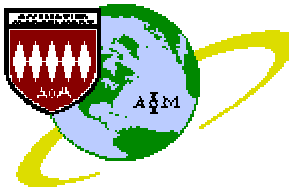

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MEASURING THE CONTEXT OF INFORMATION SYSTEMS USE

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ABSTRACT

An important research stream in information systems (IS) is predicting and explaining technology acceptance among users. This has been and remains of clear importance to system developers and IS managers, and is therefore of interest to the IS research community. It is known that the context in which a system is used affects the determinants of the user's acceptance of it. Two new multi-item constructs are developed and validated to measure the extent to which a user is using a system within each of two such contexts: utilitarian, where the system has some useful application, and recreational, where the system is being used for enjoyment. Context definitions were used to create 14 candidate items which were initially refined by a series of pre-study interviews, refined further in a study of four systems, and validated in one applied testing situation. The resulting scales exhibit good psychometric properties - reliability and convergent, discriminant and factorial validity, and show a high correlation with self reported context of use. The scales will be of use to researchers working in the area of technology adoption.

Keywords: technology acceptance, recreational information system, utilitarian information system, context of use

INTRODUCTION

An important research stream in information systems (IS) is predicting and explaining technology acceptance among users. This has been and remains of clear importance to system developers and IS managers, and is therefore of interest to the IS research community. The literature studying technology adoption is extensive. Much of this uses one of the models shown in Table 1 to examine the factors that are important to users in their decision to accept the technology. It is known that the context in which a system is used affects the determinants of the user's acceptance of it. For instance, Brown *et al*. [8] examined a voluntary versus mandatory context and found that under mandatory conditions TAM is less useful in predicting user intentions. Bretschneider and Wittmer [6] looked at the impact of industrial sector and found that it has a major differential effect on the adoption of microcomputer technology. Straub [38] studied the role of culture and reported that cultural effects play an important role in the selection of electronic communications media. Clearly the term 'context' encompasses a wide range of dimensions. However, this work examines two only two of them: utilitarian, where the system has some useful application, and recreational, where the system is being used for enjoyment. Henceforth, the term 'context' will be used to refer only to these.

The utilitarian context has been studied most in the literature. These studies are usually performed in a workplace setting. Examples include commercial use of email and fax (Straub [38]); spreadsheets (Mathieson [29]) (this study was of a commercial system but used students as respondents); company intranets (Horton *et al*. [17]) and more recently, commercial and retail banking (Brown *et al*. [8]); groupware technology (Mark and Pol-

trock [28]), use of wireless LAN technology in SMEs (Anderson and Schwager [3]), and use of PDAs in healthcare (Yi *et al*. [48]). Much of this work is empirical although the models shown in Table 1 have also been used in qualitative work (for instance see Garfield [15] who studied acceptance of tablet computers). Recently studies have moved away from a workplace setting to examine a recreational context of use. Examples of systems examined include instant messaging (Lin *et al*. [25]), television-commerce (Yu *et al*. [49]), online games (Hsu and Lu [18]), and movie websites (van der Heijden [42]).

The distinction is the position of the reasons for use. Utilitarian reasons are external to the interaction – the system is being used to achieve something outside of the interaction itself. Recreational reasons are internal to the interaction – the user does not get anything out of the interaction other than some sort of positive feeling. These two contexts are not mutually exclusive. A system could be used because it is both useful and fun.

If we accept that context impacts on the determinants of use, and that context of use is subjective, then within a group of users of one system, there could be different contexts of use and hence different determinants. So one user could consider one system to be recreational while for another it could be utilitarian. Even for one user, a system could be recreational at certain times and utilitarian at other times. In Section 2 the world wide web is used as a illustration of this. Other examples are also given. This will cause difficulty when trying to develop a model of acceptance. (Note that utilitarian and recreational contexts are not the same as mandatory and optional contexts. Users, especially home users, may use a system for utilitarian reasons, even though they have a choice. That choice might be simply 'use' or 'don't use', or more likely it will be a choice between different systems produced by competing software houses.)

