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Measuring task-specific perceptions of the world wide web

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This paper describes the development of multi-item scales for measuring user perceptions of the ease-of-use and usefulness of the Web (hereafter web), incorporating a system task focus into the scales dimensional structure (e.g. how easy or useful the web is for information search, communication and or purchasing). The items are tested on 2077 web users recruited using a web survey, revealing four factors for each scale. Perceived ease-of-web use consists of learning, search and find, transaction and communication ease, and perceived web usefulness consists of communication, purchase, information search and acquisition, and access to quality products and information. A regression analysis on web usage frequency shows how easy users find it to learn how to use the web and how useful the web is for purchasing are the best predictors of how frequently they will use the web. These results highlight the importance of training users how to effectively use hypermedia-based systems like the web, and the design of systems that are easy to navigate and that provide advanced functionality for transactional activity.

Keywords: Usability; Technology Acceptance Memo (TAM); Ease of use; Usefulness; System-task focus; World wide web (Web)

1. Introduction

As the electronic systems we design become more interactive and complex, and the tasks for which they are used becomes varied, developing models and profiles of system usability is of increasing importance. The human – computer interaction (HCI) community has a long-established history of research in this area, placing emphasis on issues of design and evaluation of systems to enhance usability. In accordance, the HCI community and International Standards Organisation (ISO) have developed principles to guide usability in system design (Bevan 2001). In ISO 9241-11, for example, usability is viewed as a quality objective and defined as the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use (Bevan 1995, Bevan 2001, Abran *et al*. 2003). The key elements of ISO 9241-11 includes: the effectiveness of use – the accuracy and completeness with which users achieve specified goals; the efficiency of use – the resources expended in relation to the accuracy and completeness with which the user achieve goals; and the satisfaction derived from use (ISO 9241-11 1992/2001). Now this provides for appropriate performance targets for design and system testing, aiding the production of a well-engineered artefact, or a system that 'can' be used. However, as noted by Dillon and Morris (1999), in addition to identifying if a user 'can' use the system, usability research also needs to help profile if a user 'will' use the system. Thus we turn our attention to the role of usability in determining user acceptance of technology.

In the field of management information systems (MIS), a powerful tool developed to model the dynamics of technology acceptance in individual users by profiling their reactions to the system is the Technology Acceptance Model (hereafter TAM). TAM is a research model that looks at the effect that system characteristics have on user perceptions and consequent acceptance of computer-based information systems (Davis 1986). In brief, a potential user's overall attitude towards using a given system is hypothesised to be a major determinant of whether or not s/he actually uses it. This attitude towards using it is in turn a function of two major beliefs: perceived usefulness and perceived ease-of-use. This approach is consistent with the

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adoption theory put forward by Moore and Benbasat (1991), who found that three innovation characteristics – compatibility, relative advantage and complexity – are consistently related to adoption. Relative advantage is akin to 'perceived usefulness' and complexity is likened to 'perceived ease-of-use'. However, a major limitation of TAM for profiling user perceptions of certain complex systems like the web, is its lack of task focus, i.e. the specification of tasks for which the system will/can be used.

In this study, we examine the measurement of the two underlying perceptions of TAM – perceived ease-of-use and perceived usefulness – for the system context, the web, and further refining the measures by incorporating a system task focus. In summary, the development of these scales to include certain task characteristics is believed to provide a more realistic and credibile measurement device for this sytem and further insight as to the key antecedents of a user's overall perception of the web.

2. Technology Acceptance Model (TAM)

2.1 *TAM background*

Understanding why people accept or reject electronic technology has proven to be one of the most challenging issues in information systems research (Swanson 1988). A long-standing objective of MIS research has been to improve our understanding of the factors that influence successful development and implementation of computer-based systems in organisations (Keen 1980). Studies from these areas have investigated the impact of users' internal beliefs and attitudes of computer-based systems on consequent usage behaviour (Srinivasan 1985, Swanson 1987). Furthermore, they have examined how these internal beliefs and attitudes are influenced by various external factors (e.g. system technical design) (Benbasat and Dexter 1986) and user characteristics (e.g. cognitive style) (Huber 1983). However, research findings have been mixed and inconclusive about user perceptions as determinants of user adoption, acceptance and system use.

