

Perceived Ease of Web Use and Perceived Usefulness of the Web: Multi-item Scale Development

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Abstract

Understanding why people accept or reject electronic technological developments has proven to be one of the most challenging issues in information systems research. This issue is also of growing concern to marketers due to the increasing adoption of electronic technologies by the marketing discipline. Therefore this study used existing scales from research in Management Information Systems (MIS) to develop measures of perceived ease of web use and perceived usefulness of the web. The results identified interval scale items that reliably measured three dimensions of perceived ease of web use and four dimensions of perceived usefulness of the web.

Introduction

With developments in electronic technology, electronic tools and vehicles have increased the exposure of consumers to information sources and channel alternatives that are characterised as highly complex, information-rich and user-directed. The electronic technology of interest to this study is Hypermedia Computer Mediated Environments (hereafter HCME) - notably the World Wide Web on the Internet. This study conceptualises and operationalises user perceptions of the web, namely *perceived ease of web use* and *perceived web usefulness*. The findings give insights into the acceptance and use of HCME-based systems - such as the web - by users and thus assist in the use and design of such systems for marketing purposes in the future.

Literature Review

In the examination of communications, much attention has focused on the study of the components of the message (ie., source, content, etc.) and the effects of such message components on the audience (ie., recall and comprehension) (Weaver 1988). However, as noted by Rice (1984) little effort has been put into the analysis of the interaction between user characteristics and the characteristics of the vehicle. Rice (1984; p20) identified that 'one need not be a technological determinist to agree that the medium may be a fundamental variable in the communication process.' After McLuhan (1984), researchers like Rice (1984) and Rogers (1986) reiterated the importance of the examination of how the technological characteristics of communication can influence both developments of the technology itself and society at large. In brief, developments in electronic technology are changing the roles performed and the level of interdependence between electronic technologies and the user (Mandelli 1997 and Hoffman & Novak 1996).

Traditional communications research has been dominated by 'push strategies' and research investigating consumer responses to push media (eg., broadcast and print media). Hodkinson & Keil (1997) indicate that a lack of scholarly effort is typical of the user-directed media area. Hypertext system interface and design issues, such as button style or window placement, are often the focus of research papers in this area (Rada 1995). However, with user-directed media, such as the web, consumers can exercise unprecedented control over the use and management of the vehicle and vehicle content with which they interact (Rust & Oliver 1994). Because of this active role played by the user, he or she also makes a contribution towards the success of the communication process. Therefore, the biggest differences in the acceptability and usage of a hypertext system, such as the web, may actually be with the characteristics of the users themselves as influenced by characteristics of the vehicle.

Specific issues with regard to the interaction between HCMEs and the user may be present that influence the acceptability and use of HCMEs. Conklin (1987) points out significant problems with using graphical browsers that inhibit HCME use. Foss (1989) further categorised three specific problems of participating in HCMEs: '*lack of closure*', '*cognitive overhead*' and '*learning by browsing*'. These problems with participating in HCMEs may influence users' perception of HCMEs. In turn, this may affect adoption and acceptance of hypertext and

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network-based systems and the content of these systems. Therefore, due to the changing role of the user, the increased complexity of the vehicle characteristics and user-directed interactivity of HCMEs, research examining user perceptions of HCME-based technologies such as the web is needed.

The Conceptualisation of Perception

Understanding why people accept or reject electronic technological developments 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). Davis (1986) developed and tested a theoretical model of the effect of system characteristics on user acceptance of computer-based information systems. The model referred to as the Technology Acceptance Model (TAM) was developed to improve the understanding of user acceptance processes, providing new theoretical insight into successful design and implementation of information systems (Davis 1986). TAM posits that two particular beliefs, *perceived usefulness* and *perceived ease of use* are of primary relevance for computer acceptance behaviours (Davis, Bagozzi & Warshaw 1989a).

Perceived usefulness (U) is defined as the user's subjective probability that using a specific application system will increase his or her job performance within an organisational context (Davis et al. 1989a). Perceived ease of use (EOU) refers to the degree to which the user expects the target system to be free from effort (Davis et al. 1989a). Davis et al. (1989a) found that perceived usefulness is a primary determinant and perceived ease of use is a secondary determinant of peoples intentions to use computers. Perceived ease of use and usefulness, however, have been primarily tested and discussed in the context of organisational settings and with reference to computer based processing systems. For example, WriteOne (Davis et al. 1989a), Wordperfect, Lotus 1-2-3 and Harvard Graphics (Adams, Nelson & Todd 1992; Segars & Grover 1993), Chartmaster (Davis 1989b) and communication based systems like electronic mail (e-mail) (Davis 1989b; Segars & Grover 1993) and voice mail (Segars & Grover 1993). This study develops the existing measures for perceived ease of use and usefulness to apply to the context and uses of the World Wide Web.