The current paper contributes to this by developing and validating two multiple item constructs to measure the context, utilitarian versus recreational, in which an IS is used. Since this context of use has an impact on the model of acceptance it is therefore of use to researchers to have a tool to measure it. The tool can be applied to individual users which would allow researchers to single out and study a context, rather than just studying a system. For instance, researchers could examine acceptance of users who are using for fun separate from users who are using for productivity. The impact of the context on acceptance could also be studied. Researchers should not assume, as most studies have, that all users are using a system in the same context.

Section 2 defines these two contexts and examines the need for a tool to measure them. Section 3 looks at how the scales were developed, validated and tested using a series of pre-study interviews, a study of four systems using student respondents and then a further study in an applied testing situation. Section 3 also examines the results of each study. These results are then discussed in section 4.

Table 1: Models of technology adoption

Technology Acceptance Model (TAM) Origin: Davis [11] based on several expectancy-theoretic theories (Vertinsky *et al*. [46]; Robey [32]; Vroom [47]; DeSanctis [13]), self-efficacy theory (Bandura [4]), behavioural decision theory (Beach and Mitchell [5]; Payne [31]; Johnson and Payne [21]) and theories on the adoption of innovations (Tornatzky and Klein [41]; Rogers [34]) Description: Models acceptance being determined by perceived usefulness and perceived ease of use, although the model has been extended by a number of writers to include other factors. These include perceived playfulness (Moon and Kim [30]); perceived critical mass (Lou *et al*. [26]); social influence (Malhotra and Galletta [27]), and other intrinsic motivations (Venkatesh [45]).
Theory of Planned Behaviour (TPB) Origin: Ajzen [1], based on the Theory of Reasoned Action. Description: Attitude, subjective norm and perceived behavioural control predict behavioural intention. Behaviour is determined by behavioural intention and perceived behavioural control. Attitude encapsulates feelings of favourableness or unfavourableness towards performing a behaviour; subjective norm reflects perceptions that people who are significant to the individual, desire that individual to perform or not perform a behaviour; and perceived behavioural control reflects perceptions of internal and external constraints on behaviour (Taylor and Todd [40]).

Table 1: Models of technology adoption (continued)

Unified Theory of Acceptance and Use of Technology (UTAUT) Origin: Venkatesh *et al*. [44] studied eight acceptance models and formulated them into the Unified Theory of Acceptance and Use of Technology (UTAUT). UTAUT models user acceptance and usage as being determined by: performance expectancy, effort expectancy and social influence which have a direct impact on intention to use, and facilitating conditions which influences use behaviour. Description: The eight models between them showed intention to use or usage as being determined by seven constructs. UTAUT models user acceptance and usage as being determined by four of these: performance expectancy, effort expectancy and social influence have a direct impact on intention to use, and facilitating conditions influence use behaviour. The remaining three of the original seven were thought not to be direct determinants: attitude toward using technology, self-efficacy and anxiety. The four constructs which have an impact are moderated by gender, age, experience and voluntariness of use.
Diffusion of Innovations (DOI) theory Origin: Rogers [33] Description: Perceived characteristics of the innovation (relative advantage, compatibility, complexity, trialability and observability) are important in forming a judgement about whether to use it. Relative advantage is the degree to which an innovation is perceived as being better than the idea it supersedes; compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences and needs of potential adopters; complexity is the degree to which an innovation is perceived as relatively difficult to understand and use; trialability is the degree to which an innovation may be experimented with on a limited basis; observability is the degree to which the results of an innovation are visible to others.
Theory of Reasoned Action (TRA) Origin: Ajzen and Fishbein [2] Description: The Theory of Reasoned Action suggests that intention to perform a behaviour is determined by attitude toward the behaviour and subjective norm.
Model of Adoption of Technology in Homes (MATH) Origin: Venkatesh and Brown [43], based on the theory of planned behaviour. Extended by Brown and Venkatesh [7]. Description: Extended version models behaviour intention as being determined by attitudinal beliefs (utilitarian outcomes, hedonic outcomes and social outcomes), normative beliefs (influences of friends and family, secondary sources and workplace referents), and control beliefs (fear of technology advances, cost, perceived ease of use and requisite knowledge).

