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Developing Best Practice in Intranet Evaluation: A Comparison of Evaluation Models for Usability and Acceptance

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ABSTRACT

Usability is an important element of why users accept an information system. Heuristic evaluation is a common method of usability evaluation often performed by independent consultants in the assessment of organisational intranets. However, there are other usability models which offer valuable analysis in the evaluation process. This paper empirically compares the Technology Acceptance Model (TAM) and the Hedonic/Utilitarian (HED/UT) scale versus a heuristic evaluation model as additional measures of intranet usability. As such this paper attempts to develop best practice in Intranet evaluation by assessing the strength of traditional heuristic evaluation constructs and those proposed by the TAM and HED/UT models. A unified evaluation toolset is proposed by the authors for practitioner use.

INTRODUCTION

The main driver behind the growth of organisational intranets is in order to meet business goals through improving the productivity and efficiency of employees (Lederer, Maupin et al., 2000). Baker (2000) argues that intranets can offer significant benefits through internal communication, collaborative/cooperative work, knowledge management and process redesign. However in the development of an intranet, usability is a critical element determining not only user acceptance of the system but also in gaining the potential benefits of intranet technology. This paper empirically compares the Technology Acceptance Model (TAM) and the Hedonic/Utilitarian (HED/UT) scale as measures of intranet usability versus a heuristic evaluation model conducted by independent consultants. The findings from this study illustrate the effectiveness of the TAM constructs in determining usability and argue that best practice in intranet evaluation can be achieved from the use of these measures in addition to heuristic evaluation audits.

DEFINING INTRANETS

Intranets are a small scale version of the Internet within an organisation which is protected from unauthorised users by a firewall and is only accessible from within the organisation (Lloyd, 1998; Horton, Buck et al., 2001; Denton, 2003). An intranet can also be seen as an information technology application to a defined community of users within an organisation (Dasgupta, 2001). In order to create an internal organisation network it makes sense to use the same technology and software as the Internet, due to its clear increasing popularity and success (Lloyd, 1998). Therefore, intranets can be accessed through the same browser used for accessing the Internet (Baker, 2000).

Intranet Benefits

In an environment where knowledge has become an extremely important resource, intranets have been identified as having significant

benefits for an organisation (Horton, Buck et al., 2001). Lloyd (1998) identifies particular benefits that have resulted for many organisations from the development of intranets and improved competitiveness which can be gained through operational efficiency and productivity is achievable in a number of areas: improved access to timely and up-to-date information; cost savings related to reduction of papers use, warehousing documents and distribution, time savings on searching for and locating information, improved productivity due to faster communication of information and easier understanding of information due to instinctive intranet interfaces (Lloyd, 1998). However, the benefits of intranets can only be achieved if intranet users are viewed as customers of the organisation and by designing the intranet with usability best practice in mind (Ganzalez, 1997). Usability is a key factor of an organisation's intranet acceptance and usage (Perrott, 2001).

Usability and IT Evaluation

Usability is defined by Mayhew (1999) as a quantifiable characteristic of a information systems system and is an important aspect of the quality of information systems (Fu, Salvendy et al., 2002; De Angeli, Matera et al., 2003). In the 1980's laboratory usability testing was the primary evaluation approach through user performance testing, according to Hartson, Andre et al. (2001) this testing allowed increased product competitiveness and reduced risk by increasing user satisfaction and acceptance of the product. The 1990's brought about a need for new models with reduced costs and time associated with the traditional usability testing methods Hartson, Andre et al. (2001). These methods are heuristic evaluations, cognitive walkthroughs, usability walkthroughs, ergonomic criteria and thinking aloud techniques (Sears, 1997; Hartson, Andre et al., 2001; Hertzum and Jacobsen, 2003).

Nielsen (1993) states that designing an intranet is predominantly the same as designing for an Internet website because the fundamentals of usability do not change from one to the other for the user. However, Nielsen (1993) outlines that poor usability of intranets result directly in organisational losses of efficiency and productivity due to users not accepting the new system, there is a cost associated to this for the organisation. Nielsen (1993) and De Angeli, Matera et al. (2003) discuss the importance of using effective methods for evaluating the usability, user satisfaction and acceptance of information systems.

