000
	• various distribution channels for the same content	Edmunds & Morris, 2000
	• vast storage capacity of the systems	Schultze & Vandenbosch, 1998
	• low duplication costs	Schultze & Vandenbosch, 1998
	• speed of access	Schultze & Vandenbosch, 1998

Having outlined the major causes of information overload, we can now look at the countermeasures that have been discussed in the literature. In the following, we will review the countermeasures and group them by the same categories as the causes which they address. The countermeasures described in business-related research publications range from *training* initiatives to IT *tools* to changes in the *structure* of an organization.

With regard to *information* itself, information overload can be reduced if efforts are made to assure that it is of high value, that it is delivered in the most convenient way and format (Simpson & Prusak, 1995), that it is visualized, compressed, and aggregated (Ackoff, 1967; Meyer, 1998), and that signals and testimonials are used to minimize the risks associated with information (Herbig & Kramer, 1994). On the *individual* level, it is important to provide training programs to augment the information literacy of information consumers (Bawden, 2001; Koniger & Janowitz, 1995; Schick et al, 1990) and to give employees the right tools so that they can improve their time (Bawden, 2001) and information management (Edmunds & Morris, 2000) skills. As far as improvements for the *organizational design* are concerned, various authors take on conflicting positions. While earlier contributions stress the importance of self contained tasks and lateral relationships (Galbraith, 1974), more recent studies see this focus on collaborative and interdisciplinary work as a cause rather than as a countermeasure of information overload (Bawden, 2001; Wilson, 1996). If the cause of information overload relates to *process* problems, several authors suggest standardization of operating procedures (Bawden, 2001; Schick et al., 1990; Schneider, 1987), collaboration with information specialists within the process teams (Edmunds & Morris, 2000), and use of facilitators or collaborative tools (such as virtual team rooms) as 'process enablers' for cognitive support (Grise & Gallupe, 1999/2000). Finally, at the level of *information technology*, several authors advocate the use of intelligent information management systems for fostering an easier prioritization of information (Bawden, 2001; Meyer, 1998; Schick et al., 1990) and providing quality filters (Ackoff, 1967; Edmunds & Morris, 2000; Grise & Gallupe, 1999/2000). Examples of such intelligent systems are Decision Support Systems (DSS) that reduce a large set of options to a manageable size (Cook, 1993).

4. CONCLUSION

In this paper, we have highlighted a key problem of the e-society that generates and distributes ever more information through its digital and print channels, namely the dysfunctional effects of information overload. We reviewed (business-related) research results from the last thirty years through the lens of a conceptual framework and focused the discussion on two of its main elements, the causes and countermeasures of information overload. We have provided a means of empirically researching and assessing the phenomenon, e.g., by using the table entries as survey question items (the respective tables for the overload's situations, symptoms, and countermeasures are documented more extensively at www.knowledge-communication.org). This can lead to a clearer understanding of why information overload has arisen in a specific context so that more precise and effective countermeasures can be evaluated. We have argued against isolated interventions that neglect crucial interdependencies among the involved factors (such as tasks, IT tools, personal skills and organizational structures). For this reason, the challenge of information overload cannot be addressed by simply implementing one distinctive countermeasure, but there must be a continuous cycle of improvement and refinement. In this sense, the framework presented in this paper can also be seen as a learning cycle on an individual, organizational and a societal level.

Our approach is limited in so far that our focus has been on information overload in business settings. We have limited our literature review to sources from marketing, MIS (management information systems), organization and accounting research. Information overload, however, has many ramifications outside this scope (e.g., in education, politics, and culture). Thus, we hope and anticipate that information overload will become a relevant research topic that is studied within and across various disciplines and domains, as it continues to be a sometimes severe side-effect of the e-society.

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AVEIRO - DIGITAL: SOCIAL SOLIDARITY INFORMATION SERVICES

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ABSTRACT

The paper presents an overview of the strategy that is being applied within the Programme Aveiro - Digital to introduce the information and communication technologies into the social solidarity institutions. It also refers the technological approach to generalize the sharing of data among the different entities and actors involved in domiciliary support services, where is a lack of use of Internet based services.

KEYWORDS

Social Solidarity Institutions, Domiciliary Support Services.

1. INTRODUCTION

The Information Society is a unique opportunity leading to the economic and social development of Portugal, but it may also represent a way to increase the gap that still separates our country from others more developed. Thus, it is urgent to find the best practical ways that will make possible to achieve the Information Society in Portugal. The Programme Aveiro - Digital attempts to respond to this important challenge through the search for better ways to the development and introduction of the information and communication technologies in a region scale as well as by showing evidence of the advantages they can provide.

The town of Aveiro is a medium sized town - 70 000 inhabitants - located in a very dynamic region and where is located the R&D branch of Portugal Telecom, an highly distinguished and proactive University, with a strong tradition in information and communications technologies, and a Local Government committed in the Internet and new technologies promotion. The making of Aveiro - Digital must be accomplished more on the basis of a radical transformation of the habits and behavior of the citizens and institutions, rather than just providing it with the necessary infrastructures and systems. Therefore, it has been considered of great importance that the Programme should promote the involvement of all on a volunteer basis while keeping a flexible and motivating attitude of relevant spontaneous initiatives among the most interested regional agents. Motivating in the mobilization of the society, and flexible in the search for dynamic actions and new initiatives, bearing in mind that its final aim must be the improvement of the quality of life in the region, in all its dimensions. For that, several strategic areas have been considered: i) Building the digital community; ii) Local government and local public services; iii) Schools and education community; iv) University and academic community; v) Health services; vi) Social solidarity services; vii) Economic sector; viii) Culture and leisure.

The social solidarity is an area of great importance for the making of the Digital Town. The information and communication technologies should contribute to a fairer society providing the equality of opportunities for all, thus avoiding the introduction of new barriers and social differences. The support of the less privileged groups of people should embody the new approaches to the problems of the less able or disabled

people. Due to those new perspectives a fundamental issue has been raised: the social involvement of the disabled people, the normalization of their lives and the study of their abilities have proved that the frontiers between the normality and the pathology are no longer evident, and that any person at any time can find himself or herself in an underprivileged situation, which can mean the discrepancy between a person's abilities or capabilities and the existing resources in a community. The social solidarity element of Aveiro - Digital is based on this paradigmatic pattern having as its central issue the level of autonomy of a disabled person within an environment as less limited as possible. Therefore, a wider flexibility of systems and services is needed in order to satisfy the needs of people in general, and the less privileged in particular. Furthermore, it is essential the modernization of the social solidarity institutions by making easier the access of the support services, by reorganizing the management and administrative procedures as well as providing new services. All this will be possible with a new attitude towards financing, equipment, training and strategic partnerships with those who have the competence and know-how (Rocha, 2002).

2. SOCIAL SOLIDARITY INSTITUTIONS AND INFORMATION SYSTEMS

There is no evidence that proves that the first priority should go to the satisfaction of other essential needs rather than to the introduction of the information and communication technologies into the social solidarity institutions. In fact, being the expense on human resources the most significant part of an institution's budget, it is then necessary to carry out an important reform in the organization procedures in such a way that the human resources can be more available to provide good quality services. One must welcome every strategy used to reduce the repetitive administrative tasks so that more time is left for the "moments of attention" to the users.

This is the main goal of the project Information Systems for the Institutions, one of the projects of the Aveiro - Digital. The consortium of the project is composed by several social solidarity institutions located in the region of Aveiro, the regional welfare services and the University of Aveiro. One of the main goals of this project is to provide the institutions with internal integrated information systems. One must take into account that a social worker is mainly an information manager. Consequently, the new technologies should be used to introduce more objectivity to the different social tasks. However, the changing in the procedures cannot be achieved only by the introduction of new equipment. It is then necessary to: i) Invest largely in training; ii) Create best practices for the introduction of the information and communication technologies; iii) Develop line partnerships between the institutions and between these and the scientific entities; iv) Introduce the workflow and remote cooperation methodologies, thus demystifying a little the necessity of a large number of meetings which are not always productive; v) Make the bureaucratic processes dependent on the information and communication technologies in order to increase their general use.

The project Information Systems for the Institutions could have a strong impact on the relations between the institutions and the local, regional and national structures of the public administration: i) Remote access to frequently required services such as asking for documents and filling in declarations by the final users; ii) New ways in the relations with the institutions with responsibilities in the local social tissue, namely in the exchange of information and flow of documents, iii) Introduction of workflow and remote cooperation methodologies in the work between the institutions and the regional welfare structure with the purpose of not only reducing the burden usually associated to an indefinite number of meetings but also optimise the productivity level of the human resources; iv) Generalize the sharing of data among the different entities of the social tissue, particularly concerning the responses in problematic areas which demand for a close cooperation among the involved parts.

3. DOMICILIARY SUPPORT

The domiciliary support services were selected, in a first phase, to study the impact and possibilities of the use of the information and communication technologies for the sharing of data among the different entities, on order to create responses for problems that demand for a close cooperation among the involved parts.

A previous study (Souza, 2003) concludes that 75 social institutions of the Aveiro region, that is to say 63% of the total number of institutions, do have any kind of domiciliary support services. These services can be supplied to people with different needs. However, all the institutions with domiciliary support services do have services for elderly people. Of the 75 institutions involved in the research, 6,8% supply domiciliary support services to everybody that do need support (elderly, disabled or people with health problems), 12% only supply services to elderly people, 8% to elderly and disabled people, and 4% to the elderly and people with health problems.

Besides the social solidarity institutions, the regional welfare structures are also involved in the domiciliary support services and maintain a formal partnership with the social solidarity institutions. There are 58% of the social solidarity institutions with periodic contacts with health institutions, where of these 25,6% maintain with the social solidarity institutions a formal partnership, against the remaining that maintain informal partnership. Other involved institutions are the regional authorities (21,5%) and the local authorities (20%), most of them with an informal partnership with the social solidarity institutions (Figure 1).
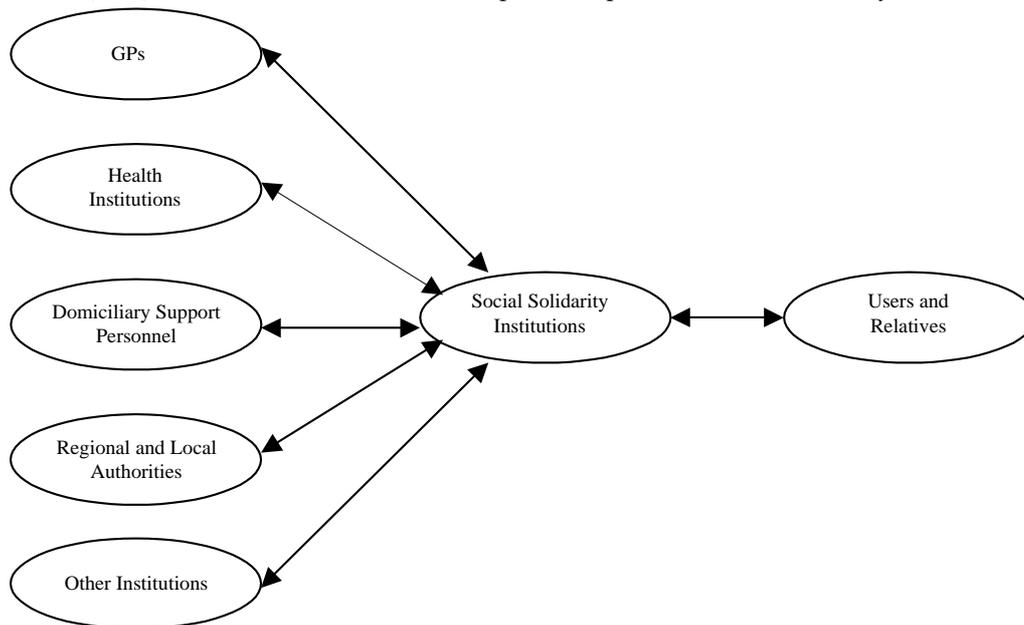
Figure 1. Actors of the Domiciliary Support Service

In what concerns the communication of the involved entities and actors in the domiciliary support process, 61% of the actors consider that the communications are done in an easy way, 21% consider that the communication is neither easy nor difficult, 17% consider very easy, 1% consider difficult or very difficult. On the other hand, in relation to the way as the communication is accomplished it is verified that does not exist significant use of Internet based services (e.g. electronic mail): 44% of the communications are face-to-face communications, 1% of the communications are made by telephone, and 55% are done through personal and telephone contacts (Figure 2).
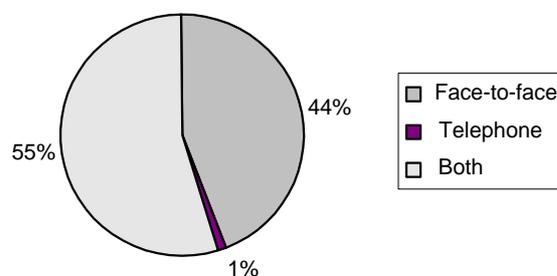
Figure 2. Communication between the involved entities

In order to facilitate and improve the communication among the different entities intervening in the process, it is in course the conception of a User Electronic Record, which is intended to be a norm within the social solidarity institutions of the project consortium (in a first phase) and extended to other social solidarity institutions (in a dissemination phase). This concept works as an integrator element (structure of information) of the software to be developed for the different systems and services of the project. In parallel, it is under development the creation of protocols that define: i) Who may access the information; ii) What type of access will be allowed; iii) Which information can be shared by the different institutions; iv) What are the forms of accomplishing such information sharing; v) What should be the appropriate security architecture.

The User Electronic Record stores and allows the access the information related with the different users, namely, identification, health problems, contact, interventions historical, etc. With the User Electronic Record, we intend to avoid the difficulties associated to the paper based records, namely: i) Difficulties to gather global data of the user (dispersed in several places); ii) Inappropriate locals of storage; iii) Physical damage; iv) Updating difficulties; v) Privacy difficulties. The User Electronic Record can allow to surpass some of this constrains. On the other hand, because it can de consulted starting from any point (for properly authorized users) it can provide the sharing of information among Institutions improving the whole process and obviating needs such as, for example, the existence of a process in a institution where the user passes its day and another in the institution where he stays during the overnight.

4. CONCLUSION

All the technological means allowing the integration and dissemination of information are now available to all. On the other hand, there is a great variety of knowledge and long experience as a result of already developed projects. There should be a considerable effort of systematization of procedures and dissemination of the methodologies, knowledge and results.

Within the domiciliary support services we verified that the new technologies are not used with the goal to facilitate and improve the communication among the different involved entities. In that sense, the project Information Systems for the Institutions of the Programme Aveiro - Digital intends to promote an important reorganization of the procedures of social solidarity institutions, through the development of integrated information systems, which are supported by the conception of a User Electronic Record.

The project has a three years plan (the firs year is almost accomplish) and one of the first goals has already been achieved: the social solidarity institutions and the welfare regional services become aware that the use of information and communications technologies could mean a whole methodological revolution to the care of disabled and elderly people. Furthermore, the confidence network built is the main result to pave the way to the future.

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AN INTEGRATION OF DIGITAL LIBRARY: CASE STUDY UNIVERSITY OF INDONESIA'S LIBRARY

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ABSTRACT

Nowadays, the demand of using library automation system in library management is dramatically increased. Very often, library automation system is a "stand-alone" application, lack of other supporting systems such as distributed system on resource sharing library collections, information retrieval system and so forth. The development of Digital Library at University of Indonesia uses an enterprise resource planning approach to integrate those systems into a Digital Library System. The Digital Library System is aiming not only will serve on campus students of University of Indonesia, but also will serve students off campus who will join University of Indonesia Distance Learning initiative. This paper describes design and implementation of the system which has characteristics of integrated functions of library automation, distributed digital library collection, and context-sensitive information retrieval technique as its search engine.