BACKGROUND

The two contexts being studied are defined as follows. The degree to which a system is used in a recreational context is defined as the degree to which the user is using the system solely for the interaction itself. That is, the interaction gives the user some sort of positive feeling (enjoyment, excitement etc.) and nothing else is produced. The degree to which a system is used in a utilitarian context is defined as the degree to which the user has a reason for use which is external to the interaction itself. That is, the interaction produces something (a document, a web page etc.) other than a positive feeling for the user. It is too simplistic to claim that a certain system is recreational, or that it is utilitarian. These represent two extremes with many systems having a certain degree of each. The world wide web is a classic example. To some people (the author's mother is one), use of the web represents no fun and no use to them, so they would score it low as a recreational system and low as a utilitarian system. Someone who is using the web for research on income tax rules may score it high as a utilitarian system but low as a recreational one. The same person who later is looking for information about cinema times and reading film reviews may now class the web as a high recreational system and a high utilitarian one. If that same person at some other time uses the web to view pornography, they would perhaps

now class it as a pure recreational system, with no utilitarian value.

Moon and Kim [30] applied TAM (explained in Table 1) with a new perceived playfulness construct, to the world wide web. Their study highlights a potential problem with ignoring context of use. The writers rightly point out that as the web is used for 'education, shopping, entertainment, work, communication, personal information, time-wasting, etc.' determinants of use may include extrinsic and intrinsic factors. They gave questionnaires to 152 students about their use of the web, however they fail to report what respondents were using it for. It is unlikely that a student researching a dissertation will have the same determinants of use as a student who uses it to view pornography. The third hypothesis they test, that there is a positive relationship between perceived playfulness and intention to use, for which they find support, only makes sense when it is known what the web is being used for. Such a relationship probably only exists for uses which score high in a recreational context.

Perhaps it could be argued that as the web is a means of sharing information and is not specific to any one application, that is why at different times it scores different amounts within the utilitarian and recreational contexts. In fact this is not the case. There are numerous examples of systems which will score different amounts in these contexts at different times. For instance we can imagine image editing software being classed as high utility/low recreation by a photography student, high utility/high recreation by someone entering an amateur photography competition and low utility/high recreation by someone who is adding captions to photographs of their child. In fact few applications sit at the two extremes where either utility or recreation scores zero.

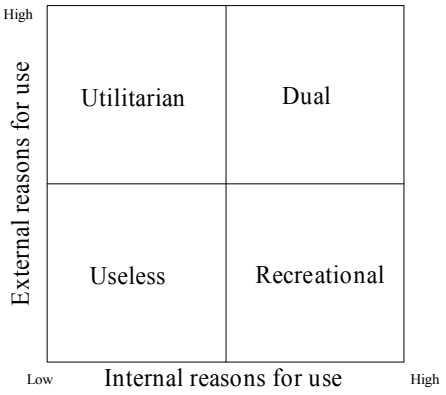

Figure 1: Contexts of use

This leads us to visualise systems within a two dimensional scale as shown in Figure 1. This scale has been divided into four quadrants labelled Useless, Utilitarian, Dual and Recreational. It is argued that whichever quadrant a system is perceived to be in by a user will have an impact on the model of acceptance which is appropriate for that user. A recent study appears to confirm this perfectly. Fang *et al*. [14] study one technology, wireless handheld devices, for three different tasks: gaming tasks which would be considered recreational, transactional tasks which included both utilitarian and dual tasks, and general tasks which were mostly utilitarian. TAM was applied to these three tasks and results showed that each had different determinants. Their results are now examined along with results of other technology adoption studies, which are listed in Table 2.