From this premise, an adapted form of the theory of reasoned action (TRA) (Fishbein and Ajzjen 1975), i.e. TAM was developed and tested (Davis 1986). TAM was developed to explain user acceptance and adoption of computer-based information technology and is based on two underlying system perceptions: 'perceived usefulness' and 'perceived ease-of-use' (Davis 1986). Tested from an organisational perspective, perceived usefulness is defined as 'the degree to which an individual believes that using a particular system would enhance his or her job performance' and perceived ease-of-use is defined as 'the degree to which an individual believes that using a particular system would be free of physical and mental effort' (Davis 1986). In the survey research conducted, Davis (1986) found that: a) system design features had a significant effect on perceived ease-of-use and attitudes to use, but not on perceived system usefulness; b) perceived ease-of-use had a significant effect on both usefulness and attitude to use; c) perceived usefulness had a significant effect on attitudes to use and usage behaviour; and d) attitude toward usage had a direct effect on usage behaviour. Research has validated TAM using several different applications including email, voice mail, word processing and spreadsheet information systems (Davis *et al*. 1989a, Chau 1996, Bronson 1999).

Of specific interest to this study is the TAM application to the web. With specific reference to the web it has been found that: a) perceived usefulness and perceived ease-of-use predict usage, but that usefulness had a stronger effect; b) perceived usefulness has a significant effect on behavioural intention; c) behavioural intention has a significant influence on usage; and d) perceived ease-of-use had a significant effect on perceived enjoyment (Moore and Benbasat 1991, Fenech 1997, Morris and Dillion 1997, Teo *et al*. 1999, Lederer *et al*. 2000, Moon and Kim 2001). However, inconsistent findings in the testing of TAM have been reported (see Legris, Ingham and Collerette (2003) for a detailed review).

2.2 *TAM and inconsistent findings*

Inconsistent findings in the testing of TAM might be a consequence of the predominate use of unidimensional scales to measure the two underlying perceptions of TAM. As these scales measure a user's 'overall' perception of the system, they might provide little insight as to the users' perceptions of how easy or useful the system is for the conduct of specific tasks and/or activities. For example, Dishaw and Strong (1999) indicate that information and communication technology is a tool for which users accomplish certain organisational and/or in some cases personal goals and thus inclusion of task characteristics may further provide a better model of system utilisation. Therefore, this study aims to test multidimensional measures of the underlying perceptions of TAM for the system context, the web, that incorporate a system task focus.

The main focus for a large percentage of TAM studies has also been the investigation of the relationship between user perceptions of the system and system use in an organisational or educational setting, where frequency of use of the system is often mandated by work-related or educational usage motivations (e.g. word processing or organisational communication). Less attention has been paid to non-organisational settings. With new developments in information and communication technologies and the changing profile of users (i.e. with both advanced and limited computing experience), motivations for usage may be changing. So too might the environment within which

the use of technology occurs. Therefore this study aims to explore the performance of the scales on users, defined by non-mandated use (i.e. web users).

These considerations as to the systems user, usage tasks and usage environment in usability measurement are consistent with HCI research and standards on usability (e.g. ISO 9241-11,) where it is viewed that usability of any given system is dependent on the systems 'context of use' (Abran *et al.* 2003).

3. System perceptions: incorporating a task context

From the aforementioned discussion of TAM, and the context within which the model has been tested, it is deemed necessary to test TAM on a system characterised by a number of use tasks and/or activities, hence the web on the Internet was selected.