IT Evaluation Models for Usability

Heuristic Evaluation

Heuristic evaluation is a popular form of usability evaluation (Barnum, 2002). The heuristic evaluation is also known as a usability engineering method for identifying problems with a user interface (Nielsen, 2005) (Hertzum and Jacobsen, 2003). In performing this evaluation, evalua-

tors assess the information system complies with a set of recognised usability heuristics or principles (Sears, 1997; De Angeli, Matera et al., 2003; Hertzum and Jacobsen, 2003; Fichter, 2004; Nielsen, 2005). Major and minor usability problems can be quickly identified through the heuristic evaluation model (Fichter, 2004). Nielsen (2005) explains heuristics as principles or rules, which describe usable interface elements and are best used early in the design process. Heuristic evaluations do not provide solutions to usability problems identified, but seek to explain the difficulties identified (Nielsen, 2005).

TAM

The TAM model was developed by Davis (1986) and is one of the most influential models of evaluating information technology acceptance and usage (Chau, 1996). TAM was designed to be applied to computer usage behaviour in order to model user acceptance of information systems, (Davis, 1989a; Van der Heijden, 2003). Horton, Buck et al. (2001) suggest that TAM is appropriate for modelling intranet acceptance. Support for TAM modelling the world wide web is also supported by Lederer, Maupin et al. (2000). The goal of TAM is to explain the usability factors that determine user acceptance and usage. Davis (1989a) states that according to TAM, attitude is directly determined by usefulness and ease of use of an information system. TAM hypothesizes that ease of use and external variables such as collated data, automatically generated reports and other useful functions have a direct effect on perceived usefulness (Davis, 1989a).

Hedonic/Utilitarian Scale

Hedonic and utilitarian concepts have been addressed by various disciplines such as sociology, psychology and economics (Spangenberg, Voss et al., 1997; Voss, Spangenberg et al., 2003). There are two dimensions to the conceptualisation of consumer attitudes; hedonic aspects resulting from sensations derived from the experience of using a product and utilitarian features derived from functions performed by a product (Spangenberg, Voss et al., 1997; Voss, Spangenberg et al., 2003). According to Dhar and Wertenbroch (2000) consumers' choice is driven by utilitarian and hedonic dimensions. In the case of intranets, employees should be viewed as internal customers of the organisation and consumers of intranet services and knowledge (Ganzalez, 1997).

Utilitarian consumer behaviour is thought of as task related and logical (Babin, Darden et al., 1994). Hedonic value is more subjective and personal than utilitarian value and results more from fun and playfulness. According to (Spangenberg, Voss et al., 1997; Dhar and Wertenbroch, 2000), hedonic products can be described as providing fun, pleasure or excitement and utilitarian products can be describe as providing helpful or functional attributes. Spangenberg, Voss et al. (1997) developed a scale to measure the users hedonic and utilitarian attitudes. This HED/UT scale is consumer-centred; it looks at the consumer attitudes and usage of products. The HED/UT scale is appropriate for assessing the consumer's attitude and usage of the organisations intranet under study. This scale showed high validity and reliability. The 10 item generalisable scale is a consistent, valid, and useful measure of the hedonic and utilitarian dimensions of product attitude and usage according to Voss, Spangenberg et al. (2003).

RESEARCH METHOD

The purpose of this research was to determine if the Technology Acceptance Model (TAM) and the Hedonic Utilitarian (HED/UT) model are equally effective measures of intranet usability and acceptance in comparison with the results from a usability audit conducted independently by consultants. The researchers collected data capturing a redesign effort conducted on an organisation's intranet enabling an investigation of the suitability of these metrics as valid measures of usability and acceptance. The study used a quantitative survey approach conducted through two questionnaires. The questionnaires were based on the technology acceptance model, hedonic/utilitarian scale and closed ended questions on heuristic principles. Twenty-six respondents completed the questionnaire in both stage 1 and stage 2. The respondents

Table 1. User experience

Optimising the User Experience	Likert value	Cronbach Alpha	p (t-test)
Usability Audit	4.27		
Stage 1	4.0641	.828	
Stage 2	4.4936		
Stage 1 / Stage 2			>0.05

of the questionnaires were all employees of the organisation and users of the organisation's intranet. The sample covered low-level staff through to high-level management providing a broad range of the organisations intranet users.