KEYWORDS

Library automation system, digital library, distributed system, information retrieval.

1. INTRODUCTION

Library automation system has evolved from time to time as one of the information system that brought major change to human activities especially in library field. The application of computing systems in libraries has been a subject of interest to professional librarians for more than 65 years. This evolution began dramatically in the last of 1960s with the development of library automation system. This system helped librarians to ease their daily activities in running the library by its automation functions.

With the development of internet, the online database industry began in the early 1970s. Coupled with integrated library system solutions, this system provides end users a "one-stop" desktop access point for materials held both locally and licensed internationally. The recent introduction of World Wide Web has allowed database producers a clear route for disseminating their resources to a wider audience, in many instances directly to the end user (in some cases bypassing the library) (Matthews, 1985).

Web-based resources moved to the forefront in the mid 1990s, after libraries determined that users had begun to spend much of their time browsing the Web searching for relevant materials that could be conveniently delivered to their desktop digital fashion. Professional librarians began to think like users in terms of "one-stop shopping" for information and having been successful at grafting their attention to the numerous resources available on the Web (Barry, 2001).

According to Kochtanek (2002), the digital library movement, still in its early stages, has begun to evolve from its early research platform to more fully developed applications, typically in selected content areas. There are many definitions that researchers defined for it, but the best and the most related terms of it is the collections of digital contents with its storing, accessing, and retrieving methods (Kochtanek, Thomas R., 2002). Combined with classic research area dealing with electronic search which is known as information

retrieval, digital library has evolved its retrieving methods from conventional search, commonly using SQL syntax, to a rich of information retrieval system. Nowadays, this evolution has new challenges to get more efficient and accurate in dealing with information that is distributed.

From the evolution of library automation system that we mentioned above, we see an opportunity to build a system that has all those capabilities. We are putting it all together into one system, Digital Library System. This system will help librarians to manage library in "one-stop" desktop application. The most important one is this system will solve problems in University of Indonesia's library. The university has distributed collections, because it has 12 faculties and each faculty has its own library. Some faculties have several departments that they are too have their own library collections. Few of them already have library automation systems that are mostly "stand-alone" application, so it can't share the information their collections. With the capability of developed digital library application, the university can manage their scientific collections, e.g. papers, dissertations, thesis, etc., in digital format. This capability will save space and time to manage that kind of collections.

This paper, which is based on LONTAR Digital Library System, describes design and implementation system which has characteristics of integrated functions of library automation, distributed digital library collections, and context-sensitive information retrieval technique as its search engine. This system aims to give rich information of library collections in low cost and acceptable speed for users of library, along with easy management collections by librarians. The system is also aiming not only will serve on campus students of University of Indonesia, but also will serve students off campus who will join University of Indonesia Distance Learning initiative.

2. COMMON UNIVERSITY'S LIBRARY CHARACTERISTICS IN INDONESIA

In University of Indonesia, the libraries are characterized by hierarchical of management and location context. At the level of university, it has only one library to support academic activities, we call it UPT Library. Its main function is similar to centralized library but limited to the coordination of library acquisition that funded from the university. It also has library collections that consist of several disciplines. Everyone from campus is able to access to University's library. The existing such library can be found at other universities in Indonesia, such as University of Brawijaya, University of Muhammadiyah, with some variations of management style.

Beside that, the university has more than one library that spread out in several faculties and several departments in order to support academic activities. Every member of the faculty's or department' libraries will be able to access their own library. The management of library is controlled by each faculty or department. Usually, the university's library conducts a routine meeting between faculty's libraries to coordinate each other. In this sense, these libraries are *decentralized libraries*. Such system library can be found beside university of Indonesia, is also at university of Gajah Mada, etc. University of Indonesia libraries are moved toward a better coordination in terms of providing optimal services to students and staffs, collection development, and policies.

In this paper, we use this *decentralized libraries* approach as the subject of research in developing digital library application. There are problems that arose in pursuing such efforts. University of Indonesia has 12 faculties and each of faculty has its own library, plus one university center library. Students usually have obstacles in finding books that their faculty doesn't have it, especially the books that are not related to the Faculty. The books, that they are looking for, may available at other faculty or department. The easiest way for finding that books is for the students have to visit each of libraries and search the books that they are looking for. So, if there is a system that can give distributed information of collections, the students will thrift their time in visiting each of the library.

Other problem is to manage scientific collections. Nowadays, demand for accessing digital content dramatically increased. In University of Indonesia, all scientific collections have not yet been digitized. Users of library have difficulties to get information about it, especially the contents of it. Moreover, users are not permitted to borrow such collections. They only permit to read it in the library. So, it would be helped to users if there is a system that can give an access to view scientific collections, where they can read it anytime

and anywhere. And this system must also become a good assistant for users in finding a subject of information that they are looking for.

The solution from above problems is to build a system that combine library automation, distributed information, digital library and information retrieval in one system.

3.   SYSTEM ARCHITECTURE

The LONTAR Digital Library System was designed for library that covers the scope of university, based on university characteristics which is consists of some faculties and departments. Each faculty and department is geographically sparse and separated at some distances and has its own library. Every library has a server and it is connected each other through the university network. Having such configuration, those faculties and department can share information of through the network and this architecture is called a distributed system.

In distributed system, the library can enrich their information collections for users by providing information collection to other library that is connected to it. So, the users will be easier and satisfy by the library service because they can get information they need only by accessing the library system that they are registered at there. For example, Thomas was registered as a member of department's library of computer science, he want to search an article about information economics. He knows that this article could be available in library of Economic faculty. So, he can access information at faculty's library of economics from his faculty's library OPAC. He doesn't have to visit faculty of economic to search that collection.

To increase the functionality of the system, it must be able to managed digital content. Librarians put their digital collections in the system. So, users of library can see it from library OPAC. Information retrieval also used to help users in finding their collections, because this concept will provide a context sensitive search. Figure 1 shows us the design of LONTAR system architecture that integrates all those components into one system.
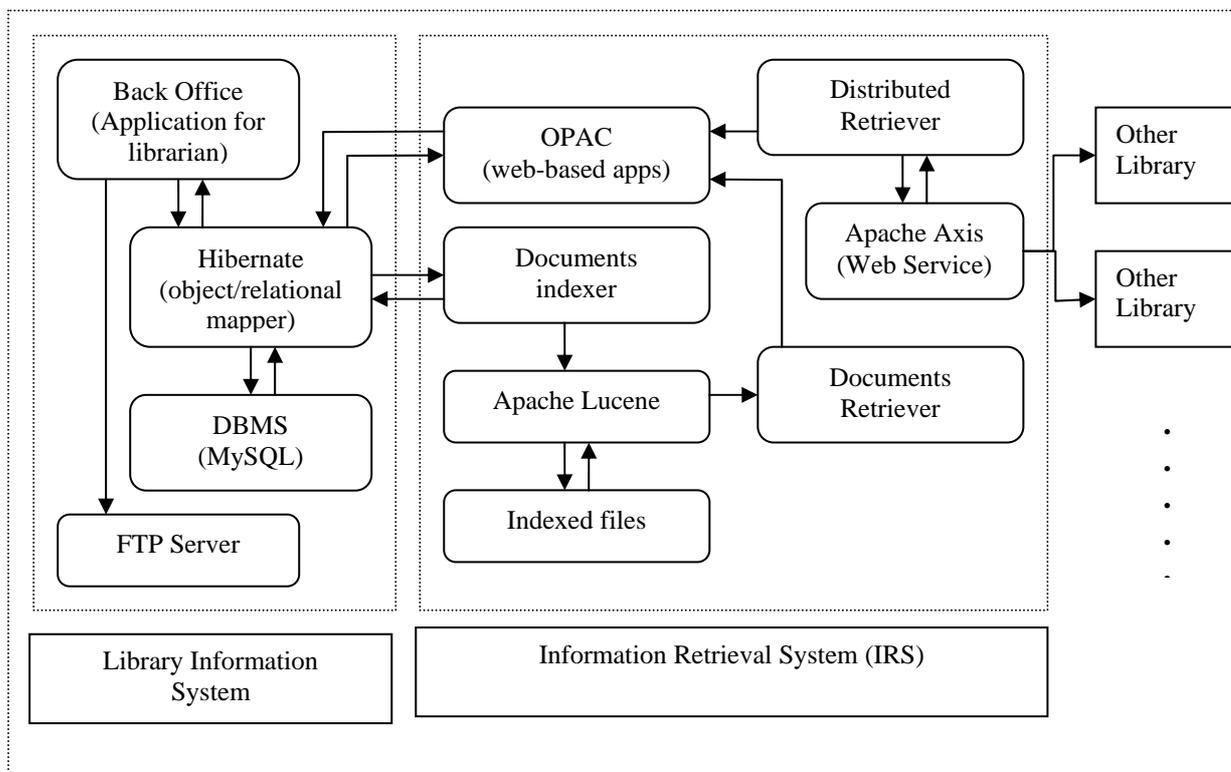
Figure 1. System Architecture of LONTAR

LONTAR has 2 major modules that are library automation module and information retrieval module. Library automation module consists of all library functions such as acquisition, cataloging, circulation and reporting. It is used by librarian to managed information of collections and shown in Figure 2. INDOMARC was used as standard format in storing information about all collections. For the non-digital collections, the system will save information in Database Management System (DBMS). But for digital collections, system will not only save information about it, but also its file. FTP Server was used to store its file, so that users can download the file whenever they want to.
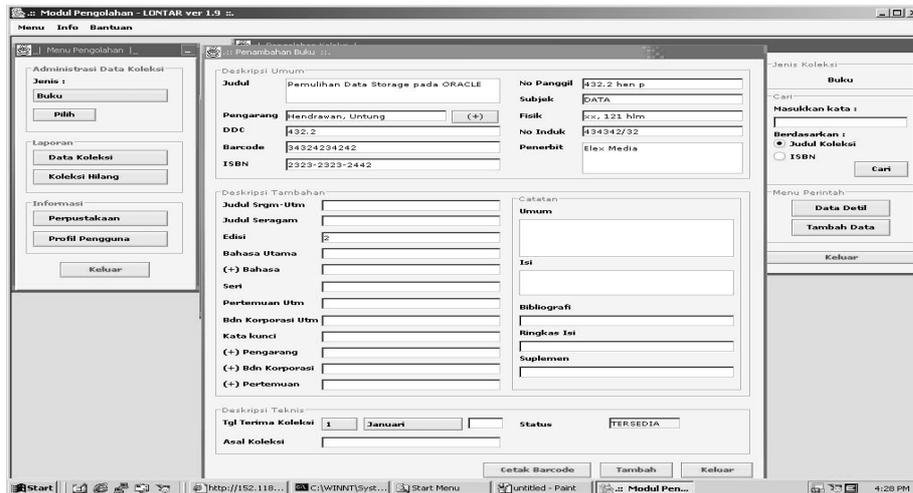
Figure 2. Back office application

Information retrieval module is considered as a front office application, because it is used by users to find information. This module is used in library OPAC (Online Public Access Catalog). When librarians enter new information of collection (in back office application), LONTAR automatically index some fields, i.e. title, authors, subject, publisher and abstract. We use Indonesian Grammar in order to stemming this information. This process will create indexed files. When users search collections using OPAC, system will search the keywords using context sensitive information retrieval method. Figure 3 shows us user interface of OPAC.
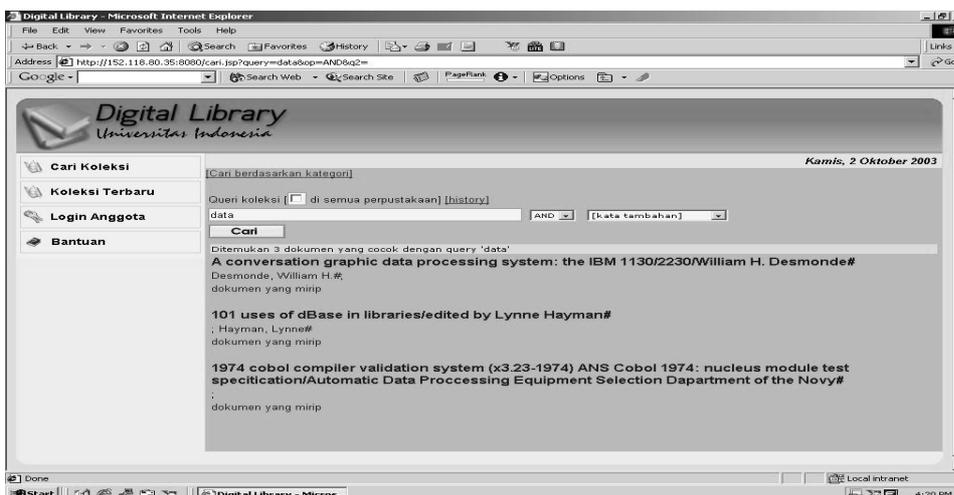
Figure 3. Online Public Access Catalog with information retrieval for searching method

The challenge was in combining distributed information from other servers. In order to communicate between servers, LONTAR was equipped by web service technology to passing information. By this technology, we consider to get low cost in storing data. A server didn't have to store information of

collections from other server in it, but they can share information to each others. Every message, that is used to communicate between servers, is using XML (eXtensible Markup Language) standard. When users want to search collection at other libraries, the keyword is passes to other servers by web service. Each server will process that keyword and return the result. This result contains title, author, publisher, subject, call number, physical description, status and rank of collections, along with code of server location. Host server will combine that result and view the result to OPAC.

In combining information that is distributed, system will sort the data by rank. If there is data which is similar, e.g. same books from 2 libraries, system will joined it and make new rank of the data, that is the average rank of it, and then re-sort the data to view in OPAC. We consider using this combined method to get a reasonable speed for users in finding collections, especially in distributed locations. Therefore, users will know location of collections that they are looking for from library OPAC.

4. CONCLUSION

The integration of library automation, distributed digital library collections and information retrieval in one system could help librarians to manage library in "one stop" desktop application. This system was designed from the library characteristics at University of Indonesia. With this system, university of Indonesia can integrate all libraries in university. They can share information of collection between department's libraries. This system could also helped librarians to manage the scientific collections into a digital content.

For future work, there are some other things need to be done such as:

1. To enhance service for the users, this system could be added with facility to search collection from wireless devices, e.g. PDA, mobile phones, etc.
2. To enhance information retrieval method that can improve the search performance.

ACKNOWLEDGEMENT

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MANAGING AND DOCUMENTING
ACADEMIC COURSE CURRICULUM INFORMATION

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ABSTRACT

The University of Athens received a grant to support digital collections and provide information, regarding all educational and research activities through an academic portal. Thus, the possibility to provide information for all courses taught in each academic semester in a systematic way was explored. Academic staff members usually provide information for the courses they teach through their own web pages, which students access to download supplementary material, as presentations or papers related to a specific lecture or even the timetable of lectures. Instead of accessing staff personal pages, it would be easier for students to obtain course related information through the Library web pages, where they could find informational material for all courses in a unified fashion. The digital library system presented in this paper was built as a supplementary tool for tutors and students that normally attend at a specific department's courses. Information related to all courses is documented using digital material metadata standards. For this purpose the Dublin Core metadata scheme was adopted and properly extended. The system must be able to provide information to the academic portal and cooperate with existing harvesters, operating in an automated fashion.

1. INTRODUCTION

The University of Athens initiated a digital collection and information portal development project funded by the Greek Government to provide enhanced educational capabilities, disseminate digital educational material and preserve research material produced by its laboratories and researchers. Students and researchers access digital material mainly for educational purposes. The project aims at two targets: a. gather digital material for educational purposes (either digitized or produced in digital form) and b. access all digital material through an Information Portal developed by the Libraries Computer Centre.