The table briefly lists the results of some adoption studies. Without speaking to the users who were studied it is impossible to know exactly what context they were using their systems in, so in the following analyses of their results some assumptions will have to be made. In addition, these studies did not all test for the same determinants, although most examined perceived usefulness and perceived ease of use, and to a lesser extent, perceived enjoyment.

Table 2: Studies of technology adoption

Reference	System studied	Main determinants of intention to use/use behaviour
Davis [11]	Email	Perceived usefulness and perceived ease of use, although the findings suggest that perceived ease of use has an indirect impact on use via perceived usefulness.
Davis *et al*. [12]	Word processor and Graphics package	Perceived usefulness and perceived enjoyment were main determinants of use for both systems.
Gefen *et al*. [16]	Online shopping	Perceived usefulness, perceived ease of use and trust in the e-vendor. Did not examine perceived enjoyment.
Horton *et al*. [17]	Company intranet	Perceived usefulness and perceived ease of use.
Hsu *et al*. [18]	Online games	Social norms, attitude of user toward technology and flow. Perceived usefulness was found to have no impact.
Hu *et al*. [19]	Use of MS PowerPoint in schools	Perceived usefulness and perceived ease of use determine continued acceptance. Perceived relevance to the teacher's job impacted on perceived usefulness.
Igbaria *et al*. [20]	PC use in SMEs	Perceived ease of use is a dominant factor in explaining perceived usefulness and system usage, and perceived usefulness has a strong effect on system usage.
Lai and Li [23]	Internet banking	Attitude towards technology determined intention to use. Attitude was determined by perceived ease of use and perceived usefulness.
Fang *et al*. [14]	Wireless handheld devices – playing game	Perceived playfulness
Fang *et al*. [14]	Wireless handheld devices – purchasing goods	Perceived usefulness and perceived security
Fang *et al*. [14]	Wireless handheld devices – accessing/managing information	Perceived usefulness and perceived ease of use.
Koufaris [22]	Online shopping	Perceived usefulness and shopping enjoyment determined the user's intention to return to the online shop.
Lee *et al*. [24]	Online learning	Perceived enjoyment and perceived usefulness. Perceived ease of use had no impact.
Lin *et al*. [25]	Instant messaging	Attitude towards technology. Perceived usefulness is not significant.
Saade and Bahil [35]	Online learning	Perceived usefulness and perceived ease of use.
Shang *et al*. [36]	Online shopping	Intrinsic factors explain behaviour. Perceived usefulness (an extrinsic factor) has no impact.
Shih [37]	Enterprise intranet	Perceived usefulness and perceived ease of use.
Szajna [39]	Email	Perceived usefulness main determinant. Perceived ease of use has an impact on perceived usefulness – the easier a system is perceived to be, the more useful it is perceived to be.
Van der Heijden [42]	Movie website	Perceived ease of use the most important determinant, followed by perceived enjoyment and perceived usefulness.
Venkatesh and Brown [43]	PC use in home	Hedonic and social outcomes drove people to adopt
Yu *et al*. [49]	t-commerce	Perceived enjoyment.

Let us start by examining systems that would probably be classed as utilitarian by the majority of users: use of PowerPoint in schools by teachers, use of PCs in SMEs, Internet banking, and general use of wireless handheld devices. Intranets would probably also be classed as utilitarian although it is common to find intra-

nets being used for more than just sharing company information. Many are used as an employee notice board to organise social events etc. This was not the case in the Horton *et al*. [17] study and we will assume that it was not the case in the Shih [37] study, so that intranets are classed as utilitarian. All of these studies are basically in agreement with the original TAM – acceptance is determined by perceived ease of use and usefulness. (The two studies of email systems concur with this. It is thought that email would fall into either the utilitarian or dual quadrant. Certainly when the Davis [11] study occurred, email was not used in the personal way it is today and would probably have been classed as utilitarian. This may also apply to the Szajna [39] study, although around this time the context probably started to change.)