The data collection process for this study was comprised of three sources: the usability audit conducted by independent consultants on the old intranet and two questionnaires conducted by the researchers on the old and new intranets respectively. The TAM, HED/UT scale and usability heuristic metrics under study in this research measured very similar aspects of usage through user acceptance, consumer attitudes and usability. From the usability audit, eight measures were selected for use in this study: 1) optimising the user experience, 2) homepage design, 3) page layout, 4) navigation, 5) headings and labels, 6) text appearance, 7) graphics and images, and 8) content organisation. For the purpose of comparison, relevant metrics were chosen from the hedonic and utilitarian scale consisting of two central measures: 1) perceptions towards hedonic aspects of using the system and 2) perceptions towards utilitarian aspects of using the system and from the Technology Acceptance model (TAM) findings are generated from four metrics: 1) perceived usefulness, 2) perceived ease of use, 3) perceived enjoyment and 4) perceived attractiveness.

FINDINGS

This section outlines the research findings, which were produced through statistical analysis from the data obtained from the questionnaire stages and the usability audit. The findings are ordered to reflect the eight measures of the usability audit and for each a comparison is demonstrated using the data from stage 1 and stage 2 of the questionnaire, followed by a comparison of stage 1 and 2 data. Finally analysis is presented from data obtained from the TAM constructs.

Optimising the User Experience

The usability audit found that documents and images on the old intranet did not provide sufficient information.

The mean average for the optimisation construct on the old intranet was 4.0641 (Table 1), which indicates a similar result to the usability audit. The paired sample t-test found that the correlation between the old and new intranet to be insignificant indicating that there was an insignificant positive relationship between the perceptions of the old optimisation of the user experience and the perceptions of the new. This indicates that either the optimising the user experience construct provides a weak measure for this heuristic or that the new intranet design didn't actually optimise the user experience.

Homepage Design

The usability audit found that the homepage was a problem area of the old intranet.

The mean average for the homepage design heuristic on the old intranet was 4.2628 (Table 2), a higher result to the usability audit. The paired sample t-test found that the correlation between the old and new intranet was insignificant indicating that there is an insignificant positive

Table 2. Homepage design

Homepage Design	Likert value	Cronbach Alpha	p (t-test)
Usability Audit	3.71		
Stage 1	4.286	.916	
Stage 2	4.8462		
Stage 1 / Stage 2			>0.05

Table 3. Page layout

Page Layout	Likert value	Cronbach Alpha	p (t-test)
Usability Audit	4.76		
Stage 1	3.7947	.885	
Stage 2	4.8077		
Stage 1 / 2			<0.05

Table 5. Headings and labels

Headings and Labels	Likert value	Cronbach Alpha	p (t-test)
Usability Audit	3.50		
Stage 1	4.333	.886	
Stage 2	4.9359		
Stage 1 / 2			<0.05

Table 7. Graphics and images

Graphics and Images	Likert value	Cronbach Alpha	p (t-test)
Usability Audit	6.16		
Stage 1	3.6346	.933	
Stage 2	5.2308		
Stage 1 / 2			<0.05

relationship between the perceptions of the old homepage design and the perceptions of the new homepage design. This shows that the homepage design construct provides a weak measure of the homepage design heuristic or that the new design didn't improve the homepage design.

Page Layout

The intranet usability audit found that the page layout length and information positioning on the old intranet was problematic.

The mean average for the page layout heuristic on the old intranet was 3.7949, a lower result to the usability audit. The paired sample t-test found that the correlation between the old and new intranet was insignificant indicating that there is an insignificant positive relationship between the perceptions of the old page layout and the perceptions of the new page layout. Overall, the mean increased by 1.01282 with a significance value of $p < .05$ which means that there is a significant difference for the page layout construct from the old intranet to the new intranet. This shows that the page layout construct provides a strong measure for the page layout heuristic.

Navigation

The intranet usability audit identified navigation as a problematic area on the old intranet.

The mean value for the navigation heuristic on the old intranet was 3.8205, which indicates a similar result to the usability audit. The paired sample t-test found that the correlation between the old and new intranet was significant indicating that there is a positive relationship between the perceptions of the old intranet and the perceptions of the new intranet. Overall, the mean increased by .70513 with a significance value of $p < 0.05$ which means that there is a significant difference for the navigation construct from the old intranet to the new intranet. This shows that the navigation construct provides a strong measure for the navigation heuristic.