In this paper, we discuss the Digital Library platform, named *CourseDL*, developed for documenting the progress of academic courses and managing supplementary informational material regarding them. The purpose of this activity is to support teaching activities and provide information and supplementary material for all courses offered by different University Departments following their progress through academic semester. Thus, it is possible to provide information for all courses taught in each semester in a systematic way.

Academic staff members usually provide information for the courses they teach through their own web pages, which students access to download supplementary material, as presentations or papers related to a specific lecture or even the timetable of lectures. Additionally, students may also download exercise material or even upload their own exercises. Instead of accessing staff personal pages, it would be easier for students to obtain course related information through the Library web pages in a unified fashion. The digital library system presented was built as a supplementary tool for tutors and students that normally attend at a specific department's courses. Creating an e-learning system was out of our scope. The system provides access to information concerning academic courses. It also facilitates tutors to upload and document supplementary material related to each lecture, instead of updating a web page. Thus, the system should be easy to use. Information related to all courses is documented using digital content metadata standards. For this purpose the Dublin Core metadata scheme [1] was adopted and properly extended. The system must be able to provide information to the academic portal and cooperate with existing harvesters, operating in an automated fashion. Thus, the Open Archives Initiative Protocol for Metadata Harvesting [2] is supported.

The rest of the paper is organized as follows: In section 2, the information maintained for each course and related metadata are presented. In section 3, the functionality of the system is discussed. Conclusions reside in section 4.

2. DIGITAL MATERIAL AND METADATA REPRESENTATION

Course related information is stored within CourseDL in the form digital objects, used to represent digital content. Three digital object types were introduced: *Academic course* digital object represents a course offered by a specific University Department. *Lecture* digital object represents lectures given as part of a specific course. Finally, *supplementary material* digital object contains supplementary digital material related to a specific course or lecture. Such elements can be a PowerPoint presentation used during a lecture, an audio file of the recorded lecture in mp3 format or an exercise related to the specific lecture or course. All information previously published in the course web page is treated as supplementary material. Digital objects are presented to users as dynamically created XML pages according to METS [3] standard, and provide links to related digital objects. Digital objects used to describe course related information and their relations are depicted in figure 1, using UML notation.
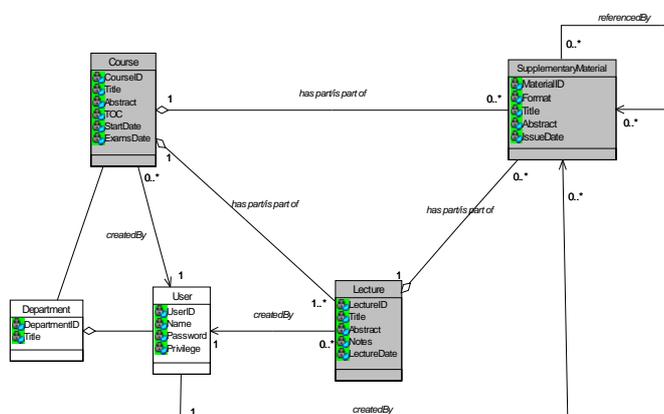
Figure 1. Course-related digital objects and supporting entities

As indicated in the figure, supporting entities have also been declared, namely user and department. The user entity provides information about the system's users (students, tutors and administrators). Different privileges may be defined to clarify who are in charge of "posting" material in the system. A user may create a new course and provide information about it as well. The department entity represents the departments belonging to the University. A course is given by a certain department and a user belongs to a department.

The metadata scheme introduced to describe courses, lectures and supplementary material is based on Dublin Core [1], which is a widely adopted standard for digital material. Course related information was mapped to specific Dublin Core (DC) elements, while some elements were omitted. Characterizing course, lecture and material digital objects using DC elements facilitates students with additional information and enhances their searching capabilities. Additional qualifiers of description element are introduced, to accurately describe course and lecture digital objects. The DC Subject element is used to characterize courses, lectures and material. Instead of adopting a subject existing schema, such as LC or Mesh [3], keywords defined by the tutor are used, to simplify characterization process. Technical metadata, as DC.Indentifier, DC.Type and DC.Format are automatically created by the system. The DC.Relation.HasPart and DC.Relation.IsPart fields are automatically added by the system, when tutors create or update course, lecture and material digital object through the graphical interface.

The DC Relation element is used to describe relations between digital objects. Two relation types were identified described by existing Relation qualifiers:

- the *IsPartOf/HasPart* relation representing composition. Each course is composed by lectures and its lecture must be part of a specific course. Supplementary Material digital object is usually related to a specific lecture. In rare cases, it may also be related to the course.
- the *ReferencesIs/ReferencedBy* relation representing reference between different supplementary material. This relation is not mandatory and is useful only if supplementary material supporting a specific lecture is related with supplementary material already given by the tutor.

Mandatory elements of a specific digital object may be automatically filled using information from its ancestor to simplify characterization process. For example, if the tutor left the Creator/Subject field black, while creating a new Lecture digital object, the system automatically fills it using information from the Creator/Subject field of the corresponding Course.

Metadata are included in corresponding XML pages using RDF representation, conforming to the instructions given in [5]. As an example, the RDF representation of a lecture metadata is depicted in figure 2.

```xml
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:dc="http://purl.org/dc/elements/1.1/"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:uoadc="http://di.uoa.gr/distributed/DC"
xmlns:dcterms="http://purl.org/dc/terms/">
<rdf:Description rdf:about="http://di.uoa.gr/distributed/corba/corbaForIdiots.pdf">
    <dc:creator>Doe John</dc:creator>
    <dc:title xml:lang="en">CORBA for Idiots</dc:title>
    <dc:subject>
        <rdf:Bag>
            <rdf:li>CORBA</rdf:li>
            <rdf:li>Beginners</rdf:li>
        </rdf:Bag>
    </dc:subject>
    <dc:language>
        <dcterms:RFC1766>
            <rdfs:label>Greek</rdfs:label>
            <rdf:value>EL</rdf:value>
        </dcterms:RFC1766>
    </dc:language>
    <dcterms:abstract>An simple introduction to CORBA</dcterms:abstract>
    <dc:publisher>Prentince Hall</dc:publisher >
    <dc:contributor>George Andrew</dc:contributor>
    <dc:type>text</dc:type>
    <dc:format xsi:type="dcterms:IMT">text/pdf</dc:format>
    <dcterms:IsPartOf xsi:type="dcterms:URI">
        <dcterms:URI>
            <rdf:label>Lecture 2</rdf:label>
            <rdf:value>http://di.uoa.gr/distributed/DC/lecture.jsp?lesson=1&lecture=2</rdf:value>
        </dcterms:URI>
    </dcterms:IsPartOf>
    <dc:identifier rdf:resource="http://di.uoa.gr/distributed/DC/lecture.jsp?lesson=1&lecture=2"/>
    <dc:date scheme="W3C-DTF">1999-11-26 T14:00-03:00</dc:date>
</rdf:Description>
</rdf:RDF>
```

Figure 2. RDF representation of a supplementary material metadata

3. PROVIDED FUNCTIONALITY

CourseDL system is accessible from any web browser. It supports three types of users: administrators, tutors and students. Administrators are responsible for maintaining department, course and tutor lists. Tutors are responsible for adding and editing lectures and supplementary material and update course information for all the courses they teach. Students may perform various search queries and view course, lecture, and material information stored in CourseDL for all courses they take. Two different interfaces are provided to retrieve information. The first one facilitates users to view a catalogue of courses offered the current semester grouped by corresponding curriculum information. Students may choose a course and browse all the lectures given so far. The second one provides extensive searching functionality. Searching is performed using specific metadata fields, as presented in Figure 3. Results are presented in a uniform manner through the *Search Results* page. The user has also the possibility to access lists of the basic entities (course, lecture and material) through which the navigation described above may be performed, as well as the user list, which contains information about the system's users and, when the user is a tutor, allows navigation to the courses provided by the tutor.
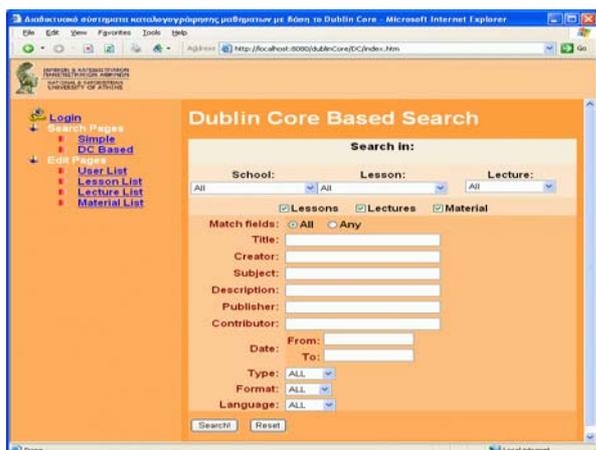
Figure 3. Searching Interface
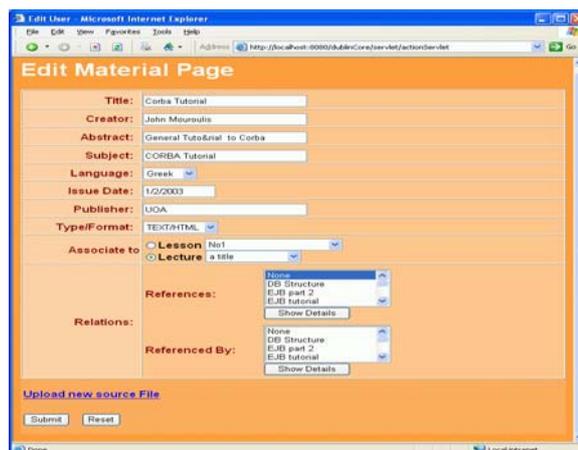
Figure 4. Edit Interface

Privileged user – an administrator or tutor that is – may also edit the information supplied for courses, lectures and supplementary material. It is obvious that a tutor may edit information belonging to a course (lecture/supplementary material) assigned to him/her. Through edit pages, the user may provide, upload or change the information about a specific course, lecture and/or supplementary material (figure 4). Both, searching and edit interfaces are developed in Greek and English language, while special attention was given in usability of edit pages, so that tutor may easily add new content regarding lectures and supplementary material.

CourseDL is designed to interact with both users accessing the system using a web browser, as well as with data harvesters. When a harvester (a search engine) makes a request, the system responds as a repository that conforms to the specifications given by the Open Archives Initiative Protocol for Metadata Harvesting (OAI PMH) [2], which includes the metadata in a XML form. When the harvester gets the URL identifiers pointing to CourseDL digital objects, it may access them. The provision of the OAI PMH interface facilitates the integration of CourseDL into the Information Portal supported for all digital content produced by the University of Athens.

4.   CONCLUSIONS

Instead of accessing staff personal pages, it would be easier for students to obtain course related information through the unified web-based environment, where they could find informational material for all courses in a common fashion. The digital library system presented in this paper, namely CourseDL, was built as a supplementary tool for tutors and students that normally attend a specific department's courses. Information related to all courses is documented using digital material metadata standards. Adopting Dublin Core metadata scheme and Open Archives Initiative Protocol for Metadata Harvesting was a wise decision, since it promotes interoperability and facilitates CourseDL seamless integration into the information portal supported by the University.

REFERENCES

[1]   Dublin Core Metadata Initiative, http://www.dublincore.org/

[2]   The Open Archives Initiative Protocol for Metadata Harvesting,
      http://www.openarchives.org/OAI/openarchivesprotocol.html

[3]   Metadata Encoding and Transmission Standard, http://www.loc.gov/mets

[4]   Medical Subject Headings http://www.w3.org/RDF

[5]   Guidelines for implementing Dublin Core in XML http://dublincore.org/documents/2002/07/23/dc-xml-guidelines/

THE DEAN CAMPAIGN: A CASE STUDY IN ONLINE INTERACTIVE CAMPAIGNING

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ABSTRACT

Online campaigning has become increasingly important to political campaigns in the United States and elsewhere. The Howard Dean for President campaign became a "poster child" for utilizing the Internet to mediate communications and inviting people to participate meaningfully in a campaign. While Dean was neither the first candidate to use online campaigning, nor did he win the Democratic nomination for the general presidential election, his campaign was notable in two intertwined respects: the enormous amount of time and attention that it paid to online campaigning and the culture of openness that encouraged and expected supporters to take autonomous action on behalf of the campaign, mediated via the Internet. The amount of energy and resources that were spent in creating and deploying online tools to generate participation cannot be overemphasized. In this paper, we will briefly describe how online interactive tools became so central to the campaign and describe the tools which the campaign utilized to achieve its goals: the website, online contributions, the blog (or weblog) and Meetups. While the campaign itself is now defunct, the importance of the medium and the tools employed is not -- as most of the tools that were brought to the fore by the Dean campaign have been co-opted by the two candidates left in the presidential race, Democrat John Kerry and the Republican George W. Bush.

KEYWORDS

Online political campaigning, digital democracy

1. INTRODUCTION

Can the Internet be used to reinvigorate an increasingly disconnected and apathetic American public? Is it possible to take politics out of the realm of a small cadre of hired political consultants and marketers and push it out to ordinary citizens – inviting them to take part and mobilize on their own behalf for a national campaign? These are some of the questions that the Dean campaign answered, at least in part.

The Dean campaign was the first Internet based presidential campaign. The campaign successfully used the Internet to take a completely unknown candidate, an obscure former governor from a tiny US state, and transform him into a serious contender for the Democratic Nomination for the Presidency of the United States. The campaign began in January 2003, with $157,000 in the bank and 432 known supporters worldwide (Trippi) which, by its end in February 2004, had raised over $50 million in small amounts from over 300,000 individuals, had 640,000 known supporters and had created a formidable, decentralized organized body of supporters of over 189,000 people around the country who had been acculturated into political action through attending political meetings organized through Meetup.com.

The campaign also forced all other democratic candidates for president to introduce the elements of transparency, interactivity and self-organizing tools to their online strategies. Each candidate for president now has a blog, has meetups, runs online fundraising campaigns and has set up forums for voters to communicate not only with the campaign but also amongst themselves. The President of the United States has now set up a blog. Howard Dean is now poised to be a force in the Democratic Party. The overarching questions of online political campaigning's efficacy has yet to be determined. However, the case study of the Dean campaign offers a tantalizing snapshot of the potential for using the Internet in political campaigns as an interactive mass-organizing tool -- beyond the "web page".

2. METHODS OF STUDY

We studied the Dean campaign through a three-month ethnographic study at the campaign headquarters in Burlington, Vermont. We studied the use of Internet tools in the campaign, interviewed key staffers, learned the culture of the campaign through participant-observation (Glaser), and gained access to statistical and archival data on the use of Internet tools. Keri Carpenter participated in the campaign as what the campaign called an "embedded researcher" at headquarters. The field research began mid November 2003 and ended late February 2004, just after the campaign ended. Keri Carpenter worked in the interdisciplinary group called the "webteam," consisting of 25 people who managed all online efforts within the campaign. Keri Carpenter both worked as a volunteer for the campaign and conducted research, in the tradition of classical participant-observation. The research yielded taped, in-depth interviews with over half of the members of the webteam, numerous informal interviews with key informants and quantitative data on Internet usage. We also read the blog daily and attended meetups, house parties, housemeetings, a "Digital Democracy Teach-in," and other related events.