World Wide Web (HCME)

HCME-based systems, like the web, enable users to engage in machine and person interactivity. *Machine interactivity (MI)* is 'the extent to which users can participate in modifying the form and content of a mediated environment in real time' and *person interactivity (PI)* includes the use of network supported software that enables users to communicate 'through' the medium (Steuer 1992, Hoffman & Novak 1996). In a recent report on Australian Internet User Trends, machine interactivity was identified as the main use of the Internet/web by 65% (16,307) of respondents, and 28% (7,025) and 7% (1,756) of respondents respectively reported Email and Chat as 'the main reasons for using the Internet' (www.consult.com 1999). Machine interactivity and person interactivity are thus the key activities undertaken by users of the World Wide Web with growth also evident in *transactional interactivity (M/P)*. Therefore perceived ease of web use and perceived usefulness of the web is defined in the context of machine interactivity (information search and acquisition), person interactivity (communication) and also transaction machine and person interactivity (purchase).

Item Generation

Earlier research on perceived ease of use and usefulness of technological developments was reviewed in the item generation process to assess existing item structure and design. For example, standardised scales developed by Davis (1986) and further refined by Adams et al. (1992), Davis (1989b), Davis et al. (1989a), Handzic, Low and O'Connor (1994), Segars and Grover (1993) and more recently by Handzic and Low (1999) follow an item structure that incorporates the desired target (system), the behaviour under investigation (using the system), the context (in work) and a time frame (unspecified future). This same structure has been applied to the items tested in this paper. In addition, an expert survey, a user observational study, site and help file content analyses and a number of in-depth interviews with web users were conducted to establish initial content validity of the domain of interest, the World Wide Web (see Page & Uncles 2000).

The construct of *perceived ease of web use (EWU)* is defined as the degree to which a user believes that using the World Wide Web for particular functions is free from effort. It is predicted that this construct will comprise five dimensions: General EWU, Learning EWU, Communication EWU, Information EWU and Transaction EWU. The construct *perceived web usefulness (WU)* is defined as the degree to which a user believes that using the World Wide Web would enhance his or her usage performance. It is predicted that this construct will comprise three dimensions: C-to-B Communication WU, Information WU and Transaction WU.

A final questionnaire was developed and administered. This consisted of 20-items measuring 5 predicted dimensions of perceived ease of web use, 23-items measuring 3 predicted dimensions of perceived web usefulness and items measuring respondents web experience, use and demographics.

Sampling Design

To assess the properties of the scale developed to test perceptions of the web, the sample was drawn from postgraduate (61%) and undergraduate (39%) university courses across two disciplines, Education and Commerce. Use of the web by each discipline, the samples domain experience, and also implementation convenience, were the primary criteria used for sample selection. The survey was administered in paper-format to increase access to respondent samples with variance in domain experience. 152 surveys were administered with 128 useable responses. To determine the appropriateness of data aggregation of the two groups for the interval scale items, an independent-sample means comparison analysis was conducted. Overall, it was found that the means for the 20 scale items measuring perceived ease of web use and 23 scale items measuring perceived web usefulness were comparable. The samples were also comparable on the descriptive items measured.

Descriptive Results

The aggregate sample had a skewed gender distribution with 88 female respondents (69%) and 40 male respondents (31%). The age distribution was also skewed with 78% of the sample less than 25 years of age. 84% of the sample had 3 or more year's computer experience, 40% had less than 2 years. 43% had 3 to 4 years web experience. 56% accessed the web on a daily basis and 42% on a weekly basis. 43% use the web on average for less than 1 hour per occasion and 46% for 1-3 hours. Furthermore, 42% of the sample access the web from 2 to 3 different locations and 56% of the sample had between 2-3 email accounts. From this description it is inferred that the sample has a medium to high level of direct web usage experience (as compared to results reported by eStats 1998; eStats 1999; Jupiter/NFO 1999b; www.consult.com 1999 and as further investigated by Diaz, Hammond & McWilliam 1997; Eighmey 1997 and Teo, Lim & Lai 1997).