The only two systems in Table 2 that would be recreational for the majority of users are the online games and the wireless handheld devices used for gaming. With online games, it is possible that gamers get something out of the interaction other than just enjoyment, for instance they might make friends, however it is felt that even if this is the case, these systems would still be classed by the majority as recreational. Use of both these systems is determined by perceived enjoyment and not perceived ease of use or perceived usefulness. (Perceived playfulness, and in the study of online games, attitude toward using technology, both equate to perceived enjoyment.) The study of instant messaging used college students as respondents. It is thought that this system would be classed as recreational if instant messaging still has novelty value for the users, and dual if that novelty value has worn off. It is unknown exactly what the respondents use messaging for as the authors of this study did not ask them.

If we look at the dual quadrant, three of the systems in the list are known or thought to lie here. Despite claiming it is purely recreational, the movie website studied by Van der Heijden [42] is probably dual. The word processor and graphics package studied by Davis *et al*. [12] is used in part for fun (this is known as these authors asked respondents this) and likewise, the wireless handheld devices used for transactions were probably dual.

All these studies agree that perceived usefulness and perceived enjoyment were the determinants of use. It is uncertain if the online learning environment studied by Lee *et al*. [24] would be classed as dual but we can imagine that it might by some users. In any case, the determinants are the same as for the other dual systems. PC use in the home would likewise probably be dual and use is determined by hedonic and social outcomes. The determinants of use in the studies of online shopping are mixed. One reason for this may be the sheer variety of shopping activities (shopping for food, clothes, gifts, shopping as 'therapy' etc.).

Context of use therefore clearly has an impact on the determinants of use. This makes measuring it important.

SCALE DEVELOPMENT AND PRETEST

A series of steps taken from Davis [11] were followed to develop multi item scales with high reliability and validity. The definitions shown in Section 2 were used to generate 14 candidate items for each of the two constructs. The items are shown in Tables 3 and 4. In Tables 3 and 4, each item makes reference to 'SYSTEM X' which would be the information system under study. The items are similar, which is deliberate as they are intended to measure the same underlying construct.

Technology acceptance studies (and indeed many other studies) often use around 5 items to measure 1 construct. The reason for this is that different users may assign a slightly different meaning to each item when they read it. Using more than one item reduces this effect. 14 items were developed to allow for elimination of unsuitable ones. Pre-test interviews were then conducted to assess the meaning of each item and examine how closely it approximates the construct.

The pre-test interviews were conducted with a mixture of faculty, postgraduate students and university administrators. The interviews were intended to enhance the scales' validity by ensuring that each item corresponds with the definitions of each construct. Fifteen interviewees were asked to perform two tasks taken from Davis [11]: prioritisation and categorisation.

Table 3: Potential items for utilitarian context

In relation to the use of SYSTEM X that has just been discussed, please state how much you agree with the following items:
1.I find X useful
2.I never use X for longer than is necessary
3.It is necessary for me to use X
4.It is essential for me to use X
5.I use X as it's the best way of getting the task done
6.I use X to complete a task
7.I only use X to achieve something
8.Using X increases my performance at getting the task done
9.Using X increases my productivity on the task
10.Using X saves me time
11.Using X wastes my time
12.After using X I always have something to show for it
13.I always close down X immediately after I complete my task
14.It would be difficult for me to do the task without X

Table 4: Potential items for recreational context

In relation to the use of SYSTEM X that has just been discussed, please state how much you agree with the following items:
1.Using X is fun
2.I use X just for the sake of it
3.I enjoy using X
4.Other than a positive feeling I don't get anything out of using X
5.I could while away long hours by using X
6.I could spend a lot of time using X without meaning to
7.I look forward to using X
8.I get a positive feeling from using X
9.I use X to escape from it all
10.After I use X I don't have anything useful to show for it
11.Using X is a good way of passing the time
12.I get a good feeling from using X
13.I only use X when I have some spare time
14.Using X relaxes me