3. ONLINE INTERACTIVITY = SUPPORTERS + MONEY

The Dean campaign made online interactivity a central pillar of their political campaign. The campaign manager, Joe Trippi, was a veteran of 1990s dot-com, open source ventures and was interested in the possibilities of using the Internet as a tool to attract supporters and raise funds. The candidate himself had jumped into the fray of Democratic hopefuls largely in order to energize a disenfranchised and apathetic Democratic party. Thus, a central theme of the Dean campaign was mobilizing citizens to get involved, or reinvolved, in the democratic process. The reliance on interactive online tools as a method to garner supporters and to raise funds was cemented early on in the campaign.

In April 2003, an email was sent out to known supporters asking them to sign an online petition condemning Republican Senator Rick Santorum's anti-homosexual statements regarding a pending lawsuit before the Supreme Court concerning sodomy laws. The email asked supporters to sign an online petition and to contribute to Dean's presidential campaign. The response was immediate. The campaign received 12,000 signers to the petition and raised $25,000 in the three days after the email (at a time when the campaign was raising an average of $6,000 in three days). This was a "light bulb moment" in the campaign. It showed that once people found something with which they could align, they wanted to follow through with an action -- some visible way of expressing their support. The Santorum petition secured an enduring belief within the campaign that interactivity mediated through the Internet would both raise funds and attract supporters.

Following this, the campaign was styled as a "grassroots" or "netroots" campaign that encouraged citizens to become involved, both online and offline, and to participate more meaningfully in elections. As a result, the campaign scrambled to introduce any tools that would smooth that process of participation.

4. THE TOOLS

The major tools that the Dean campaign used were: the website, the blog, Meetups, "the bat" fundraising campaigns, DeanLink and GetLocal. The official campaign website (located at deanforamerica.com) functioned as a portal for all campaign activities. The website had the standard brochure information such as a biography, the candidates' record and policy papers. However, it also lead the visitor to a host of tools designed to encourage various levels of participation. Users could sign up on the main mailing list or contribute money to the campaign through a secure web page. Users could also sign up to attend local face-to-face meetings on the first Wednesday of each month facilitated by the online tool at Meetup.com.

The homepage content was intentionally designed to be a starting point for investigations about the Dean campaign. It provided general information and overall snapshots of what was going on to the inquisitive visitor and offered quick and easy ways to get involved further in the campaign. However, conversation about the campaign did not take place on the main website. Conversation about the campaign took place on the blog at blogforamerica.com.

4.1 The Blog – interactive "play by play" Coverage

The difference between the blog, located at blogforamerica.com and the website was twofold: the blog content was updated much more frequently than the website and the blog offered supporters the ability to post comments on each blog entry. The blog was the central news source about the campaign with news updates posted up to twenty times a day. The comment capacity allowed the blog to create a cohesive community of supporters who were able to publicly and visibly take part in the campaign. Where the website was a place to go, the blog became a place to stay. The readership of the blog grew quickly. In May 2003, the blog had a readership of 3-4,000 people per day. By the beginning of July, there were 20,000 readers per day, and by September, 40-50,000 readers. By December, 80,000 people were reading the blog each day and by January, readership grew to nearly 90,000 people per day. During the period October 15th, 2003 to February 4th, 2004, the blog received an average of 2722 comments per day. At the height of the campaign, almost a hundred thousand people were reading the blog every day and it received more than 6000 posted comments each day.

4.2 Meetups – "clicks to bricks"

Meetup.com is a commercial online tool that allows people to organize face-to-face meetings. Meetup.com software provided a way to connect supporters face-to-face without having to send out field organizers to every city in the nation. Meetups are entirely organized and run by volunteers. Supporters found meetups through the Dean website, blog or email. Users fill in their zip code and are presented with a list of meetups being organized in their local area. If none are close enough, users are prompted to begin one in their local area. The campaign ran thirteen consecutive monthly meetups in 1,100 locations across the country with total attendance reaching over 189,000 people and with only one dedicated staffer. This low level of administrative support hints at the possibility of large-scale self-organizing collaboration possible with the use of well-designed Internet tools.

4.3 "The Bat" Fundraising Campaigns

The Dean campaign raised enormous amounts of money online from hundreds of thousands small contributors. From the earliest incarnations of the website, the campaign accepted online contributions. All of the mass emails contained links to the online contribution form. The "contribute" link was always featured prominently on the homepage. The blog often featured calls for contributions. However, it was not just the ubiquity of the "contribute" tools that made the effort so successful. Visible feedback on the fundraising progress and the chance to discuss donations on the blog made the difference.

One of the crucial ideas that the Dean campaign introduced into campaign fundraising was feedback. In early June, Trippi had the idea that to raise more funds, the campaign needed to give supporters a monetary goal to reach. Furthermore, instant or near instant feedback was needed to show supporters how they were progressing towards the goal. The campaign wanted an icon that they could display on the webpage to provide this feedback. Larry Biddle, the Finance Director, came up with the idea of using a baseball bat to represent this. The bat was a thermometer-like visual representation of how much money had been raised measured against a certain goal.

The success of the bat was immediately evident. The first bat campaign, begun on Friday June 27th, raised $500,000 in one day at a time when raising $50,000 a day was extraordinary.

Supporters chattily commented on the blog about how "pushing up the bat" made them feel. They felt tremendous ownership for bat fundraising and many comments on the blog were about the reasons they contributed, how much they contributed and posts to convince others to contribute. The following comments were made in the wake of the first bat campaign. They express the sense of satisfaction and ownership that supporters got from succeeding in making fundraising goals: "Funny thing is, thousands of us are giving our money to Dean, and yet we look at that bat and feel like we've won the Lotto!" "I've never given money to a politician in my life, and not only did I give Dean a hundred bucks, but I've committed myself to trying to get as many people as possible aboard. I don't want my beautiful 8-week-old daughter to have pay for what I believe are the current administration's mistakes."

The culture of transparency and interactivity coalesced in the fundraising: the openness of the campaign, the constant goals and visual feedback for the results of efforts, and the online community space where supporters could express their joy all contributed to the financial success of the campaign and the feeling of community engendered throughout the campaign. Strikingly, these funds were collected in small amounts from over 300,000 people, with an average donation of about $165.00. The fundraising effort showed that "real money" could be raised on the Internet, in small amounts, without large corporate donations.

4.4 DeanLink and GetLocal

DeanLink and GetLocal were two additional tools that were rapidly introduced during the Dean campaign. Both of these tools were Dean-themed adjuncts to existing online tools. GetLocal allowed users to set up and organize events beyond the monthly Meetups organized through Meetup.com. Through GetLocal, supporters could register any event that was happening that people wished to invite Dean supporters to – large and small, such as a Dean-themed party, a debate watching party, handing out flyers at the local supermarket, etc. DeanLink, a Friendster-inspired (http://www.friendster.com) web application, allowed supporters to create an online profile, to locate and communicate with other supporters in their local area in order to further cement the feeling of community within the Dean supporter community. These tools, while important, were not introduced early on enough in the campaign for a true community to coalesce around them before the campaign came to an end in February 2004. However, the Kerry campaign is using the DeanLink ideas, in his case pointing supporters to sites like Friendster and Tribe in order to accomplish his "online networking" goals.

5. CONCLUSION

While the Dean campaign was unsuccessful in securing the Democratic party's nomination for a presidential run, the central lesson of the campaign was that Internet tools can be used to organize collaboration for political activity on a massive scale. The ground broken by the Dean campaign has been quickly co-opted by the two campaigns still in the running for the US Presidency in 2004. Each of these campaign's activities feature blogs, interactive campaign websites and extensive online activist web applications. While it is too soon to tell what the actual ramifications these online activities will have on how voters cast their ballots, it is fair to say that online campaigning is here to stay. Will the Internet increase rates of voter participation, or will its chief use be to provide a platform for new voices unable to be heard in the traditional mass media? The Internet is a new player in politics and it is not yet clear what the future may bring. However, understanding collaboration at the scale of national politics is an important area for continuing investigation for all researchers interested in utilizing this new medium to increase voter education and participation in the democratic process.

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MULTI MODE MULTIMEDIA MESSAGING SYSTEM AS AN INTEGRATED WIRELESS MESSAGING IMPLEMENTATION ON CAMPUS NETWORK

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ABSTRACT

This paper has successfully implemented the application of the multi mode multimedia messaging system which demonstrated the availability and usage of immediate messaging passing via cell phone as a fast and easy approach. The study focuses on the architecture of the mobile telecommunication network environment. It has enabled the school to pass messages cross-campus and to allow one to respond at one's convenience. In addition to serving the students, the administration staff and faculty benefit as well. This project has also been piloted with the computer center staff that often has the urgent need to respond to immediate issues caused by system emergency. The result of the study was implemented for staff who maintain the National Broadband Experimental Network which runs under the National Telecommunication Project in Taiwan.

KEYWORDS

Multi-mode multimedia messaging, WLAN, GPRS, mobile telecommunication network

1. INTRODUCTION

In the usage of the wireless network environment, the mobile telecommunication network provides the user more convenience and mobility in connecting to the Internet than the Wireless Local Area Network (WLAN). The advantage of the mobile telecommunication network is that it supplies both the larger service range and the higher transmission rate. The advantage of Wireless LAN is opposite to the mobile telecommunication network. It has a higher transmission rate and can provide a good connection quality in the indoor environment. The disadvantage on the other hand is the limited range of support and service.

The bottleneck of the wireless network environment will be examined by this proposed system in which we attempt to combine the advantages of the two kinds of wireless networks to develop a suitable messaging application in the integrated environment. In setting up the architectures of the multi-mode multimedia messaging system (refer as M4 system), the goal is to combine text-based services and the wireless LAN to transfer multimedia objects and to use the mobile telecommunication to deliver short messages that will work using services other than the SMS system. Moreover, the M4 system was designed to divide to more parts on WLAN/GPRS network access module to hold system management module and M4 message editor. With the additional multimedia server and object storage module, we made the M4 system fully complete and easy to operate.

2. ARCHITECTURE OF THE WLAN/GPRS MULTI-MODE MULTIMEDIA MESSAGING SYSTEM

The developed system combines the advantage of the mobile telecommunication network and the wireless local area network. The main idea is that we use different processes to enhance their own characteristics. The system architecture in detail and its corresponding modules are described below. The system has been implemented and provided service for a period of 9 months before modification for the user interface was enhanced. The architecture of the system remains but general interface was modified for easier access.

WLAN/GPRS multimedia multi-mode messaging system is designed to integrate the Wireless LAN and GSM/GPRS Network to send the multimedia message in real time. Because the SMS/EMS/MMS system are still the text-based or text-like services, we try to use the Wireless LAN instead to transfer multimedia objects and use the mobile telecommunication network to deliver short messages. The proposed system, **M**ultimedia **M**ulti-**M**ode **M**essaging System, is briefly called as M4 system. Its architecture is shown in Fig. 1.
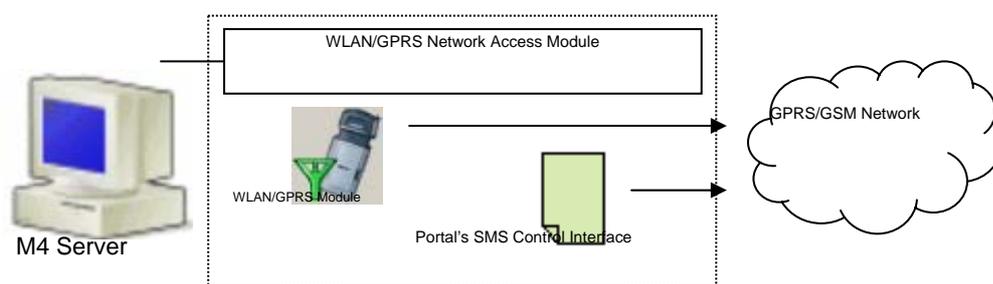
Figure 1. System Architecture of WLAN/GPRS multimedia multi-mode messaging system

The architecture of this M4 system can be divided into four parts as the WLAN/GPRS network access module, the M4 message editor, the multimedia server & object storage module, and the system management module. The purposes of these four components are described in the following.

2.1 WLAN/GPRS Network Access Module

This system uses the high bandwidth of Wireless LAN to replace the mobile telecommunication network to transmit the multimedia object. To deal with the delivery of the short message with multimedia objects, our system uses two methods to transmit the content of the message. One uses the WLAN/GPRS dual-mode device, and the other uses the SMS delivery interface of portals or the telecom service provider.

2.2 M4 Message Editor

The message format of the system is different from those of the standard SMS/EMS or MMS message. To create the multimedia message, our system designs a specific message format. This specific message format allows the user to read the message and the multimedia objects conveniently. The message editor is used to create a specific message format for the receiving objects.

2.3 Multimedia Server & Object Storage Module

The system holds two methods to access multimedia objects: one downloads objects directly and the other displays objects in the real time. The download method is suitable to all objects in our system. The real time display method is suitable to the message within multimedia objects. In order to provide these access methods, we need to construct several corresponding servers, like the file transmission server, the multimedia server, the VoIP server, the object storage server and so on.

2.4 System Management Module

Management interface is important for the M4 system. It holds the system configuration parameter, the system user management and the object database management. All the interfaces with the server and security management are to assist the administration for the management and control of the system.

3. THE OPERATING OF THE PROPOSED SYSTEM

The operating environment for this study was conducted with two systems, web based and windows based, in order to separately consider the both the server side and the client side. The servers for the environment, regardless of its being web-based development or windows based, will both receive the request from the client, usually a windows based client. However, on the client side, the device will be different depending on the web based environment. The desktop or lap top users will use the web browser on these devices and, through the specific web page as the interface, will request and receive messages. The windows based client device with laptop computer and GSM module user uses the developed program and GSM module to request and receive messages.

3.1 Server Development

The main function for the server is to handle the user request which process the sign in information, the delivery handling, as well as the friendly inquiry request, the group broadcasting request, the user transmission/receiving record query request, the message content receiving request, and the multimedia object download or real-time display request. As the server gets the request, it will begin process the corresponding process to deal with users' requests. To satisfy the majority of users, we have implemented both the web based interface environment as well as the windows based interface. Some other server as we needed are the web server, the file transmission server, the mail client/server, and the database system.

3.2 Client Development

Likewise consideration was made for the client side development, as the main function is to be able to guide users to read message and download objects. Both web based and windows based systems were implemented in the operating environment. The general function on the client side was mostly to send and receive messages and to access multimedia objects. The user can access the web browser anywhere; however the windows based client will need to have the GSM/GPRS device module to receive the short message. The control program in the study was also designed to integrate with the GSM/GPRS module in order to guide the user in receiving messages and retrieving multimedia objects.

4. CONCLUSION

To utilize the wireless LAN area network, the integrated multi mode message system was proposed and demonstrated in a working environment. The work was done including architecture design with Internet and mobile telecommunication network environment. The goal was to achieve the delivery of the multimedia object and the message to bring the high bandwidth and real time delivery, the object storage and retrieving method to use the phone number to convert to specific message format. The message object included text, image, video and audio. The work was demonstrated in the cross campus network to show real time, guaranteed and confirmed delivery.

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HiNet SMS, http://hiair.hinet.net

Posters

AN ADVANCED MODERN PHYSICS REAL TIME ONLINE EXPERIMENT

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ABSTRACT

In addition to our well known "virtual" LockIn experiment and a simple solar cell real time online experiment, we have now implemented a complete advanced modern physics experiment for execution, on the internet. Here phonon spectroscopy in Silicon at very low temperature (4.2 K) may be performed online, in real time, as part of the requirements of our Advanced Physics Lab, or for other people or organizations interested in that kind of experiment. In this experiment we make use of a real lockin amplifier, like the one being simulated in our virtual experiment, as the principal measuring device.