Headings and Labels

The intranet usability audit found that the headings and labels needed to be more meaningful and unique and easily understandable by existing and new users of the old intranet.

The mean value for the headings and labels construct on the old intranet was 4.3333, which indicates a higher result to the usability audit. The paired sample t-test found that the correlation between the old and new intranet was significant indicating that there is a positive relationship

Table 4. Navigation

Text Appearance	Likert value	Cronbach Alpha	p (t-test)
Usability Audit	3.71		
Stage 1	3.82	.778	
Stage 2	4.5256		
Stage 1 / 2			<0.05

Table 6. Text appearance

Text Appearances	Likert value	Cronbach Alpha	p (t-test)
Usability Audit	5.60		
Stage 1	4.8846	.869	
Stage 2	5.2308		
Stage 1 / 2			>0.1

Table 8. Content organisation

Content Organisation	Likert value	Cronbach Alpha	p (t-test)
Usability Audit	4.20		
Stage 1	4.0385	.805	
Stage 2	4.6795		
Stage 1 / 2			<0.05

between the perceptions of the old headings and labels and the perceptions of the new headings and labels. Overall, the mean increased by .60256 with a significance value of $p < 0.05$ which means that there is a significant difference for the headings and labels construct from the old intranet to the new intranet. This shows that the headings and labels construct provides a strong measure for the headings and labels heuristic.

Text Appearance

The intranet usability audit found the only area of improvement of text appearance on the old intranet was consistency.

The mean value for the text appearance construct on the old intranet was 4.8846, which indicates a lower result to the usability audit. The paired sample t-test found that the correlation between the old and new intranet was insignificant indicating that there was an insignificant positive relationship between the perceptions of the old text appearance and the perceptions of the new text appearance. Overall, the mean increased by .34615 with a significance value of $p > 0.1$ which means that there is not a significant difference for the text appearance construct from the old intranet to the new intranet. This shows that the text appearance construct provides a weak measure for the text appearance heuristic or that the new intranet design didn't improve the text appearance.

Graphics and Images

The intranet usability report identified that there was insufficient use of graphics and images to aid users in the understanding and comprehension of information on the old intranet.

The mean value for the graphics and images construct on the old intranet was 3.6346, substantially lower than the usability audit. The paired sample t-test found that the correlation between the old and new intranet was significant at .496 indicating that there is a positive relationship between the perceptions of the old graphics and the perceptions of the new graphics and images. Overall, the mean increased by .92308 with a significance value of $p < 0.05$ which means that there is a significant difference for the graphics and images construct from the old intranet to the new intranet. This shows that the graphics and images construct provides a strong measure for the graphics and images heuristic.

Content Organisation

The intranet usability audit found a need for the homepage and homepage sections on the old intranet to provide important and well-structured information on them.

Table 9. *Enjoyment*

Perceived Enjoyment	Likert value	Cronbach Alpha	p (t-test)
Stage 1	3.5165	.931	
Stage 2	3.9121		
Stage 1 / 2			<0.05

Table 11. *Usefulness*

Perceived Usefulness	Likert value	Cronbach Alpha	p (t-test)
Stage 1	4.3910	.945	
Stage 2	4.7115		
Stage 1 / 2			>0.05

The mean value for the content organisation heuristic on the old intranet was 4.0385, a lower result to the usability audit. The paired sample t-test found that the correlation between the old and new intranet was insignificant indicating that there is an insignificant positive relationship between the perceptions of the old content organisation and the perceptions of the new content organisation. Overall, the mean increased by .64103 with a significance value of $p < 0.05$ which means that there is a significant difference for the content organisation construct from the old intranet to the new intranet. This shows that the content organisation construct provides a strong measure for the content organisation heuristic.

Perceived Enjoyment

The paired sample t-test found that the correlation between the old and new intranet was significant at .644 indicating that there is a positive relationship between the perceptions of the old perceived enjoyment and the perceptions of the new. Overall, the mean increased by .39560 with a significance value of $p < 0.05$ which means that there is a significant difference for perceived enjoyment from the old intranet to the new intranet. This shows that the perceived enjoyment TAM construct provides a strong measure of enjoyment.

Perceived Attractiveness

The paired sample t-test found that the correlation between the old and new intranet was .117 indicating that there was an insignificant positive relationship between the perceptions of the old perceived attractiveness and the perceptions of the new. Overall, the mean increased by 1.07418 with a significance value of $p < 0.05$ which means that there is a significant difference for perceived attractiveness from the old intranet to the new intranet.