3.1 *Task-oriented system perceptions*

The web enables users to engage in both interactivity with the system (machine interactivity) and through the system (person interactivity) (Hoffman and Novak 1996), with further growth evident in transaction and purchase-oriented interactivity (machine and person interactivity) (Phau and Poon 2000). In a report on Internet User Trends from a sample of 25,000 Internet users, machine interactivity activities such as information search and acquisition were identified as the main use of the Internet/web by 64 per cent of participants (www.consult.com.au 1999). In addition, person interactivity was reported as the main use of the Internet/web through the use of email and chat by 28 per cent and 7 per cent of participants, respectively (www.consult.com.au 1999). In this report, person interactivity included the use of web-based email (e.g. Hotmail.com, or Yahoo! mail), web supported newsgroups, chatrooms, billboards and non-browser-based email software (i.e. Pegasus®, Eudora®, Lotus Notes®). Transaction activities such as online shopping and financial transactions were an additional task reported, however www.consult.com.au (1999) only reported 1 per cent of users identifying it as the main reason they use the Internet/web.

Machine and person interactivity are thus the key activities for which users use the web, with growth evident in transactional tasks. Therefore, for the study tested here, the two underlying perceptions of TAM – perceived ease-of-use and perceived usefulness – will be defined and measured within the system – task context of information search and acquisition (machine interactivity), communication (person interactivity) and also for the conduct of purchase or transactional activities (transaction-based interactivity), thus avoiding the 'limited task focus' and unidimensional measurement of system perceptions apparent in other TAM studies.

To correspond with the system – task focus, the construct of perceived ease-of-web use (PEWU) is defined in this study as 'the degree to which a user believes that using the web for particular activities/tasks is free from effort'. It is predicted that this construct will comprise five dimensions consisting of how easy users perceive the web: overall, to learn how to use, to communicate, to search and find information, and to conduct transactions. Furthermore, the construct perceived web usefulness (PWU) is defined here as 'the degree to which a user believes that using the web will enhance his or her usage performance of particular tasks or activities'. It is predicted that this construct will comprise three dimensions of how useful users perceive the web for: communication, acquiring information and for purchasing goods and services. As such, these definitions are not constrained by an organisational context or general perceptions of use used in earlier measures of the constructs.

3.2 *Relationships between task-oriented web perceptions*

To explore the task-oriented context of the PEWU and PWU measures refined here, a relationship proposed by Davis (1986) and further validated by other researchers of TAM will be further investigated. It was originally hypothesised that perceived ease-of-use will have a significant direct effect on perceived usefulness stating that, all else being equal, a system that is easier to use will result in greater usefulness for the user (Davis 1986). Davis reported a relatively strong relationship between perceived ease-of-use and perceived usefulness ($r = .64$). For non-web-based electronic systems, this hypothesis has been further supported within the literature (Davis *et al.* 1989a, Davis *et al.* 1989b, Adams *et al.* 1992, Taylor and Todd 1995, Igbaria *et al.* 1995, Chau 1996, Gefen and Keil 1998, Bronson 1999, Karahanna and Straub 1999). In addition, with respect to web-based systems, and as tested in an organisational usage context, a positive relationship has also been supported (Morris and Dillion 1997, Teo *et al.* 1999, Moon and Kim 2001). Consistent with past research, it is proposed that this relationship will be supported in this study (H1) when tested using a summated version of each scale.

H1: Perceived ease of web use will have a positive relationship with perceived web usefuless.

Of key interest to this study, is the relationship between the underlying factors of PEWU and PWU. It is proposed that user perceptions of how easy the web is to use for certain tasks will have a stronger positive relationship with user perceptions of how useful the web is for similar usage tasks (H2). For example, how easy users find the web for communication will have stronger relationship with how useful they find it for communication than how useful they find it for information search and acquisition.

H2: Perceived ease of web use will have a stronger relationship with perceived web usefulness for related rather than unrelated usage tasks.