KEYWORDS

Advanced Technology in Education, Online Scientific Lab

1. INTENTION AND REALIZATION

In distance education at all levels, there is no lack of theoretical instruction in virtually all disciplines making use also of the multimedia and interactive features of the internet. The Advanced Physics Lab of the Physics Department at the University of Konstanz / Germany has itself published a "virtual" experiment [1], i.e. the simulation of a physical system, a modern electronic measuring device in our case, the so-called lockin amplifier, which allows for investigation of the essential behavior of the system over the internet. We call this a "virtual" experiment because only a simulation of the system is investigated in an "experimental" manner, no real experimental equipment is involved, however. This offer has proved to be very helpful over the last six years, not only to our local students but also to thousands of interested people worldwide, to understand the features of the instrument and to make proper use of it also under realistic experimental conditions.

Whereas similar simulations, though mostly not as large and serious as our one, can relatively frequently be found on the internet, real time online physical experiments over the internet have remained absolute exceptions, offered only temporarily, or accessible with proprietary software only. So it was our intention, making use of the commonly used Java programming language, to implement the software for physical real time online experiments accessible by common internetbrowsers, and to make the experiments available not only to our students but also to a world wide interested scientific community.

This intention resulted in two online real time experiments hitherto, a solar cell experiment [2] on a beginners' lab level which is successfully in use now for two years. Founding on our experiences with this first experiment, we realized an advanced level solid state physics online real time experiment, the *Phonon Spectroscopy Experiment* [3]. This experiment makes use of *a real* lockin amplifier, investigated *as such* already in the above cited virtual experiment, for the detection of very small signals. In this way students may learn to compare the "theoretical" and "practical" behavior of the same measuring instrument under idealized and real experimental conditions as well as the exciting physics of phonons, their generation and detection in the naturally "sophisticated" case of silicon. All this may be performed in real time, over the internet, without specialized software, by any interested people world wide.

2. THE EXPERIMENT

As is well known, the atoms in a solid are not at rest in the lattice but are oscillating across their equilibrium positions, resulting in coherent lattice vibrations, the phonons, spreading throughout the lattice. The allowed quantized energies of these vibrational excitations are dependent on their momenta in different crystal directions, the energy vs. momentum diagram is called phonon dispersion spectrum.

Phonon dispersion spectra, important in solid state physics, are generally investigated by means of neutron diffraction, necessitating the use of high neutron flow nuclear reactors. This requirement generally makes phonon spectroscopy inaccessible for educational physics labs.

In our case [3], however, it is possible to detect phonons in the lab, due to a special feature of the electronic band structure in Silicon. This feature allows for detection of the energy of phonons for a special momentum value given by the lattice properties of Si.

In this experiment a *real two phase lockin* amplifier is used as the main measuring device. The lockin may be remotely controled over the internet by means of a serial RS232 interface between computer and lockin.

The lockin is being used here in both of its essential working modes, "f", and "2f", as described in the virtual lockin experiment.

In the "2f" case, the system is sensitive to the first harmonic of the fundamental frequency, which is generated by the system under investigation itself in the form of "kinks" in the lockin input voltage run. The physical origin of these kinks is one of the major theoretical aspects of the experiment the students have to deal with.

Experimentally, the kinks representing the phonon energy positions, eU – even when smeared out over a certain voltage range - tranform into relatively sharp peaks in the lockin output diagram, correct experiment parameter settings supposed.

In the "classical", i.e. non-online, local version of the phonon spectroscopy experiment, without support from the virtual lockin project, the origin of the phonon peaks and their dependency on the lockin and experiment parameters remained largely obscure with the students. This situation has remarkably improved since the online combination of both experiments. One part of the lockin project is exclusively devoted to the 2f mode and allows for detailed examination of the lockin output as a function of the input "system function" and the lockin settings. In this way, the actual measuring process in the real time experiment may be *simulated simultaneously* with the virtual experiment over the internet, and becomes more comprehensible in all details. The virtual data may be compared with the real data, differences between "reality" and "fiction" become very clear, and can be assigned to certain reasons. This kind of intense learning process is impossible without "cooperation" between corresponding real time and virtual experiments, and is a convincing example of the usefulness of providing both kinds of experiments over the internet.

Concerning the real work with the phonon experiment, I(U) diagrams of two backward Si diodes have to be taken, one at 4.2 K, the other one at room temperature, for comparison. These data are taken without modulation voltage across the diodes, in DC mode. The data will be drawn on a plotting area on the working panel of the experiment. The data also may be stored on the experiment server, retrieved by ftp, and further worked on and analyzed at home with any common data processing software (Origin, MS Excel, …).

When working with the lockin, diagrams of the lockin output voltages (two channels) vs. DC voltage across the system investigated (the backward diode), superposed by a small, adjustable modulation voltage, are taken. These diagrams may be rescaled over the whole height of the plotting area in order to show small characteristic details. They may be stored, again, for later work.

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AHKME: ADAPTIVE HYPERMEDIA KNOWLEDGE MANAGEMENT E- LEARNING PLATFORM

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ABSTRACT

The aim of AHKME is to provide students and teachers an e-learning platform with adaptive features and knowledge management facilities, where students will have quality educational contents that fit their characteristics, previous knowledge and learning styles and teachers will have authoring tools to define learning methods. Its main goals are to be an e-learning platform for general purpose and to guarantee reusability and interoperability among other learning environments compliant with IMS specifications.

KEYWORDS

E-learning, adaptive, knowledge management, student model.

1. INTRODUCTION

This poster presents AHKME, an e-learning platform where teachers have tools to create didactic materials and evaluate learning objects in order to obtain quality educational resources, and students carry out their knowledge acquisition through quality learning objects and adaptive learning techniques giving their characteristics, the learning activities provided, the instructional design, the learning style theory, and the learning objects' features.

2. AHKME DESCRIPTION

The platform is divided into several components (see Figure 1): Learning Object Metadata Manager (LOM Manager) and Learning Design sub-system, Student Model, Adaptive sub-system, Knowledge Management sub-system, and Packaging and Presentation sub-system. The Student Model is not seen as component because it's constructed on the basis of the sub-systems feedback and helps these sub-systems to get information about student's characteristics and profile.

This system is a web-based platform, which components are defined using the IMS specifications set (IMS, 2004). Other structured educational technology specifications were analyzed, as the Sharable Content Object Reference Model (SCORM) (SCORM, 2003) and Educational Modelling Language (EML) (Koper, R., 2003). Nevertheless, the former neither considers the student modelling nor the evaluation, and the later is running obsolete. Therefore, the IMS specifications were chosen to this work.

The LOM Manager is a tool to define learning objects and metadata that follows the IMS LOM specification (IMS LOM, 2003). The Learning Design (LD) sub-system is an authoring tool to define the instructional design components, based on learning methods and activities. Among other attributes, it stores meta-information about the learning components and learning styles. It follows the two IMS LD (IMS LD, 2003) levels: level A to define activities and level B to define conditions and properties. The Student Model stores for each user its learning style, characteristics, and current and previous knowledge. The Adaptive sub-system, determines the most adequate learning method according to the students' characteristics, his/her interaction with the system, and the learning design attributes. It has an engine that uses agents to establish

the best adaptive technique given the student and the learning design characteristics. It acts like an adaptive meta-model. The Knowledge management sub-system classifies and evaluates the information stored (learning objects and LD courses) through expertise evaluation. It will use agents to retrieve and classify information regarding teachers and students preferences. The Packaging and Presentation sub-system presents educational contents to each student according to the adaptive meta-model and, also, traces the student interaction in order to give feedback to the other models. It follows the IMS CP specification (IMS CP, 2003).
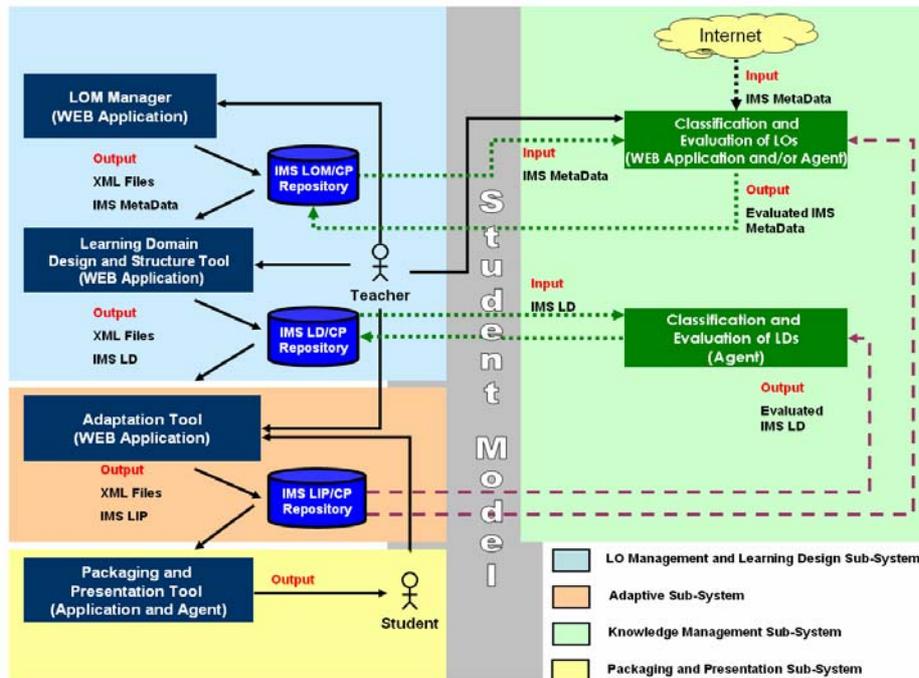
Figure 1. AHKME platform

3. CONCLUSION

The main advantages of the AHKME platform are its adaptive characteristics and knowledge management capability to manage quality educational resources as well as the interoperability of their learning components by means of the IMS specifications used. Being a general purpose platform it can be applied to several kinds of domains, students and learning strategies, in both commercial training and educational areas.

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THE ROLE OF THE INTERNET IN THE STOCK MARKET TRANSACTIONS

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ABSTRACT

The importance of electronic distribution channels has grown significantly in recent years. The fast development of the Information and Communication Technologies has revolutionized the form as the businesses are led. To compete, banks effectively need to hug a new strategical thought, based on the unbundling of banking services and processes and the deconstruction of the integrated banking model.

KEYWORDS

Internet banking; financial sector; brokerage online.

1. INTRODUCTION

E-commerce deals with the process of buying and selling or exchanging of products, services and information via computer networks including the Internet (Turban et al, 2000). Although the use of Internet has more than doubled annually since 1997, the Internet for e-commerce from the consumer point of view is still limited. Consequently, one of the largest problems with the investments in e-commerce has been an inadequate development of the sales volumes, or in other words an overoptimistic view of consumers' interest to buy goods and services via the Internet. Forecasts of the annual sales expansions have ranged from 40 to 340 percent (Timmers, 1998) promising huge returns on investment. However a sufficient market penetration, which is a prerequisite for profitability, has not yet taken place.

2. PAPER'S GOAL

The Internet provided the companies with diverse opportunities, but it has also modified the rules of competition inside an industry causing threats (Werthner and Klein, 1999). Through one look at these threats and opportunities, we intend to verify the variation suffered in the number of transactions in the Lisbon Eurostock, and on the other hand to verify if if this communication channel to request the trasactions has attracted new investors.

3. RESULTS

Since 1997 the number of users of the Internet in Portugal has grown to a very raised rhythm, fixing, in the second quarter of 2002, a tax of penetration of the Internet of 42.6% of the population. This factor led to the rendering of services of financial intermediation through the Internet, with the number of financial intermediaries that accept the orders through this channel duplicating in the analysed period. The transactions through the Internet represented, in the last quarter of 2002, about 9% of the volume negotiated in normal sessions of stock market in the Euronext Lisbon, increasing from 5% in the equal period of 2001. Despite the

retraction of the negotiated volume in normal sessions of the stock market, the Internet affirmed itself as an important channel for the reception of orders, having grown about 21% in comparison to the year of 2001. The year of 2002 was the first complete year of activity with new brokers intervening in this market segment with essentially online vocation. Three from the five most important financial intermediaries had the biggest volume of transactions through the Internet. They represented 54% of the market. About 80% of the received orders in the banks was in the written form, with 48% to be received in their agencies. The Internet is the second channel most used by this type of financial intermediary, representing almost 25% of the received orders. Concerning the brokers and stock exchange dealers, the great majority of the orders was communicated by phone (85% in the case of the brokers and 65.5% in the case of the stock exchange dealers). The Internet channel is the second tool that investors used to transmit its orders to the stock exchange dealers (18%), not having expression at the level of brokers.

4. CONCLUSION

The Internet presents a series of opportunities for the established financial entities. It allows the development of efficiency and it helps cost reduction, the elimination of the human being intervention in the relations between the customer and the bank systems, the improvement of reply times and service quality and errors are scrumbled. The Internet is the only instrument that allows the orders to enter directly into the system. The Internet appears as a leveller instrument because any person can have the same ways that so far only the great investors had. This communication channel does not allow to classify the investors for categories, therefore the orders are treated by arrival order. It also represents a series of threats for the already established entities. The Internet is a new direct channel that favors the entrance of new competitors from other countries or other sectors. On the other hand it implies an easier access to the financial information. The continuation of this study leads us to the understanding of the influence of this new information technology, as well as to the verifying whether there is a new type of investor.

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VISUAL CONTEXTUALISATION OF DIGITAL CONTENT

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ABSTRACT

The poster describes research in visual contextualisation where on-line humanities knowledge spaces are made more comprehensive and user-friendly. European history is the chosen knowledge domain resulting in the creation of a multilingual European history ontology. This ontology helps machine algorithms in semi-automatically creating semantic metadata for digital resources which describe the context of the resources, in this case history. The VICODI system demonstrates the idea of contextualising humanities resources and visualising their context through SVG maps and colour coded links in multilingual texts.

KEYWORDS

Visual contextualisation, semantic web, ontology, multilinguality, European history

Visual Contextualisation of Digital Content (VICODI)[6] is an EU 5FP IST collaborative project. The main goal of VICODI is to semi-automatically create multilingual semantic metadata for digital resources which effectively describes the context of the resources. This context is visualised via historical maps and colour coded links. The showcase domain of VICODI is European history from 500CE to the present.

The VICODI history ontology supports the process of semi-automatic context generation and context matching by storing relevant historical knowledge in machine processable form. However to succeed an ontology with a well-defined formal semantics is needed. The task of devising a multilingual ontology of history is daunting. History has

Figure 1. VICODI GUI with a visual contextualisation system devoted to European

several unique features which are problematic from an ontological point of view, including complexity, time and suitable electronic historical sources. To model the complexity of history requires numerous hierarchical concepts and sub-concepts as well as property relations and an almost unlimited number of instances. Our solution to this quandary is to have a simple stable upper structure which allows algorithmic heuristics to infer further connections between the concepts, instances and property relations. Thus the complexity of history is represented in the ontology with thousands of instances but with relatively few concepts and property relations. The VICODI ontology has eight property relations and seven historically meaningful basic concepts: abstract notion, event, individual, location, object, organisation, and social group. The hierarchy below these concepts is shallow (3-4 levels) stopping at a meaningful abstraction level, which is still general

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[6] http://www.vicodi.org/

enough to place easily new instances. Since there were no freely available comprehensive large-scale thesauri, ontologies or appropriate history repositories we built an ontology based upon an empirical deductive analysis of a representative 2000 document corpus related to European history. The result is an extensible and growing history ontology of 10 000 instances.

To address the complexity of time, interval times were introduced resulting in an existence time for every instance. So far the intervals of the existence time are precisely defined although the use of fuzzy logic to map imprecise existence time is being examined (Motik & Nagypal, 2003).