Perceived Usefulness

The paired sample t-test found that the correlation between the old and new intranet was significant at .738 indicating that there is a strong positive relationship between the perceptions of the old perceived usefulness and the perceptions of the new. Overall, the mean increased by .32051 with a significance value of $p > 0.05$ which means that there is an insignificant difference for perceived usefulness from the old intranet to the new intranet. This indicates that the perceived usefulness construct is a weak measure of usefulness, however this may also indicate that the new intranet design may not have actually improved intranet usefulness.

Perceived Ease of Use

The paired sample t-test found that the correlation between the old and new intranet was insignificant at .317 indicating that there was an insignificant positive relationship between the perceptions of the old perceived ease of use and the perceptions of the new. Overall, the mean increased by .32372 with a significance value of $p > 0.1$ which means that there is not a significant difference for perceived ease of use from the old intranet to the new intranet. This shows that the perceived ease of

Table 10. *Attractiveness*

Perceived Attractiveness	Likert value	Cronbach Alpha	p (t-test)
Stage 1	3.9835	.959	
Stage 2	5.0577		
Stage 1 / 2			<0.05

Table 12. *Ease of use*

Perceived Ease of Use	Likert value	Cronbach Alpha	p (t-test)
Stage 1	4.7308	.948	
Stage 2	5.0545		
Stage 1 / 2			>0.05

use TAM construct did not provide a strong measure of ease of use in this case.

DISCUSSION AND CONCLUSIONS

The constructs used by the usability audit suggested both weak and strong measures were present. The page layout, navigation, headings and labels, graphics and images, and content organisation were identified as strong measures, while the optimising the user experience, homepage design and text appearance constructs were suggested to be weak measures. However these suggested weak measures might indicate that there was not an actual improvement on the new intranet design in relation to these constructs.

Many of the heuristic evaluation constructs were identified as inappropriate alternatives to the traditional heuristic evaluation method as users may not have had the necessary usability expertise to identify the problems sufficiently through these constructs (Hertzum and Jacobsen, 2003). However, these constructs can certainly provide further usability evaluation information for evaluators in identifying specific usability problems. Therefore the constructs are valid supplements to the traditional heuristic evaluation method. The heuristic evaluation method is also more effective at identifying usability problems that advanced users may encounter (Fu, Salvendy et al., 2002).

The TAM construct, perceived enjoyment was identified as a strong measure of enjoyment which is consistent with previous literature (Davis, 1986; Davis, 1989b; Horton, Buck et al., 2001; Van der Heijden, 2003). Perceived enjoyment had a very strong positive correlation between the old intranet and the new, with a significant mean improvement of users perceived enjoyment of the new intranet. This indicates that the users found the new intranet design to be a more enjoyable experience than the old intranet.

The perceived attractiveness construct found a low positive correlation but a significant mean difference between the old intranet and the new intranet design. These results suggest that the construct is a strong measure of attractiveness and this is supported by previous literature (Davis, 1986; Davis, 1989b; Horton, Buck et al., 2001; Van der Heijden, 2003). This indicates that the new design actually improved the attractiveness of the intranet.

Perceived usefulness in this study had a very strong positive correlation between the old intranet and the new, with an insignificant improvement of users perceived usefulness of the new intranet. This indicates that the user perception of usefulness from the old intranet to the new intranet design may not have actually improved.

The TAM constructs, perceived ease of use was identified as a weak measure of ease of use, which contradicts the findings of (Davis, 1986; Davis, 1989b; Horton, Buck et al., 2001; Van der Heijden, 2003) as a strong validated measure of ease of use. The TAM construct, perceived ease of use had an insignificant positive correlation between the old intranet and the new, with an insignificant improvement of users perceived ease of use of the new intranet. This weak finding for the perceived ease of use measure may suggest that users did not find an overall improvement in ease of use from the old intranet to the new intranet design.

The research study has identified a possible unified usability evaluation toolset for organisational intranets. In an attempt to define a toolset that would represent best practice in intranet usability, such a unified toolset could be constructed from the eight heuristic usability constructs and would also include all of the TAM model constructs as these were identified as appropriate for a unified usability evaluation toolset.

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