3.3 *Task-oriented web perceptions and web usage frequency*

It has been further hypothesised that perceived ease-of-use and perceived usefulness will have a significant effect on usage frequency (Davis 1986). Therefore, all else being equal, a system that is easier to use and more useful to the user will be used more frequently. Researchers have found a positive relationship between perceived ease-of-use and usage frequency for non-web-based systems (Davis *et al*. 1989b, Adams *et al*. 1992 (study 1), Igbaria *et al*. 1995). However, inconsistency in findings is also evident in the literature with studies also reporting a minimal or no relationship between perceived ease-of-use and usage frequency (Davis 1986, Adams *et al*. 1992 (study 2), Bagozzi *et al*. 1992, Taylor and Todd 1995). With respect to the Internet and web-based systems, increased consistency in support for a relationship between PEWU and current web session usage frequency is evident (Fenech 1997, Karahanna and Straub 1999, Teo *et al*. 1999, Lederer *et al*. 2000). It is further evident in the literature that perceived usefulness is reported as having a stronger relationship than perceived ease-of-use with usage frequency for non-web-based (Davis 1986, Davis *et al*. 1989b, Adams *et al*. 1992) and web-based systems (Fenech 1997, Gefen and Straub 1997, Karahanna and Straub 1999, Teo *et al*. 1999, Lederer *et al*. 2000). Thus the more useful the web is perceived the higher the frequency of use of the web. In this study, we examine the difference of using summated unidimensional and multidimensional scales of web perceptions on web usage frequency.

First, consistent with the literature on web-based systems it is proposed that both user perceptions of how useful and easy the web is to use will have a positive effect on usage frequency (H3).

H3: Perceived ease of web use and web usefulness will have a positive relationship with usage frequency of the web.

It is further proposed that given the differing tasks for which the web is used, task-oriented perceptions of the web will differ in their prediction of how frequently users use the web. For example, given the degree to which users use the web for information search acquisition, how easy and useful they find the web for information search and acquisition will be a stronger predictor of web session usage frequency than how easy and/or useful they find the web for purchasing.

H4: Task-oriented perceptions of how easy and useful the web is to use will differ in their effect on web usage frequency.

4. Methodology

4.1 *Participants and sampling design*

To test the performance and structure of the scales used to measure the constructs of interest in this study, and examine the relationships proposed, a single cross-sectional web-based survey design was used to collect data from a sample of web users. In 2001, 2,246 participants were recruited with 169 responses removed due to duplicate and/or incomplete responses, thus leaving 2,077 usable participant responses. To acquire a sample as representative as possible of the web population at the time of data collection, participants were recruited from a banner ad campaign (43 per cent), a website link (27 per cent), an email or email list (13 per cent), offline promotion and advertising (4 per cent), a search engine query (2 per cent), word-of-mouth (2 per cent) and, subsequently, 9 per cent from 'other' sources. From the website log file analysis, of those who visited the website during the study (unique visitors: $n = 5104$) a total of 41 per cent submitted a usable survey. According to the banner advertising reports, a total of 867,617 unique users were exposed to the banner ads, with 893 usable responses recruited from these unique users. This provides a usable response of 0.1 per cent from web users exposed to the banner advertising.

The sample recruited has an even gender distribution (56 per cent male), 48 per cent of participants are aged 31 and over, 45 per cent of the sample are full-time wage earners with only 19 per cent currently study an undergraduate or postgraduate degree. Furthermore, over 50 per cent had achieved an undergraduate university degree or higher, indicating a highly educated sample. This profile is demographically representative of the national web user population at the time of data collection (Netratings 2000, ABS 2000, NOIE 2001).

4.2 *Measures*

4.2.1 Perceived ease of web use and perceived web usefulness. Scales for the constructs PEWU and PWU generated by Page and Uncles (2000) are adopted here. Page and Uncles (2000) reviewed earlier research on perceived ease-of-use and usefulness of technological developments in the item generation process to assess existing item structure and design (Davis 1986, Davis 1989a, Davis 1989b, Adams *et al*. 1992, Segars and Grover 1993, Handzic and Low 1999). In order to establish initial content validity, the item generation process also involved: an expert survey, website content analyses, browser help files content analyses, a novice observational study and in-depth interviews. Specifically, each with a Likert-question-response format, 20-scaled items were generated to measure PEWU and 23-scaled items to measure PWU.