The ontology editing tool is a revised FZI KAON Framework editor based on an extended W3C RDFS standard (Maedche et al, 2002). This editor provides a graphical user interface with an editable graph-based viewer. Due to KAON's capability to provide programmatic ontology access huge numbers of instances were added to the ontology by processing textual glossaries or Excel sheets. This - together with our simple and intuitive concept hierarchy - significantly sped up the ontology populating process, as the history experts could use their preferred software tools when codifying knowledge.

In order to make the knowledge contained in the documents and formalised in the ontology visible into a multilingual user friendly Web portal interface VICODI developed a graphical contextualisation interface, which uses Scalable Vector Graphics (SVG) to visualise digital content via historical maps (see Fig. 1). Users can paste history-related texts in a contextualisation box and have this information automatically processed and classified on the basis of LATCH (Location, Time, Category) (Wurman et al, 2000). Moreover, textual information is visualised on a map of Europe from the corresponding historical period. European history terms (listed in VICODI ontology) are automatically highlighted and their contextual relevance is marked. Ontology searching and browsing may be either by Yahoo-type browsing or by location (SVG maps), time (decades from 1000-2000CE) and/or subject (historical topics). The portal also provides web-based tools for the uploading and authoring context of new historical content.

The Management System of Knowledge Space (MSKS) and the context and transformation engines are the core of VICODI. The MSKS provides for continuous storage, translation and management of both the ontology and contextualized historical documents (repository). The context engine uses text categorization to build correlation scores between documents and the notions in the ontology. This allows the system to enhance the document's visualization and linkage to give the users a faster and more intuitive understanding of a document's position among the notions represented in the ontology. The transformation engine processes the data of the relevant contextual information from the context engine and outputs it by either transforming it into SVG instances (dynamic maps) or by generating hyperlinked (contextualised) documents.

CONCLUSION

Some of the most important results so far are: 1. The creation of a usable and extensible multilingual European history ontology. 2. Complexity within the history ontology can most easily be achieved by a shallow concept hierarchy and property relations. 3. The development of the ontology structure was a combination of a middle-out or deductive and inductive process. Concepts were initially defined and then tested against instances found in a 2000 document corpus and if needed redefined, removed or created. 4. The capability of KAON to provide programmatic access to the ontology makes it possible to mass upload instances with the aid of textual glossaries or Excel sheets. 5. Timed relations and instances can mimic the change of meaning over time as well as historical developments. In addition timed relations and instances can deal with overlapping time as well as with unknown and uncertain dates.

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E-LEARNING: AN EXPERIENCE IN A SHARED VIRTUAL CAMPUS IN THE GROUP 9 OF UNIVERSITIES

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ABSTRACT

In this work we present a practical experience of implementation of a virtual environment of teaching shared among students of different universities. Specifically, a virtual course for teaching Information and Communication Technologies in Business Environment has been developed at the Business Administration Department of Universidad de Cantabria. The principal innovations of this course are its non-presential character and the participation of students from 9 universities, proceeding besides different qualifications and being the course recognized academically as credits of free configuration in the 9 universities. The course name is "Introduction to the e-organization". It has been developed using one of the best-known e-learning platforms: WebCT. With this program it is possible to recreate an educational virtual environment, with the whole elements in a classroom. In this paper the genesis of this innovative project and the results obtained in the two last academic courses, as well as the main characteristics of the virtual course developed are commented. The results obtained during these courses can be considered as very positive, so much by the elaborate educational resources as by the teaching strategies utilized and the students' acceptance.

The teaching labor in university education is a complex task for several factors. One of them is the necessary and continuous refresher of knowledge and methodology. Three years ago, the Computing Management Group at Universidad de Cantabria decided to initiate a continuous innovation program in teaching. This program is based in computer applications and telecommunication technologies. It began in 2001 with subjects that was imparted following a classical philosophy of master class, with the special feature that included like a complement, a virtual course parallel to classes' development. This initiative has evolved up to achieve impart, in the academic course 2002 – 2003, a whole virtual subject with satisfactory results. This project has its continuity guarantee a cause of the great acceptance obtained among the students in this second year (course 2003 – 2004).

The committed work to develop a quality non-presential subject is more complex that it could seem a priori. It is not sufficient to make a web site and place the same notes that in a traditional master class. It involves a systematic and structured process in which the subject's responsible analyzes a set of aspects and requirements previous to subject start. In this way, once defined those it is possible to tackle with certain success guarantees the beginning of the course.

A META-PERSPECTIVE ON THE ASYNCHRONOUS DISCUSSION FORUM

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ABSTRACT

The asynchronous discussion forum (ADF) is an integral part of the different models of virtual universities. The purpose of this poster presentation is to i) present an analysis of the mission statements of online institutions which would underlie the implementation of instructional tools such as the ADF; (ii)to describe the application of ADFs within different models of online learning and (iii) to present a framework of the pedagogical and epistemological foundations which underlie these applications from a *meta-perspective*. This poster will visually present a framework for conducting and interpreting research about the ADF. This, in turn, has important implications for practice and emerging policy in the increasingly diverse online learning environment.

KEYWORDS

Asynchronous discussion forum; online learning; meta-perspective

1. INTRODUCTION

A review of the research literature provides little insight toward the epistemological and pedagogical foundations of the ADF from a *meta-perspective*. No study to date has explicitly depicted the different ways in which ADFs are incorporated into the online learning environment. Subsequently, the literature sheds little light on best ADF practices – with respect to particular pedagogical goals and epistemological theory.

2. RESEARCH METHODOLOGY

The meta-perspective on the ADF was obtained in the following manner:

i) Different models of online universities were identified to establish the institutional frameworks in which ADFs are used as instructional tools;

ii) An analysis of the mission statements of online institutions provided insight into the institutions' pedagogical and epistemological assumptions, which would underlie the implementation of instructional tools such as the ADF;

iii) This was followed by an analysis of the ways in which ADFs are currently embedded in the growing number of online courses, degree programs, and institutions. This analysis is presented in a table form.

3. CONCLUSION

A concept map, which could serve as a framework for ADF researchers and practitioners will conclude the poster presentation. This conceptual framework that will be presented propose pragmatic guidelines for the incorporation of the ADF into the online learning environment.

FROM LIBERALIZATION TO TECHNOLOGICAL INNOVATION: THREE DECADES OF THE PORTUGUESE BANKING SYSTEM EVOLUTION

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ABSTRACT

In the last couple of years, there has been a growing concern about the important role that technology should play in the process of modernization of the financial and banking system. In fact, the impact of the Information and Communication Technologies on the banking services has received significant attention in several academic and scientific researches due to their importance to the sector's process reform. Because banks and financial companies have naturally explored the use of those ICTs in order to increase their profitability, the major point of this study is connected to a review of the literature in order to analyse the sector's evolution tendencies.

1. INTRODUCTION

Some ideas have been written and discussed about the importance of technology in the specific context of the financial services. In this perspective, the major concern of the present paper is connected to the study of the Portuguese financial sector's evolution tendencies, considering the impact of the technological innovation to its modernization and development. Since technology can be responsible for the promotion of development, it was stated that competitive advantage will largely depend on the technological innovation. Thus, the three decades historical journey analysed in this research paper showed that technology can increase the market's competition level and the creation or destruction of competitive advantage.

2. THREE DECADES OF STRUCTURE REFORMS

It seems clear that to project the evolution tendencies of the Portuguese banking services in the future it is necessary to analyse its historical journey. The present political and monetary choices related to institutional duties, economic instruments and the effects of liberalization are quite responsible for the end of the 70s highly ruled structure. Among the main factors that contributed to that inefficiency, we could highlight: the activity regulation (concerning credit limits, segmentation and specialization of the financial and banking activity) and the financial agreements between the Portuguese Government and public companies (where the selection of Investment Projects was made with no efficient criteria). Concerning the activity regulation, it was needed for two special reasons: to stop the private internal credit expansion (considering the balance of payments' deficit) and to provide a financial source to a highly dimensioned public sector. On the other hand, concerning the Portuguese Government financial agreements, it's important to refer that many credits were given to an endless number of public companies with no financial stability and, in many cases, those credits didn't get any payback. On this basis, the Portuguese financial services were under a heavy administrative control that made it highly complex and with no competitive advantage. Thus, that economic structure

proved to be most inefficient, bringing systematic competitive losses for the Portuguese economy. Only with the Portuguese joint to the European Community, in 1986, those restrictions started to end. Due to the reform needs and community founds, a range of structure reforms was implemented and the process of the financial system modernization started. In fact, with the preparation to join the European Community, Portugal assumed the agreement to gradually liberate its economy. As immediate consequence, a process of a growing number of banks and private institutions (assurance companies and private banks) started and the degree of competition in the sector grew up. In a general point of view, with the sector's opening to the private initiative, a gradual desintermediation of the banking services started and, thanks to the end of legal barriers, the sector developed an organic growth based on the expansion of the traditional agencies net. In this perspective, and according to Monteiro Barata (1995), the Portuguese bank activity reflected an economic sustained growth during the 80s. In the early 90s, the *General Regulation of Credit Institutions and Financial Societies* was published, with special emphasis to the *Second Directive of Banking Coordination*, where the principles of the organization of the banking activity were established. Based on those principles, the figure of *Universal Bank* spread and increased the growth of agents acting in the banking sector. As an immediate consequence, intermediation rates started to decrease accordingly and banks and financial institutions started to bet in the financial and technological innovation as a way to reach competitive advantage. From this extent, this period was marked by a general diffusion of informatics and electronics in the banking activity concerning ATM, POS and phone services. Thus, it's possible to conclude that ICTs started to exhibit a dynamic growth with doubtless advantages related to quality, prices and range of services. This way, due to its limitless research capacity, interactivity and solution simulations, it can be assumed that the ICTs development can lead the banking activity to a range of new business opportunities and this evidence can be responsible for the promotion of a higher degree of competition between financial institutions.

3. CONCLUSION

In the last three decades, in order to liberalize the Portuguese economy, the financial services suffered a huge reform. According to Jesus Pinhal (2000), a backward system was able to reform and improve. Nowadays, the Portuguese banking sector is seen as a modern system, totally opened to the concurrence and comparable to the other OECD countries in terms of technology, efficiency and profitability. From liberalization to technological innovation, many were the factors that contributed to the sector's modernization: impulse of new private banks, joint to the European Community, introduction of the new technologies in the banking activity and so on. The technological innovation in particular, turned the banking services into a complex market and its impact is increasing if we consider the importance of the Internet in the sector's activity.

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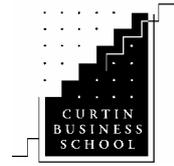
A SURVEY OF LEARNING STYLES IN AN INTRA AND INTERNATIONAL CONTEXT

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POSTER ABSTRACT

Considerations on various dimensions of learning strategies are always worthy of study and thought. A theme which dominates the research literature is a student's motivation to learn – where the learner is viewed as the client. Learning strategies are of continued interest to educators wishing to optimise their "clients" learning experiences. This is especially important, yet difficult to achieve in a sophisticated, multi-national and multi-cultural world where workers are expected to increase and maximise their skill levels. Further, with today's combination of cultural myopia and diversity of learning styles, a "single forms" approach to the delivery of training is not practical, and is certainly not justified.

This paper argues that a "client's" learning style and its fit with their "peer group" or "group norm" can significantly impact upon a student's ability to benefit from their chosen learning strategies. It further explores the possibility of using the LSQ as an interventionist tool to help practitioners determine appropriate educational programs that enable the individual to attain their learning objectives.

This paper postulates that international evidence regarding preferred learning styles and behaviour can inform educators in several ways as they decide whether to enhance existing preferences or to encourage the development of weaker preferences. However, before such implications can be considered it may be necessary to study the relationship across sub-cultural groups, between students learning styles and perceived national traits and gender. To this effect, a survey of International comparisons for LSQ data is presented from a variety of sources.

This paper examines the reliability of Honey and Mumfords' L.S.Q. (Learning Styles Questionnaire) instrument and builds upon various national surveys from 1988-2004. It concludes that there is growing evidence to support the circumplex explanation of the LSQ model, that the Activist and Reflector styles of Learning is reliably identified by the LSQ instrument and that both styles may form a new bi-polar axis.

This paper further argues that due to long term proof of face validity and retest-retest reliability of the LSQ instrument that its use in identifying learning styles should be encouraged and the identification of norms for well-defined occupation groups should be extended.

eSIMAC SERVER:
AN INFORMATION SYSTEM FOR STORAGE AND MANAGEMENT OF DIFFERENT TYPES OF DATA RELATED TO A GREAT VARIETY OF LAND COVERS

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ABSTRACT

The main contribution of this paper is to propose a system designed by the Remote Sensing Group (GTD) of the Computer School (Technical University of Madrid, Spain) named eSIMAC Server. This system integrates applications developed and updated by the GTD with a large amount of spatial and spectral data, facilitating the concurrent access to the system via web.

KEYWORDS

Remote Sensing data, *three layer* architecture, Web application, MCV pattern.

1. SYSTEM eSIMAC SERVER

eSIMAC Server has been designed according to J2EE standards and supported in a *three layer* architecture (Figure 1). The design of the architecture is based on the *Model-View-Controller* pattern (MVC) and for its implementation the free distribution project of Struts has been chosen, customized at Remote Sensing ambit. A potential user only requires a standard HTML navigator to access to the system. Additionally and depending on the client category, a navigator that supports Java applet´s can be required. In the *controller* layer, the global system will include different tools that allow to process the data. The *model* will include all the data and a careful access control of users. In this way, the system allows the storage, management and processing of different information relative to a great variety of land covers.
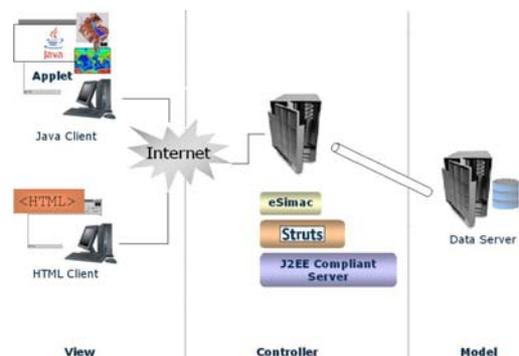
Figure 1. Architecture of the global system

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http://www-noospherics/

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DEVELOPMENT OF AN E-LEARNING SYSTEM FOR ECOLOGICAL PRODUCT DESIGN

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ABSTRACT

This poster session presents the design process for an e-learning system about ecological product design. Our experience indicates that constant testing helps to make the design of an e-learning system clearer and easier to understand and to bring together the ideas of content providers, potential users, and e-learning experts which often diverge quite considerably by rendering these different views transparent and hereby forming a basis for further improvements.

KEYWORDS

e-learning, hypertext navigation, ecological product design

1. DESIGN: PRINCIPLES AND PROCESS

The Ecodesign e-learning system is supposed to fulfill the needs of professionals in manufacturing companies. The main concept of the system is to present the learning material in an interactive manner which emphasizes concrete examples. The basic functionalities are access to various kinds of material, access to examples, and communication (e-mail, discussion forums and chat) with other members of the group or teaching staff. To avoid high drop-out rates we adopt two strategies: blended learning and active tutoring (Reichl & Vierlinger). The Ecodesign e-learning program uses an office metaphor to ease understanding of the system.

The project started in September 2003. In the first stage, a prototype has been implemented from scratch using the open source platform Zope and Python and is being used in a course. During the project it turned out that content providers are not always willing to deliver material conforming to the hypertextual approach. In the first rather informal test, the subjects chose a navigation system which resembles the tree of the Windows Explorer. In addition, the final outline also incorporates breadcrumbs and graphical maps.