In the first task, prioritisation, interviewees were given one of the context definitions shown in Section 2 to read and were then shown the corresponding 14 items. They were asked to rank each item according to how well its meaning matched the definition. This was then repeated with the second context. This allows items most closely matching the definitions to be kept and others removed. For the second task, interviewees were asked to group the items for one of the contexts into categories so that items in each category were similar in meaning to each other and dissimilar in meaning from the other categories. Again this was repeated with the second context. This allows the items to be put into clusters which identifies if there are any aspects of the definitions which are over or under represented by the items. If parts are under represented new items can be added. If parts are over represented, items can be removed.

The goal of the pretest was to reduce the number of items for each context by around 4. Prioritising the recreational items revealed that respondents thought that items 2,10,6 and 13 matched the definition least. Categorisation revealed 3 clusters. The first (items 1,3,14,8,7,12) seems to capture the 'good feeling' aspect of the definition. Cluster 2 (items 11,6,5,13) is all about spending time using the IS. Cluster 3 (items 2,9,10,4) seems to be about not having a product at the end of the interaction. Removing items 2,10,6 and 13 would therefore leave cluster 1 with 6 items and the others with only 2. It was decided to do this with the understanding that at the end of Study 1 when more items would be removed, items should be removed from cluster 1 in preference to clusters 2 and 3.

Prioritising the utilitarian items revealed that respondents thought that items 11, 13 and 2 matched the definition least. 4 clusters were found. Cluster 1 (items 14,5,4,3) relates to how necessary the system is in performing a task. Cluster 2 (items 8,9) refers to the efficiency of the IS in doing the task. Cluster 3 (items 2,10,13,11) is about not wasting time by using the IS. Finally, cluster 4 (1,7,6,12) captures using the IS to achieve something useful. Removing items 11,13 and 2, practically removes cluster 3 which indicates that not wasting time is not seen by respondents as part of the definition of a utilitarian system. (As an aside, this actually may make sense conceptually – many people use systems at work because 'that's what the company uses' and not because they are necessarily efficient.)

Since context is dependent on use, when these items are used to measure context a specific use for the system must be given. Whatever system is being studied should be set in context by specifying to respondents to consider the 'use which has just been discussed', which makes reference to instructions which would be given to respondents prior to looking at the items.

STUDY 1

A study was conducted to assess the reliability, convergent validity, discriminant validity and factorial validity of the multi-item scales from the pre-test. A sam-

ple of 90 undergraduate students was asked to state how much they agree with the 10 items for the recreational, and 11 items for the utilitarian contexts, for four systems that should have been familiar to them. The four were a student portal called Nexus used to sign up to tutorials and as a repository for module materials, the university email system, MS Word, and the card game Solitaire. In accordance with Section 3.1.1, a use for each system was specified to respondents. The students were asked to consider using Nexus to print lecture slides, keeping in touch with a friend back home using the university email system, writing a dissertation using Word and playing Solitaire while waiting for a tutorial to start. A seven point Likert scale was used with anchors from strongly agree to strongly disagree. The instructions told students to ignore a section if they had never used that system. 26 responses were received (29%). All but 3 respondents answered for all four systems; these 3 had not used Solitaire before.

RELIABILITY AND VALIDITY

The 10 items for the recreational context construct achieved Cronbach's alpha reliability scores of .90 for Nexus, .94 for the email system, .94 for Word and .93 for Solitaire. The 11 items for the utilitarian context construct achieved Cronbach's alpha reliability of .89 for Nexus, .87 for the email system, .96 for Word and .91 for Solitaire.

Factorial validity was assessed by principle component analysis to determine if the items form two separate constructs. The data were pooled from the four systems giving 101 observations. Table 5 shows the results. These demonstrate that the utilitarian items and recreational items load onto distinct factors.