Scale Development and Analysis

Perceived Ease of Web Use

Initial data screening and analysis of correlation patterns (KMO Measure of Sampling Adequacy = 0.93, Bartlett's Test of Sphericity: Approx. Chi-Square = 1852.041, df = 190, Sig. = 0.000) for the full sample for the construct perceived ease of web use showed that the data was well suited for factor analytical investigations. An assessment of the scree plot identified 4 dimensions that explained 70% of the variance of perceived ease of web use. Hence a principal component analysis with a varimax rotation forcing a 4-dimension solution was conducted on the sample. Reliability analysis was performed to check for the internal consistency of the scale items and as items q14 and q15 had corrected item-total correlations below 0.5 they were deleted. The final perception scale thus comprises 14-items with a total scale reliability of 0.94. These 14-items measure 3 dimensions that explain a corrected 72% of the variance of the construct, perceived ease of web use.

In summary, dimension 1 comprises 7-items with factor loadings 0.61 - 0.79. This dimension explains 29% of the variance with a reliability of 0.91. Dimension 1 was labeled 'Behavioural' because it comprised items that related to the ease of use of doing 'tasks' or 'processes' on the web. For example, 'communicating with organisations', 'comparing products' or 'navigating'. Dimension 2 comprises 5-items with factor loadings 0.65 - 0.79. This dimension also explains 29% of the variance with a reliability score of 0.92. Dimension 2 was labeled 'Informational' as items loading on this factor comprised items relating to the ease of use of information 'processing' or 'acquisition' and 'usage' on the web. Dimension 3 comprises 2-items with factor loadings 0.692 - 0.820. This dimension explains 13% of the variance with a reliability of 0.82. Dimension 3 was labeled 'Transactional' as items related to the ease of use of the web for 'bookings' or 'purchase' activities.

Perceived Usefulness of the Web

Initial data screening and analysis of correlation patterns (KMO Measure of Sampling Adequacy = 0.874, Bartlett's Test of Sphericity: Approx. Chi-Square = 1717.465, df = 253, Sig. = 0.000) for the full sample for the construct perceived usefulness of the web showed that the data was well suited for factor analytical investigations. A principal component analysis with a varimax rotation forcing a 6-dimension solution was conducted on the full sample. A reliability analysis of the scale identified that items q20, q22, q23, q24, q36, q65 had corrected item-total correlations below 0.5 and thus were deleted. The final perception scale thus comprises

14-items with a total scale reliability of 0.91. These 14-items measure 4 dimensions that explain a corrected 70% of the variance of the construct, perceived usefulness of the web.

Dimension 1 comprises 5-items with factor loadings 0.65 - 0.88. This dimension explains 20% of the variance with a reliability of 0.91. This dimension was labeled 'Communication' as items loading on this factor related to the usefulness of the web for facilitating consumer-to-business communication. Dimension 2 comprises 4-items with factor loadings 0.67 - 0.79. This dimension explains 19% of the variance of perceived usefulness of the web and has a reliability of 0.87. Dimension 2 was labeled 'Purchase' because it comprised items that related to usefulness of the web for facilitating product purchases. Dimension 3 comprises 3-items with factor loadings 0.66 - 0.72. This dimension explains 18% of the variance with a reliability score of 0.77. Dimension 3 was labeled 'Information Acquisition' as it is based on items relating to the usefulness of the web for the acquisition and location of information. Dimension 4 comprises 2-items with factor loadings 0.63 - 0.66. This dimension explains 12% of the variance with a reliability of 0.70. Dimension 4 was labeled 'Quality', as it comprised item loadings relating to the usefulness of the web for the 'quality' and 'range' of information and/or products sought.

Conclusion

In an attempt to increase the efficiency and effectiveness of customer services and channels of marketing communication and distribution, marketers are rapidly adopting HCME electronic technologies, such as the web and electronic kiosks. In turn, this focuses much attention on the adoption and use of these technologies by specific target audiences. Grounded in MIS research, the Technology Acceptance Model posits that two particular beliefs, *perceived usefulness* and *perceived ease of use* are of primary relevance for computer acceptance behaviours (Davis et al. 1989a). Therefore, the prime objective of this study was to develop scales that measured a users perceived ease of use and perceived usefulness of a HCME-based electronic technology, commonly known as the World Wide Web. The results reported 14-items that reliably measure the dimensions of 'behavioural', 'informational' and 'transactional' perceived ease of web use and 14-items that reliably measure perceived usefulness of the web for 'purchase', 'communication', 'information acquisition' and 'product and information quality'. These scales were developed to facilitate research in the area of user acceptance and use of HCME-based systems and, specifically, to assist in the successful design and implementation of systems like the World Wide Web from a user's perspective.

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