The properties and dimensionality of the scale items generated were tested using data collected using paper-based in-class surveys from undergraduate and postgraduate student samples. These samples were selected, based on web usage experience (i.e. low, medium and high) and were aggregated for data analysis. Page and Uncles (2000) identified 14 items that reliably measure three factors of 'behavioural', 'informational' and 'transactional' PEWU and 14-items that reliably measures the PWU for 'purchase', 'communication', 'information acquisition' and 'product and information quality'. The results of the scale testing is discussed in detail in Page and Uncles (2000) and reported in table 1.

4.2.2 Web session usage frequency. To measure current web session usage frequency, one item with an eight-category multiple-choice response option as developed by Page (2003) was used. The eight response options included: 5 or more times a day; 2 – 4 times a day; once a day; 4 – 6 times a week; 2 – 3 times a week; once a week; once every two weeks and once a month.

4.3 *Data analysis*

The first stage of data analysis consisted of a factor analysis (Principle Components Analysis (PCA), Varimax rotation) to identify and confirm the performance and dimensionality of the multi-item scales: PEWU and PWU. The robustness of the scales was assessed by internal consistency reliabilities as indexed by Cronbach's coefficient alphas and was within the guidelines of Nunnally (1978).

The relationships proposed between the constructs outlined in this paper were examined by means of Spearmans rho correlation coefficient and stepwise multiple regression analyses. Given the large sample size used, a stringent p level ($p < 0.001$) was used to report statistical significance.

Table 1. Scale development statistics for PEWU and PWU scales.

Scale and dimension	D	VAR%	α
Perceived ease-of-web-use (14-item interval scaled)	3	72	.9
Behavioural	D1	29	.9
Informational	D2	29	.9
Transaction	D3	13	.8
Perceived web usefulness (14-item interval scaled)	4	70	.9
Communication	D1	20	.9
Purchase	D2	19	.9
Info. Search/acquisition	D3	18	.7
Quality access	D4	12	.7

Note: D = Dimension/Factor; VAR = Per cent of variance explained; α = Reliability Alpha.
$n = 128$.
Source: Page and Uncles (2000).

These techniques were selected, given the objective of the study to test and further examine the underlying dimensions of the constructs PEWU and PWU and explore the relationship between these underlying dimensions and a user's frequency-of-web-session use.

5. Results

5.1 *Factor analyses and scale reliabilities*

5.1.1 Perceived ease of web use. Initial data screening and analysis of the correlation pattern showed that all of the 14 items, individually and collectively, met the necessary threshold of sampling adequacy for factor analytical investigations (KMO Measure of Sampling Adequacy = 0.91, Bartlett's Test of Sphericity: Approx. Chi-Square = 11372.124, df = 91, Sig. = .000). From this analysis, 3-items were removed due to factor loadings below ± 0.60 resulting 11-items. Thus the PEWU scale comprises 11-items with a total reliability of 0.9. These 11-items measure four dimensions that explain a corrected 64 per cent of the variance of PEWU.

As shown in table 2, dimension 1 comprises 4-items with factor loadings 0.68 – 0.81. This dimension explains 24 per cent of the variance with a reliability of 0.9. Dimension 1 was labelled 'Learning' because it comprised items relating to how easy users perceive it is to learn how to use the web, for example, learning how different features work and what different features are. Dimension 2 comprises 2-items with factor loadings 0.75 – 0.86. This dimension explains 15 per cent of the variance with a reliability of 0.8. Dimension 2 was labelled 'Search and Find' because it comprised items relating to how easy users perceived it is to search and/or find information on the web. Dimension 3 comprises 2-items with factor loadings 0.78 – 0.83. This dimension explains 13 per cent of the variance with a reliability of 0.7. Dimension 3 was labelled 'Transactions' because it comprised items relating to how easy users perceived it was to conduct transactions or book and/or purchase goods and services on the web. Dimension 4 comprises 3-items with factor loadings 0.62 – 0.75. This dimension explains 12 per cent of the variance with a reliability of 0.6. Dimension 4 was labelled 'Communication' because it comprised items relating to how easy users perceived it was to communicate through the web.