ACKNOWLEDGEMENT

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Doctoral Consortium

CENSORSHIP IN CYBERSPACE: REGULATION OF FREEDOM OF EXPRESSION IN DIGITAL TIMES

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ABSTRACT

The Internet presented new challenges to the issue of censorship and freedom of expression and the present work attempts to find a solution to these challenges that could be acceptable by more than one legal culture. The analysis is undertaken from the legal perspective; however, in case of the Internet such approach would impermissibly narrow research and weaken conclusion, that is why social, political, moral and other issues are also dealt with. While the right to freedom of expression is at heart, the inquiry is very much Internet-specific; it defines the place and the meaning of the Internet in the contemporary society and derives new arguments from the findings instead of revisiting traditional human rights rhetoric and applying it to the Internet settings. One particular problem in the field is the absence of common denominator for Internet speech regulation by different members of international community. More than just producing occasional spillover effects, separate Internet speech regulations create a new attitude to the right to freedom of expression bringing into being sophisticated system of restraints instead of enabling free flow of ideas. The work argues that it really matters what kind of media the laws deal with; it reveals what harms and dangers can follow from separate Internet censoring measures; and, finally, it demonstrates that it is both possible and necessary to move a little on the attitudinal limb in the common direction of respect to freedom of expression on the Internet.

KEYWORDS

Policy issues, Internet regulation, freedom of expression.

1. INTRODUCTION

The issue of Internet speech regulation comprises two main themes, the first is the traditional freedom of expression problem, the second is the modern phenomenon of the Internet. One is obvious – being caused by the worldwide technology, Internet-related problems require international solution. Speech in cyberspace goes beyond the borders and "we cannot simply stand back from this international space and say that these questions are local issues" (Lessig). To try to find a common ground on the speech issues is a challenging task. Very soon at the beginning of the research it became clear that little help could be found within the human rights discourse. While containing many convincing arguments, it has little prospect of success in changing the general attitude of speech-opposing societies. Besides, established human rights doctrines leave considerable discretion to states in regulation of their internal affairs providing that basic democratic values are respected; but the Internet diffuses national boundaries and collides norms of many states, including those with proclaimed commitment to democracy and human rights. Thus, the research went further and concentrated on examining what is so particular about the Internet that defies effective regulation, how its technological particularities can be used for development of Internet-specific arguments, and what conclusions can be deduced from the findings. Certainly, there can be no illusion that the arguments brought forward in this work cannot possibly be accepted by everyone. The goal is another – to reveal potential drawbacks of existing policy choices and to offer a viable alternative that, hopefully, could be accepted by many members of international community.

2. OBJECTIONABLE SPEECH

With the immense diversity of Internet authors and even bigger diversity of Internet readers any Internet content can potentially offend someone, be contrary to someone's personal views on decency, or be regarded as damaging the society's moral values or state security. Remarkable, most of the objections are based on quite legitimate concerns, in the most controversial cases these concerns become exaggerated but not invalid. As one illustration, many terrorist groups are on the web. On the one hand, many states expressly prohibit and remove their sites; on the other hand, "one man's terrorist is another man's freedom fighter." Many radical and extremist groups do not regard themselves as terrorists and they often get support from others: Tunisia arrests 20 persons for involvement with radical Islam sites – the outcry of western human rights movement follows; Germany struggles to remove Nazi sites from the Internet – its efforts are nullified by permissiveness of the Unites States; the US denounces radical Jewish sites as terrorist organizations – the fact is incomprehensible by Jews: "Bombs and grenades are terrorism. Pencils, html and Torah-Bible are views and ideas!!!" The list of objectionable themes is extensive and there is hardly a single topic that would enjoy consensus, not only on the international but also on a regional level. In the past states were satisfied with their policies being able to protect them from outside intrusion, today the need for cooperation is compelling.

3. FORMS OF INTERNET SPEECH CONTROL

To meet the complexity of the issue one could distinguish new forms for the Internet speech control analysis: aimed at removing objectionable content from the Internet altogether (input control) and aimed at making objectionable content unavailable for, or not looked up by particular audience, although it continues to exist on the Internet (output control). On the input side there are two participants that ensure that the material gets and remains online. The first is the author of the material (input-user) who may be restrained by civil or criminal sanctions established by a state. Interesting is how far a state can go to get hold of such a person. Sometimes one website may be enough for liability in another state, as it happened to an Australian citizen on his short trip to Germany for Holocaust denial online. The second actor on the input side is the Internet service provider that hosts objectionable material on its server (input-ISP). For this actor a state may establish sanctions as well; the approach differs considerably – from full ISP liability in Algeria to no ISP liability unless actually aware of illegality of content in the EU states.

On the output side the actors are similar. First, there is a person looking up the information on the web (output-user); control on this level is achieved by liability for viewing illegal sites (Burma, Tunisia, Australia). Second, companies providing Internet access (output-ISPs) often become tools of control when obligated to block certain content; compliance with the filtering obligation is ensured by all possible means, from ISP being actually extension of the government in Cuba to the carrot and the stick CIPA provisions in the US that conditioned the receipt of subsidies by public libraries to the use of filters on library computers. Particular players on the output level are search engines. The growing amount of information in cyberspace constantly increases their importance, especially considering that they offer cached copies of many sites. Not surprisingly, states want to get them under control and try to do so with limited success.

4. TO CONTROL OR NOT TO CONTROL?

Most of constitutions of the world contain provisions on freedom of expression but the real question is how they are interpreted by legislature, courts and society. In practice responses are different and sometimes freedom of expression in cyberspace survives: the US Communication Decency Act was struck down by the Supreme Court on the First Amendment grounds, wealthy Saudi Arabian citizens dial to a neighboring country to avoid local Internet restrictions. One example is of constitutional interpretation, the other of technical opportunities of the Internet and both of them confirm the famous Gilmore phrase – "The Internet treats censorship as damage, and routes around it." There are serious reasons to want to keep it like that.

4.1 Pure Speech

When human rights are valued and the right to freedom of expression is respected, there are still limitations on this right once effect of the expression goes beyond "purely spiritual" effect of opinion (in German terminology) or presents "clear and present danger" (in the US terminology). The Internet gives way to new reflections because speech in cyberspace does not have an apparent causational link to any physical harm. It clears speech from accusations of being more than exchange of ideas: it is not possible to say "kill" to a dog over the Internet; it is not possible to incite a spontaneous riot on the Web. Even if some of Internet speech does not deserve much protection it should not cause many concerns in respect of physical harm at least.

4.2 Non-Intrusive, User-Controlled

A noteworthy feature of the Internet is its particular non-intrusiveness – it places control in hands of the user and gives the full discretion as to what sites to visit, what files to download, what forums to choose for a discussion. For example, there are just three ways to visit any website – to type the known address into "address" line in the browser, follow the link on another webpage and to submit request to a search engine. All three methods require conscious and willing participation of the user and certainly presuppose intent. Quite logical is the conclusion that "the Net is arguably the safest of all mass media" (Godwin). To be accurate, there remain some problems, such as misleading domain names and spam messages leading to unwanted content or pop-up pages that make it hard to leave a site. However, states should not feel reluctant to fight fraudulent tricks by legal means, as it is already happening. Besides, even in these instances control is not taken away from the user but just requires more caution: there is always an option not to open spam messages, not to visit suspicious sites and to use search engines instead of guessing domain names.

4.3 Public v. Private

"Increasingly, as activity that would be permitted in real space moves to cyberspace, control over that activity has increased" (Lessig). It is particularly true where distinction of public and private is concerned. Difference in status is essential for legal consequences of speech: private communications are seldom criminalized and most restrictive measures are directed to public communications. To illustrate the point, private gatherings of individuals would not require state intrusion whatever their purpose is (be it discussion of racist issues or watching obscenity) as long as they neither disturb public order nor conspire for illegal activity, even if public discussions of this kind would be objectionable. However, once the groups sets up an Internet site for personal communication, as by some miraculous occurrence it appears in public domain. Without promotion campaign or hidden tricks to attract the public it is not adequate to treat all websites as public space and apply stricter public speech regulations. Besides, if some part of cyberspace is popular it means that the issues raised there are important to a large group of people – is it not the main task of the democracy to enable it?

4.4 Technical Inefficiency

The technical inefficiency argument concerns filtering and blocking by ISPs and is based on the premise that there should be no useless censoring measures. Certainly, regulation "need not be perfect to be effective" but it has to perform its function with some degree of success. Without going in detail into deficiency of existing filtering and blocking technologies, one thing is evident – currently there are no means to adequately regulate the flows of Internet content. Mirror sites of objectionable content, cached copies of sites provided by search engines, usage of proxy addresses are just a small part of existing opportunities to overcome local restrictive measures. Unfortunately, the technical inefficiency argument is applicable to output-ISP control only. When a state wants to avail itself of control of individual users, it has the necessary means. There is not much benefit from technical measures if their application evokes prosecution risk.

4.5 Thought Control

There is actually an easy technique that allows a state to censor Internet usage of its citizens (output-user control) – surveillance. Already many countries require that ISPs keep customer information for some period. The method can be quite efficient even with occasional "surveillance raids" – awareness of possible invisible

control is likely to foster a "censorship mentality," stifling not only the expression but also the motivation to get informed. As Ingram observed, "my inability to acquire certain information, to be acquainted with certain opinions, or to have access to certain ideas cannot fail to have a profound effect on my own thinking" – the effect is much more considerable when I know information is there but I *don't dare* to look up. Imposition of liability for *viewing*, particularly for occasional viewing, as may easily be the case when aimlessly surfing on the Net, has only been known in the worst moments of the history of the mankind. Production, distribution, possession of illegal material have been and remain valid grounds for prosecution. But prosecution for viewing in cyberspace is like prosecution for not closing the eyes when walking along the street. Whatever the objectionable topic is, individuals should remain free to turn their eyes in any direction.

4.6 Jurisdiction

The discussion is heated on how far a state can go in exercising its authority over authors of online material. Is mere webpage enough to be subjected to jurisdiction of another state? On the one hand, a court cannot assert extraterritorial jurisdiction over a foreign national simply on the basis that his/her website contains data violating the forum state's laws; on the other hand, it has already happened, supported by the arguments that "customary international law permits a nation to apply its law to extraterritorial behavior with substantial local effects" (Goldsmith). As Cassese noticed, "international law is a realistic legal system. It takes account of existing power relationships and endeavors to translate them into legal rules." It is important that the law develops in the proper direction today. In many legal cultures principles of fair procedure or due process are necessary prerequisites for liability; the worldwide liability for expression protected in home forum would put this principle at risk.

5. CONCLUSION

Unlike other media, the Internet started totally free and is getting more and more controlled. Certainly, some control is necessary for any human activity; however, other values of human society should not be forgotten in these undertakings. Control of output actors should be undertaken carefully, or not at all. Providing responsible attitude, Internet speech would not harm but it could help in self-development, enable free discussion of hot issues or even make illegal activity transparent for the law-enforcement authorities. If nevertheless a state is determined to assume some control over Internet content accessible within its borders, obligation of filtering on output-ISP is preferable, while control of output-users (which amounts to total surveillance) is totally unacceptable. Control of input actors is a double-sided issue. On the one hand, nothing here questions the authority of a state to control input actors within traditional jurisdiction. Moreover, such control is desirable as the only way to remove harmful material from the Internet. Extensive extraterritorial jurisdiction, however, is inadmissible as infringing on principles of fairness, foreseeability and due process on international scale and being simply inadequate for the potential harm.

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ENUNCIATIVE SPACE: BRIDGING THE 'DISTANCE' IN ONLINE TEACHER EDCUATION

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ABSTRACT

This paper explores the ways in which teachers negotiate meaning in their literacy practices, within current curricular conditions, and in doing so, shape and are shaped by their environment. Specifically, I examine the ways in which online learning enhances/inhibits teachers' attitudes, knowledge and skills to teach reading well. I also explore the way online learning evolves into a community of practice, thereby providing an 'enunciative space' where teachers are *free* to live their stories of practice. As a participant observer in an online Reading Course, I examined the interplay between functions of language, dialogism and reflective practice. I explore design considerations that contribute to understanding the 'knowledges' of teacher education as a critical complex epistemology of professional development.

1. INTRODUCTION

Globally, educational institutions exist in a culture of accountability enticing a shift to more technicist models of teacher professional development. A focus on measurable competencies lends itself to particular teaching/learning models adopted and perpetuated by the vast majority of commercial platforms available to establish online learning environments. Seeking a more dynamic teaching and learning interaction, my doctoral research focuses on ways in which teachers come to understand their literacy practices in an online community of learners, within a platform developed on-site, and created to respond to both teacher and student as informant.

Importantly, the platform that hosts this course was developed by a team of instructors, researchers and technicians in order to respond to the needs of the students and the instructors following frustration with the pedagogic limitations of commercial platforms. In order to develop a critical complex vision; i.e. teachers with an awareness of the complexities of educational practice, (Kincheloe, 2004), we must also create conditions in the online classroom to support and foster the type of pedagogy necessary for transformative practices to result. My research explores these conditions, and asks: Does form follow function or vice versa? In what ways have the form and function of the course been conceptualized? Are they conceptualized in a way that allows a reciprocal relationship, or are they held as distinct? Does the design support and enhance the desired function or hinder it? What is/are the desired function(s)?

These are some of the questions that have guided my inquiry. The answers are found in the voices of the teachers themselves, as they participate in their professional development. I have come to better understand the way this online environment provides the 'enunciative space' so essential to transformative practice. As universities around the world move increasingly into offering online courses, such pedagogical design questions must drive their decision making.

2.   DEVELOPING 'ENUNCIATIVE SPACE'

The focus of this study was to better understand the ways in which teachers negotiate meaning in their literacy practices within current curricular conditions, and in doing so, shape and are shaped by their environment. My experiences teaching on-line courses piqued my interest in its potential as a meaningful and interactive means of professional development where teachers bring stories from practice to the learning experience.   Clandinin and Connelly see "teaching and teacher knowledge as expressions of embodied individual and social stories" (Clandinin & Connelly, 2000, p.4). What stories are we living? How do those stories shape our practice? How do we negotiate our stories when we come together as a community of teachers?

Wenger (1998) suggests, "engagement in social practice is the fundamental process by which we learn and so become who we are" (n.p.). The online courses in which i participated were a vehicle for teachers to engage with each other around the social practice of teaching. My experience teaching online led me to view these courses as a rich source of teachers' reflective thinking and a place for both personal and professional growth. Teachers came to these courses from varying levels of experience, backgrounds, commitment, and engagement, and from both elementary and secondary settings.

Teachers are caught and even co-opted by conflicting values in teaching (Halstead, 1996). Stories that illustrate such struggles have long been collected and documented(Cochran-Smith & Lytle, 1993; Connelly & Clandinin, 1999; Palmer, 1998; Preskill & Jacobvitz, 2001). I too have grown concerned about whether the present curricular conditions in education foster an emphasis on the 'external goods' to a degree that is significantly and seductively shaping both teachers' identities and their practices. As I moved from classroom teacher to teacher educator, the nature and extent of the problem became more evident.

Many of my elementary and secondary pre-service students expressed a strong desire to be 'trained' in the commercial programs they observe being used in their practica. Even seasoned teachers aligned themselves with marketed conceptualizations of teaching reading. For example, in an early component of a course I taught recently, in-service teachers were asked to describe their language arts programs. Anticipating rich descriptions of various components, I was more than a little surprised and dismayed to find statements such as, "I am a First Steps™ Teacher", or "I am a Four Blocks® Teacher". When asked to elaborate on their classroom program, teachers provided an outline of the *product* that they were *trained* to use. The products had been purchased, I was told, in part to satisfy administrative requirements for district and school *Action Plans*. The *Action Plans* form part of the annual documentation required by the Ministry of Education to address standardized test results. Increasingly it seemed, teachers have come to believe that they are required to 'buy in to' and deliver commercialized conceptions of literacy, in order to *be* 'good teachers' (Hibbert, 2002). The 'ends' and whom they might best serve, remain unquestioned.