Convergent validity exists when items which are intended to measure one construct are demonstrated to be related to each other. Discriminant validity exists when items which are intended to measure different constructs are demonstrated to be unrelated to each other. This was assessed by multitrait-multimethod (MTMM) analysis (Campbell and Fiske [9]). The MTMM matrix shows the correlations between each item for the four systems. Interpreting the matrix is not an exact science but essentially correlations in the heterotrait-monomethod triangles and validity diagonals should be high while correlations in the heterotrait-heteromethod triangles should be low. (The heterotrait-monomethod triangles show the correlations among each system measured with one item. The validity diagonals show the correlation between each system measured with each item. The heterotrait-heteromethod triangles show correlations between different systems measured with different items.)

Table 5: Factor analysis of utilitarian and recreational questions from study 1 (absolute values under 0.4 suppressed, no rotation used, n = 101)

Item		Factor 1 (utilitarian)	Factor 2 (recreational)
Utilitarian	1	0.67	
	2	0.92	
	4	0.91	
	5	0.87	
	6	0.87	
	7	0.62	
	8	0.88	
	9	0.85	
	10	0.86	
	12	0.74	
	14	0.79	
Recreational	1		0.83
	3		0.87
	4	-0.61	0.44
	5		0.68
	7		0.88
	8		0.90
	9		0.65
	11		0.81
	12		0.90
	14	-0.42	0.58

For the recreational scale, 83% of the correlations in the validity diagonals were significant at the 5% level, with 66% being significant at 1%. 47% of the correlations in the hetrotrait/monomethods triangles were significant at the 5% level with 37% being significant at 1%. Only 16% of the correlations in the hetrotrait/hetromethods triangles were significant at 5%.

The utilitarian scale performed less well, but still adequately. 65% of the correlations in the validity diagonals were significant at the 5% level, with 53% being significant at 1%. However, only 7% of the correlations in the hetrotrait/monomethods triangles were significant at the 5% level with 5% being significant at 1%. 5% of the correlations in the hetrotrait/hetromethods triangles were significant at 5%.

The factor analysis and the MTMM analysis support the construct validity of the two scales.

SCALE REFINEMENT

11 items is perhaps too many to use in testing situations. As was said earlier, many constructs are measured with 4 or 5 items. Based on Study 1, the scales were reduced to 5 items each. Those with the highest validity diagonals and heterotrait-monomethod triangles were retained. For the recreational scale items 1, 3 and 14 from Cluster 1 were removed, as were items 4 (Cluster 3) and item 5 (Cluster 2). This left:

1. I look forward to using X
2. I get a good feeling from using X
3. I get a positive feeling from using X
4. Using X is a good way of passing the time
5. I use X to escape from it all

Redoing the MTMM analysis after refinement meant that 91% of the correlations in the validity diagonals were significant at the 5% level, with 67% being significant at 1%. 50% of the correlations in the hetrotrait/monomethods triangles were significant at the 5% level with 43% being significant at 1%. Only 17% of the correlations in the hetrotrait/hetromethods triangles were significant at 5%.

For the utilitarian scale, items 4, 6, 7, 10, 12 and 14 were removed. This completely deletes Cluster 3, from which only one item was left after the pre-test. It leaves two items from Cluster 1 (items 3 and 5), two items from Cluster 2 (8 and 9) and one item from Cluster 4 (item 1).

1. Using X increases my performance at getting the task done
2. Using X increases my productivity on the task
3. I use X as it's the best way of getting the task done
4. I find X useful
5. It is necessary for me to use X

Redoing the MTMM analysis after refinement meant that 80% of the correlations in the validity diagonals were significant at the 5% level, with 75% being significant at 1%. 10% of the correlations in the hetrotrait/monomethods triangles were significant at the 5% level with 7% being significant at 1%. 8% of the correlations in the hetrotrait/hetromethods triangles were significant at 5%.