In summary, the 14-items measuring PEWU differ in dimensionality between the student samples used in Page and Uncles (2000) and web sample in this study. In fact, four dimensions have been identified in the web sample, as opposed to only three dimensions in the student sample. The reliability of the scale remains consistently high though for both samples, despite the removal of 3-items from the scale analysis due to low scale-item correlations. Different dimensionality might be explained by the fact that the web

Table 2. Item/factor scores and scale statistics for the scale: PEWU.

Scale Items	FS	D	VAR%	α
Perceived ease-of-web-use (11-item summated scale)	–	4	64%	0.9
Learning how the different features of the web work is easy	.81			
Learning what the different features of the web do is easy	.79			
Information about the web is easy to acquire	.77	D1	24%	0.9
It is easy to gain knowledge about using the web	.68			
It is easy to search for information on the web	.86			
It is easy to find information on the web	.75	D2	15%	0.8
Booking goods and services is easy to do on the web	.83			
Purchasing products is easy to do on the web	.78	D3	13%	0.7
Communicating with companies is easy to do through the web	.75			
The information on the web is flexible to interact with	.69	D4	13%	0.6
Communicating with individuals is easy to do through the web	.62			

Note: FS = Factor score; D = Dimension; VAR = Per cent of variance explained; α = Cronbach alpha.
D1 = Learning ease; D2 = Search and find ease; D3 = Transaction ease; D4 = Communication ease.
$n = 2077$.

sample has different experience and/or motivations for web use than the student sample, and thus find different tasks more or less easier to use and useful.

5.1.2 Perceived web usefulness. Initial data screening and analysis of the correlation pattern showed that all 14-items, individually and collectively, met the necessary threshold of sampling adequacy for factor analytical investigations (KMO Measure of Sampling Adequacy = 0.88, Bartlett's Test of Sphericity: Approx. Chi-Square = 12614.496, df = 91, Sig. = 0.000). The final PWU scale thus comprises 14-items with a total reliability of 0.9. These 14-items measure four dimensions that explain a corrected 70 per cent of the variance of PWU.

As show in table 3, dimension 1 comprises 5-items with factor loadings 0.66 – 0.84. This dimension explains 23 per cent of the variance with a reliability of 0.9. Dimension 1 was labelled 'Communication' because it comprised items relating to how useful users perceived the web to communicate through. For example, communication is fast and efficient through the web. Dimension 2 comprises 4-items with factor loadings 0.72 – 0.83. This dimension explains 20 per cent of the variance with a reliability of 0.8.

Table 3. Item/factor scores and scale statistics for the scale: PWU.

Scale items	FS	D	VAR%	α
Perceived web usefulness (14-item summated scale)	–	4	70%	0.9
Communication with organisations through the web is fast	.84			
Communications with organisation is very efficient through the web	.82			
The web is useful for communicating with organisations	.78	D1	23%	0.9
Using the web to communicate with organisations saves me time	.76			
The communication between organisations and consumers is reliable through the web	.66			
Purchasing products is very efficient with the web	.83			
Using the web to purchase products saves time	.82			
Using the web to acquire products is fast	.79	D2	20%	0.8
The web is useful for the purchase of products	.72			
Using the web to search for information saves time	.83			
The web enables fast acquisition of information	.79	D3	17%	0.8
The web is useful for the acquisition of information	.75			
The web enables access to high quality products	.78			
The web enables access to high quality information	.64	D4	9%	0.6

Note: FS = Factor score; D = Dimension; VAR = Per cent of variance explained; α = Cronbach alpha.
D1 = Communication; D2 = Purchase; D3 = Info Search and Acquisition; D4 = Quality Prod and Info Access.
$n = 2077$.