In Canada, as elsewhere in the developed world, both teachers' work and the production of *verifiably* literate students are under the microscope. The introduction of provincial teacher testing, standardized testing of students and a graduation requirement that at the secondary level students pass a literacy test, have contributed to the intensification of the focus on teaching literacy.

Smylie and Conyers (1991) have argued that it is necessary to shift from "deficit-based to competency-based approaches in which teachers' knowledge, skills, and experiences are considered assets" (p.2). The conceptualization of the online learning environment in which I have participated, represents such a shift. As other researchers have observed, an online learning community can be designed to "support the actual practices and daily tasks of the participants" (Shultz & Cuthbert, 2002) at whatever point they may be in their learning. At the same time, it can bring teachers together to discuss new research and ways in which their learning informs their practice.

Smyth (2001) noted teachers' desire to engage in meaningful dialogue, calling it a need for *enunciative space* (Spivak, 1988, in Smyth). Enunciative space is defined as:

> the opportunity to articulate what it meant to be a teacher; to tangle with social issues beyond the technicalities of teaching; and having some agency within which to question and challenge the wider structures surrounding teaching and learning; and in the process gaining some ownership of the determination of ones' own pedagogical work (p. 159).

Enunciative spaces must support, value and encourage teachers, or teachers will be less likely to take the risks that lead to learning (Atkinson, 2001). In an online course, once teachers' stories are shared, they are subjected to scrutiny from the other participants. In fact, posting their stories requires developing a

"willingness to expose one's viewpoint to the critical gaze of others" (Furlong, 2001, p. 27). Exposing oneself to such scrutiny is not easy. Along with submitting to the critical gaze of others, is the need to take on some forms of reflective practice (Cochran-Smith & Lytle 1993).

Reflective practice may help to reveal discrepancies between the initial 'cover stories' presented in the early portion of the course and the 'lived stories' that emerge as trust and community develop. For example, teachers will need to think about,

> …to what extent their view that their present patterns are shaped by outside forces over which they have little or no control are justified, and to what extent their views of the difficulties involved in shifting patterns are rationalizations for an unwillingness to risk administrators' or parents' displeasure (Berlak & Berlak, 1981, p. 245).

As other researchers have noted, the dual roles of being both teacher and learner in a collaborative environment, produced insights that helped those involved grow both individually and together as professionals (Evans & Policella, 2000). The online community enables teachers to engage in a unique kind of professional discourse as both teacher and learner. Furlong (2001) suggests that such discourse differs from normal conversation in the ways that "participants explicitly criticize the background consensus concerning belief systems, norms, values and ideologies taken for granted in everyday life" (p.27).

Online learning has been described as a "powerful tool for the development of critical thinking and deliberative skills. The dependence of current conferencing technologies on writing enables students to reflect more deeply on their ideas as they try to articulate them effectively"(Eastmond, 1998, p.73). In my research, I joined an online course as a participant observer, both listening to and telling stories of practice.

3. CONCLUSION

My study begins with a vivid recollection of feeling alienated in my chosen profession after approximately a decade immersed in it. Upon reflection and further study, I have come to recognize that in part, this was due to the implementation of institutional goals and pedagogic models that were in sharp contrast to what I had come to believe effectively furthers teaching and learning. Teachers want and require dialogue about their practice in a space that recognizes their knowledge, experience and current needs, while assisting them in figuring out what they can do within their current context. Teaching online courses led me to wonder if the participation in such courses provides a vehicle that supports teachers' reflective practice, personal and professional growth, and if so, how?

As Stepich & Ertmer have noted, "community cannot be mandated in an online course" however, "it can be promoted through careful attention to the overarching structure of the course, as well as the design of learning activities within the course" (2003, p. 33). Preliminary results in this study indicate that while the role of the instructor in an online classroom is vital and complex, thoughtful attention to the structure of the environment fosters not only community, but pedagogical reasoning and action in such a way that both the teacher and his or her practice is transformed. The complexities of their practice can be brought to the discussion in ways that permit the critical interrogation needed to move beyond the technical rationale.

Adapting and applying Halliday's (1978) models of language functions in the analysis of the research text contributed to further understandings about the ways in which the course structure both fosters and inhibits certain types of discussion. It became evident that while the depth and breadth of the discussions were ample, the current design did not foster imaginative thinking.

This research is limited in its scope: a single course has been studied in depth. It is important to continue this work and look across subject areas. It would be interesting to learn, for example, if the nature of the reading course and students that take such a course, play a significant role in the way the discussion evolved.

This work has implications for course designers, instructors and researchers as we move into an era where more and more universities are developing courses to be taught in an online environment. Since many universities opt for commercial platforms; a model that we discarded due to its limitations, these findings may serve to assist software developers, consumers and others making decisions at the design level as well.

ACKNOWLEDGEMENT

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ROUGH FUZZY APPROACH FOR USER-CENTRIC TEXT INFORMATION RETRIEVAL

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ABSTRACT

In this paper, we have considered the problem of user-centric text information retrieval from web documents. We have proposed a complete framework to show how rough set based reasoning can be used to build a user relevance feedback based text filtering system. The system uses discernibilty analysis to analyze the user's relevance feedback on a set of documents obtained with the initial query to obtain a more focused, modified query. In order to provide customized information to the user, the documents fetched by the modified query are ranked by the system using rough-membership functions. We have also integrated fuzzy reasoning concepts into our analysis to deal with certain aspects of natural language nuances like synonymy and provide fuzzy grading to documents. Finally, we have tried to provide a framework whereby ontological structures can be used for concept approximations using rough sets. We have also shown how hedge-algebra based reasoning can be used to reason about properties of concepts.

KEYWORDS

Rough – fuzzy reasoning, User- preference based learning, Query modification, Text filtering, Ontology based query processing.

1. INTRODUCTION TO TEXT INFORMATION RETRIEVAL (TIR)

Text information retrieval deals with the problem of locating and retrieving relevant documents from a collection in response to information need request formulated as a query by a user. One of the most important sources of information is the World Wide Web which has an overwhelming collection of documents scattered all over the world covering almost any topic. Search engines like Google or Yahoo etc. are a collection of programs which help the users to locate relevant information. However due to the enormity of this collection locating relevant information is not an easy task. In this paper we have worked towards developing user-preference based text information retrieval mechanisms that use rough-set based and rough-fuzzy reasoning techniques.

2. REVIEW OF CURRENT TRENDS IN TIR

Research in text information retrieval area is being currently directed towards making the problem of information retrieval more user-centered and goal-oriented. Some of well-known IR systems designed along these lines are WebPlanner (Jochem 1999), "Syskill & Webert" (Pazzani et al. 1995) and (Balabanovic 2000).

Different reasoning paradigms as Boolean model, Vector-based model, Semantic model (Deerwester et al. 1990), Fuzzy model (Szczepaniak and Gil 2003), and Rough set based model (Pawlak 1982; Stefanowski and Tsoukias 2001; Srinivasan et al. 2001; Das-Gupta 1988; Bao et al. 2001; Chouchoulas and Shen 2001; Jensen and Shen 2001; Menasalvas et al. 2002) have been employed to analyze the relevance feedback and expand initial query. Finally, the most recent trend in text information retrieval is to incorporate the use of domain ontological structures to improve the effectiveness of retrieval. Zhong has suggested that ontology plays a crucial role in knowledge-based web information retrieval (Zhong et al. 2002).

3. MOTIVATION FOR THE CURRENT WORK

It is obvious that web documents which have to be retrieved on the basis of words present in them, cannot have a unique relevance factor associated to them, since relevance is a function of individual user preferences. Now, since it is possible that two documents may contain the same set of words in entirely different contexts, and it is also possible that two completely different set of words may actually convey the same information – thus we felt that rough sets would be the ideal tool for user-centric document classification since it can handle non-unique classificatory analysis. Besides, one can actually deal with various approximations of concepts while computing relevance. On analyzing existing literature we observed that though the concept of rough similarity has been applied for text analysis, the concept of discernibility has not been explored at all in this context. We observed that discernibility can be the key to building a relevance-feedback based text retrieval system, since it can be made to store individual user's preference. We have shown how this can be actually applied to modify the initial query based on the user's feedback and also used to rank future documents for the user. We have also integrated fuzzy reasoning concepts with rough similarities to give intuitionistic results to the user.

We also note that, while ontologies are being currently described as the main focus of building the intelligent web, almost none of the work so far has addressed the issue of incorporating imprecise knowledge into the structure. We have tried to provide a framework whereby ontological structures can be used for concept approximations using rough sets. In this framework, we also incorporate elements of fuzzy reasoning to deal with uncertain concepts.

3.1 Problems Addressed in the Thesis

Specifically we have dealt with the following problems:

(i)   We have proposed a Rough set based query modification scheme which modifies the user's query based on the relevance feedback of the user. We have shown that this scheme yields queries which retrieve better documents for the user.

(ii)   We have proposed a Rough Membership function which can take into consideration the peculiarities of the text-retrieval domain and rank documents appropriately.

(iii)   We have proposed the design of a user-centric client-side information filtering system, which uses the basic scheme of query modification stated earlier to retrieve better documents for the user. However since the retrieved documents are still ranked by the backend search engine. Hence we have integrated a rough - fuzzy ranking mechanism with the filtering system which re-ranks the documents using the user's preferences.

(iv)   Finally, assuming that the user now has a set of relevant documents only at his or her disposal, we have attempted to apply the rough-fuzzy reasoning techniques to design an ontology-based query processing mechanism which can search for information effectively within this collection. We have proposed rough-fuzzy techniques to enhance the current standards of Description Logic.

 Now we will give a brief overview of each of the problems that we have addressed in this thesis.

4. QUERY MODIFICATION AND USER PREFERENCE MODELING THROUGH DISCERNING POWER OF WORDS

We have extended the concept of discernibility (Komorowski et al. 1999) to analyze an information system and extract the most discerning attributes and values. The idea is to use the discerning power of words to judge whether a document is relevant or not to the user. In our approach a document is represented as a weighted vector consisting of words and their relative weights (normalized) in the document. It is a relevance-feedback based approach, hence the user has to initially pose a query to a standard search engine. The results of this query are judged and ranked by the user. The document vectors and user ranks are then used to build a decision table which is analyzed to find the set of most discerning words. We find **positive**

discerning words which are desirable in a document and **negative discerning** words which are to be avoided while searching for relevant documents. We use the positive and negative discerning words to formulate an improved search query for the user. This can also imbibe the user's preference and helps in fetching more relevant documents. We have used a modified version of the MD-Heuristic algorithm described in (Komorowski et al. 1999) to obtain the set of discerning words from this. The set of most discerning words returned by our algorithm are accompanied by their weights. The weights can be positive or negative indicating whether they are positively discerning or negative discerning. We use the sign of the weight to formulate a Boolean query which is a modification of the initial query. The set of most discerning words along with the minimal set of cuts obtained can be used to represent the user's preference.

4.1 A New Rough Membership Function for Ranking New Documents

Using the minimal set of cuts obtained above, we now obtain a reduced decision system D containing the most discerning words only. We assign interval names to all values of discerning words corresponding to their minimal cuts and convert it to a symbolic decision system **S.** When the modified query is presented again to the search engine, a new set of documents is retrieved. In general these are better than the earlier ones. However these are still ranked according to the underlying search engines ranking mechanism. Hence we have proposed a new rough membership function to compute the ranks of new documents according to the stored user preference. Since for most of the words, the equivalence class for a document may be very small or NULL, traditional rough-membership computations do not work in this case. Thus we propose the use of a new rough membership computation function that takes into account the relative degree of membership of a document into different categories with respect to each discerning word using sieve **S.** The final categorization of a new document is provided as a function of all these memberships. The system is capable of eliminating bad documents very effectively, though it is less discerning for high quality documents.

5. ROUGH-FUZZY REASONING FOR TEXT-RETRIEVAL

Using the above mechanism for building a modified query we now extended the work to include synonyms of words also. Since degree of synonymy between two words may be varying so we considered the inclusion of rough-fuzzy reasoning techniques proposed in Srinivasan et al. 2001, along with our methods for this. Though rough similarity measures between document and query were proposed but it was not specified how these could be used to compute document relevance. We explored the possibility of incorporating a learning mechanism along with this, to build a complete text retrieval system, which can start with an initial query, modify this and fetch new documents for the user. We decided to present the user with a fuzzy membership of the final document to the various categories since this presents a more intuitionist picture about the document rather than a numeric measure. Table 1 summarizes the system performance as follows:

Table 1. Accuracy of system evaluation: comparing system rank vs user rating

Initial Query	Modified Query	Accuracy
Alcohol Addiction	alcohol, addiction, abuse, drugs, treatment, health, description, rehabilitation, help, revised (-)	80%
HIV	AIDS, treatment, HIV, epidemic, health, description, information, service, virus, details (-)	80%
Blood Cancer	Cancer, health, medical, information, blood, leukaemia, help, myeloma, alive, symptom, companion (-), safety (-), poison (-)	72.3%

6. ROUGH-FUZZY TECHNIQUES FOR ONTOLOGY BASED INFORMATION PROCESSING

One of the chief problems of text information retrieval is the absence of a standard vocabulary that can assure unambiguous knowledge exchange among various operators. Ontology provides a formal specification mechanism that can be exchanged between various agents to understand concepts unambiguously. One can reason about the specified concepts using the constraints that bind them. As of now, an ontological specification is not equipped to handle imprecise definitions and reason with them. Since the reasoning is strictly deductive, there is no provision to handle uncertainties and vagueness. For example, if it is specified that the concept "Perfume" is defined by property "fragrance" which has value "nice", then there is no way that a chemical which is defined to have a "delicate aroma", can be classified under perfume. We have proposed a framework to extend ontology based query processing to handle uncertain concepts also.

In our work, we have shown how ontological structures can be strengthened with the inclusion of fuzzy qualifiers which can model linguistic variables very elegantly. Specifically we have proposed rough operators for handling ontological relationships like class-subclass or has-property. We have then proposed a complete framework for extending documents and user query by including related concepts specified in the ontological structure. We have also integrated rough-fuzzy similarity measures to compute relevance of a document to user queries. We have worked with the (Wine ontology) developed by W3C for verifying our results.

7. CONCLUSION

Earlier works on rough set based text information retrieval had mostly concentrated on modelling user queries or compute rough-similarity measures in a general way. To the best of our knowledge, applying these measures and their modifications towards building a relevance-feedback based information-filtering system is a novel contribution of this work. Our work is different from all the earlier approaches in the way we modify the initial user query and compute the relevance of the documents for the users.

In this work, we have proposed several rough-set theoretic and rough-fuzzy concepts which can be effectively utilized to design customized document-filtering systems. We have proposed discernibility based query modification and rough membership computation functions which are suitable for document ranking. We have also proposed the complete design of a client-side information filtering system which can use synonymous words and rough similarity measures to obtain good documents and also provide fuzzy ranks to these documents for the user. Finally, we have proposed the use of rough-fuzzy reasoning for ontology based query processing systems for better performance with unstructured documents.

In future we intend to extend the work towards enhancing Description Logic to handle rough-fuzzy reasoning methodologies also. New axioms and rough-fuzzy constructors will have to be proposed to empower the current ontological framework to argue with imprecise knowledge.

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