STUDY 2

The proposed scales were piloted in an applied testing situation. The respondents were users of a system designed to program Lego robots. 34 responses were received. The request for participation was posted on the popular Lego bulletin board Lugnet, where an estimated 150 people would have read it giving a response rate of 26%. (This estimation was made from the user statistics of the message board website and from the experience of other online surveys of hobbyists such as Chesney [10]). The survey asked respondents to state how much they agreed with the ten statements using a seven point Likert scale with anchors from strongly agree to strongly disagree. The use that was specified for the system was using it to create a robot which would follow a moving light source.

Cronbach's alpha scores for the two scales were .85 for utilitarian and .82 for recreational. Factorial validity was assessed as before by principle component analysis. The results are shown in Table 6. While the factorial analysis results looks inconclusive, it should be noted that most users use this system for both fun and for usefulness and so the utilitarian and recreational contexts were correlated i.e. both were often high. This would have impacted on the results of the factorial analysis.

To examine the relationship of the scales with context, respondents were shown a version of Figure 1 and asked to state in which quadrant their perceived use of the system lies. Averaging answers for the 5 utilitarian items and the 5 recreational items gives the degree to which the user is using the system in each context. According to a strict interpretation of Figure 1, a respondent scoring less than 4 (halfway between the 1 and 7 anchors on the Likert scale) in both is classing their system as 'Useless'; greater than 4 in Utilitarian, less than 4 in Recreational would be 'Utilitarian'; greater than 4 in both would be 'Dual'; and less than 4 in Utilitarian, greater than 4 in Recreational would be 'Recreational'. However this strict interpretation of Figure 1 is inappropriate. These are psychometric scales and Figure 1 is only intended to be illustrative; there is no definite point where a system stops being used in one context and starts being used in another; a grey area exists between them. However, for the purposes of this study, to examine whether the scores respondents achieve on the scales does have a relationship with their perceived context of use, such a point must be specified. If, instead of using (4,4) as the cut off coordinates between the four quadrants, (5,5) is used (i.e. the area classed as Dual is made slightly smaller), then there is a strong statistical relationship, $r = 0.48$ significant at the 1% level, between respondents' scores in the scales and the quadrant in which they perceive their use of the system to be in. (Moving the cut point is appropriate as the respondents, who were all adult fans of Lego, are likely to tend to be more positive about the system than negative i.e. they are less likely to give responses at the lower end of the scales.)

The scales have so far been used in two further studies and in both cases, there has been a strong positive

relationship between scores achieved for each context and the user's self reported perceived context of use.

Table 6: Factor analysis of utilitarian and recreational questions from study 2 (absolute values under 0.4 suppressed, Varimax rotation used, n = 34 Util = Utilitarian scale, Rec = Recreational scale)

Item	Factor 1	Factor 2
Util1	0.90	
Util2	0.94	
Util3	0.73	0.45
Util4	0.71	
Util5	0.47	0.48
Rec1	0.63	0.53
Rec2	0.77	0.48
Rec3	0.77	0.46
Rec4		0.69
Rec5		0.67

CONCLUSIONS

This project aimed to develop and validate two new scales to measure the degree to which a system is being used in utilitarian and recreational contexts, two separate dimensions of use which are theorised to impact on the appropriate model of acceptance. The scores respondents give on each construct's items are averaged to give that respondent's degree to which they are using in each context. The scales are intended to be used on users of a system rather than potential users of a system. Researcher's can apply these scales to individual users to determine their context of use. For example, a researcher interested in studying the determinants of acceptance of a system which is used for fun, could apply the scales to respondents and filter out users who are using for utilitarian reasons. Or a researcher examining a system which is used in different contexts by different users (e.g. the web) could include the scales in their survey instrument to examine whether context had a moderating effect on the determinants of adoption.

The scales exhibited good psychometric properties. Strong reliability was seen, as was excellent factorial validity and the scales demonstrated good convergent and divergent validity. In addition, they correlated well with the self reported context of use. Their generality remains to be seen by future research.

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