Dimension 2 was labelled 'Purchase' because it comprised items relating to how useful users perceived the web to purchase goods and/or services. For example, using the web to purchase products saves time. Dimension 3 comprises 3-items with factor loadings 0.78 – 0.83. This dimension explains 18 per cent of the variance with a reliability of 0.8. Dimension 3 was labelled 'Information Search and Acquisition' because it comprised items relating to how useful users perceived the web to search and acquire information. For example, using the web to acquire information is fast. Dimension 4 comprises 2-items with factor loadings 0.64 – 0.78. This dimension explains 9 per cent of the variance with a reliability of 0.6. Dimension 4 was labelled 'Quality Access' because it comprised items relating to how useful users perceived the web as a mean to access quality information and/or products. For example, the web enables access to high-quality information.

In summary the results identify that the 14-items that measure PWU have consistent reliability and dimensionality between both the student samples used in Page and Uncles (2000) and web sample used here.

5.1.3 Current web session usage frequency. Operationalised using an ordinal single-item scale, the item responses were coded from lowest frequency (1 = once a month) to highest frequency (8 = 5 or more times a day), with a median score for the web sample of 7 = 2–4 times a day. By comparison, the median usage frequency category for the student sample was 6 = once a day. Thus although comparable in many respects, the web sample used the web more frequently that the student sample.

5.2 *Relationship between task-oriented web perceptions*

To explore the relationship between overall PEWU and PWU (H1) proposed by (Davis 1986) and further validated by other researchers of TAM, Spearmans rho correlation coefficient is used, the results of which are reported in table 4. In brief a significant positive relationship was found to exist between unidimensional measures of PEWU and PWU ($r = .7$, $p < .01$). Therefore, the easier the web is perceived to use overall has a positive correlation with the more useful users will find the web.

Additional correlations were also conducted to examine the relationship between the task-oriented dimensions of PEWU and PWU (H2). It was found that user perceptions of how easy the web is to use for communication, transactions and information search had higher positive relationships with how useful they perceived the web for similar tasks.

5.3 *Task-oriented web perceptions and web usage frequency*

Investigation of the relationships between overall user perceptions of the web (H3) and user perceptions for specific tasks (H4) and current web session usage frequency is now briefly explored. Table 5 contains the results of the two stepwise multiple regression analyses performed.

5.3.1 Overall user perceptions of the web. Overall PEWU had a significant positive effect on web session usage frequency (WSUF), however only explains 3 per cent of the variance in web session usage frequency. Under the stepwise method, overall perceived web usefulness was excluded from this model.

Table 4. Means, standard deviations and spearman rho correlation coefficients of the scale: PEWU and PWU.

		No. of Items	M	SD	1	2	3	4	5	6	7	8	9	10
1	Ease of web use (total scale)	11	56.30	9.94	1.00									
2	D1: PEWU Learning	4	20.15	4.74	.87**	1.00								
3	D2: PEWU Search/Find	2	10.53	2.56	.75**	.58**	1.00							
4	D3: PEWU Transactions	2	10.06	2.28	.65**	.42**	.36**	1.00						
5	D4: PEWU Communicate	3	15.56	2.95	.75**	.49**	.46**	.44**	1.00					
6	Web usefulness (total scale)	14	71.26	11.81	**.74****	.50**	.52**	.63**	.74**	1.00				
7	D1: PWU Communicate	5	24.78	5.68	.60**	.38**	.38**	.40**	**.78****	.83**	1.00			
8	D2: PWU Purchase	4	19.15	4.50	.56**	.37**	.35**	**.71****	.42**	.77**	.43**	1.00		
9	D3: PWU Search and Acquire	3	17.39	3.03	.58**	**.45****	**.59****	.36*	.48**	.67**	.45**	.36**	1.00	
10	D4: PWU Access Quality (Info/ Products)	2	9.95	2.12	.56**	**.44****	.44**	.42**	.48**	.68**	.42**	.46**	.52**	1.00

**p < 0.01 (1-tailed).
$n = 2077$.

Table 5. Results of the stepwise multiple regression analyses on web session usage frequency (WSUF).

Model	Predictor	B	S.E. (b)	β	R^2	Adj. R^2
Model 1[a]	PEWU (Total Scale)	0.02	0.00	0.17	0.03**	0.03**
Model 2[b]	D1: PEWU – Learning	0.04	0.01	0.15	0.04**	0.04**
	D2: PWU – Purchase	0.02	0.01	0.07		

[a]Excluded variables: PWU (Total Scale).
[b]Excluded variables: PEWU – Search/Find; PEWU Transactions; PEWU Communication; PWU Communication; PWU Information Search and Acquisition; PWU Access to Quality Info and Products.
**p < 0.01.
$n = 2077$.

5.3.2 User web perceptions with a system-task focus. Perceived ease of learning how to use the web and perceived usefulness of the web for purchase both had a significant positive effect on web session usage frequency (WSUF); however, together they only explain 4 per cent of the variance in WSUF. Under the stepwise method, all other dimensions of PEWU and PWU were excluded from this model.

6. Discussion

The statistically significant positive relationship found in this study between 'overall' PEWU and overall PWU is consistent with the findings by Davis (1986) and other researchers as previously mentioned. Of special interest to this study is the findings that highlight the importance of understanding and investigating the perceived usefulness and ease-of-use of electronic technologies for the undertaking of certain tasks, as opposed to just an overall measure. For example, in table 4, how easy users find the web to learn, although significant, does not have a strong relationship with how useful they find it to purchase via this technology. However, how easy they find the web for the search and acquisition of information, for conducting transactions and to communicate, does have a strong effect on how useful they find the web for searching for and acquiring information, for purchasing, for communicating and overall, respectively, thus implicating the importance of profiling task-oriented system perceptions and using multidimensional scales over overall or unidimensional measures of system perceptions.

Furthermore, it was identified that when using an overall measure of system perceptions to determine system usage, as is typically undertaken, that support was found for a significant positive relationship between PEWU and web session usage frequency, but not with PWU. This finding is consistent with the literature on the testing of TAM on Internet and web-based systems (Fenech 1997, Teo *et al.* 1999, Karahanna and Straub 1999, Lederer *et al.* 2000). However, when taking a closer look at perceived ease-of-use and usefulness of the web for specific tasks, it was reported that two specific tasks – how easy users find the web to learn how to use and how useful they find the web for purchasing – had a significant positive effect on WSUF, and were the best predictors of WSUF. From this we can further ascertain that the tasks for which we use electronic information and communication technologies in fact have a very important influence on the degree and nature of the relationship between our perceptions of the system and consequent usage.

As information and communication technology are continuing to develop in both design and multi-functionality, the measures tested here can be used to help profile user perceptions of other information and communication technologies and pinpoint specific areas for system development. In conclusion, in this study improved scales were developed to measure PEWU and PWU for the conduct of specific tasks for which the web can be used. These scales were developed to facilitate the successful design, development and adoption of systems like the web, by taking into account task-specific user perceptions of the web. These system- and task-specific differences may help to explain the inconsistencies evident in the literature on the relationship between system perceptions and system usage.

Further exploration and testing of these differences across both system and user contexts is required and gives studies such as this wider applicability. One extension would be to look at user perceptions and usage of other user-driven electronic technologies, incorporating differing system – task focus. This might include touch-screen electronic kiosks and ATMs, wireless system technologies such as WAP, and iMODE, and electronic organisers like palm pilots. Furthermore, the sample base also could be widened to explore the question of how other samples might score using the scales developed here. In conclusion, this study provides a basis for further investigation and understanding of user-system perceptions and usage.

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