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EVALUATING THE UTILITY AND IMPACT OF THE WORLD WIDE WEB

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ABSTRACT

Many service providers are now providing applications on the Web that encourage people to satisfy information needs on the Web. The proposed research attempts to investigate the usage and evaluation of these Web-based information services by providing some initial efforts toward developing conceptually-based scales for evaluating the extent to which Web services satisfy information needs that arise outside the traditional organizational/work domain. The emphasis on non-work based tasks allows the research to focus on the use of the Web in satisfying information needs that arise outside the work-place/task domain. Three streams of literature are considered: usage of the Web, user satisfaction of the Web, and the complementary field of individual performance and the impact of information technology. Based on these foundations, as well as focus groups and pilot surveys, questionnaire items were developed and analyzed across three surveys for their dimensionality and reliability of scales measuring access, usability, task-technology fit, social influences and individual performance impacts. This paper reports the results of the final Web based survey which generated 720 responses. Predictors of performance included the following scales: training (developing Web skills), fun/entertainment, years of overall computer experience, mediation (shopping cost), greater weekly usage.

1. INTRODUCTION

World Wide Web (Web) services for satisfying personal day-to-day needs are growing at a rate that will have substantial influence in the larger information infrastructure. In parallel with the unprecedented rate of growth in home access and usage of the Internet, businesses, institutions and information providers are increasing their online presence at similarly unprecedented rates. Home users are now able to conduct consumer transactions and satisfy personal needs on the Web. The Web is now competing with traditional modes of business and information service provision by providing a real alternative mode for customers to satisfy their needs.

Web based consumer services are popularly perceived as being successful. However there has been little evaluation of how well the Web meets its customers requirements. As this massive investment in Web based applications and vast market of users/customers continues to grow evaluation of the usefulness of Web based services is mandatory. There has been much research investigating the level of usage and satisfaction of information systems within an organisational context. The Web, however, is an information system that

has a vast number of users who are not confined by an organisation context and for whom use of the Web is optional. This new, vast number of users has lead to the provision of a multitude of new possibilities to provide information systems and services, however, at the same time, implying a multitude of new aspects to consider when designing systems. User profiles may be less homogenous than earlier and therefore their needs are more complex to define. Providers aiming to build successful Web systems must attract usually voluntary users to visit and revisit the site. This requirement makes the users' perception of the quality of the Web system critical for its success. (Lindroos, 1997).

This paper develops candidate scales for measuring the extent to which the Web meets non-work related information needs, based upon a review of relevant literature on the extent of, nature of, and potential influences on, Web usage.

2. LITERATURE REVIEW

2.1 Web Usage

While there has been some research into user perceptions of the Web to date, much of this work has been undertaken from a marketing perspective. Hoffman and Novak (1996), in addressing the role of marketing in hypermedia computer-mediated environments, propose a broad structural model of consumer navigation of the Web. This model is important as it identifies constructs of individual usage of navigating the Web, including characteristics of the user, the task, the experience of navigating the Web and outcomes including a positive experience, and learning. The focus of this model is the concept of flow. Flow is defined as the *"state occurring during network navigation that which is characterised by a seamless sequence of responses facilitated by machine interactivity, (2) intrinsically enjoyable, (3) accompanied by a loss of self consciousness, and (4) self-reinforcing. In the flow experience, which formalises and extends a sense of playfulness consumers are so acutely involved in the act of network navigation in the Web that nothing else seems to matter"* (Hoffman & Novak 1996, p. 57). Atkinson and Kydd (1997) investigated the effect of the individual characteristics of playfulness on Web usage, basing their hypothesis on previous research investigating playfulness and computer usage (Csikszentmihalyi & LeFevre, 1998). They found that playfulness is significantly associated with total Web use and that intrinsic motivations to use the Web were associated with frequent Web use for entertainment purposes.

In another marketing investigation, Eighmey (1997) considered two questions concerned with the benefits delivered by commercial Web sites as well as the approaches that deliver the greatest benefit. As part of that study, a scale of 44 items among six thematic areas (Marketing perceptions, Entertainment value, Informational value, Ease of use, Credibility, Interactivity) was used to measure user perceived benefits of visiting 28 commercial Web sites. Three factors emerged: playfulness, clarity of purpose, and timeliness and the approach to presenting information. Overall, Eighmey found that Web users are assisted by information placed in an enjoyable context.

The "Homenet" study (Kraut et al., 1997) found that electronic mail use was more popular and more stable than use of the Web in general, and drove continued use of the Internet overall. In the study participants used email in at least 49% of their Internet sessions, but the Web in only 38% of them. An investigation of usage patterns of the Internet in Singapore (Teo, Lim, & Lui, 1997) found that messaging and browsing activities are performed more frequently than downloading or purchasing activities.

2.2. Influences on Usage and Evaluation of the Web

Klobas (1995) tested the ability of three models of information resource use to explain the use of the Internet. The three models were: Information Use (Allen, 1977); Technology Assessment Model (TAM) (Davis et al., 1989); and The Theory of Planned Behaviour (Azjen, 1993). Klobas found that the Theory of Planned Behaviour best explained the use of the Internet. The good performance of the Theory of Planned Behaviour

in the study showed that information resource use is motivated by similar factors as those influencing other human behaviours. This is an interesting finding, as, unlike other information technology, the use of the Internet is not mandatory, so it is appropriate that the use of the Internet is explained by the Theory of Planned Behaviour. Given these findings, further exploration of the Theory of Planned Behaviour as a candidate model for measuring the impact of the Web follows.

The Theory of Planned Behaviour is a general model designed to explain specific human behaviours. It has been used, among other things, to explain why people participate in different recreational activities and health related behaviours. The Theory of Planned Behaviour is the foundation of models examining the intentions of users to utilise systems and to increase their use (Davis et al., 1989).

The most direct influence on behaviour is intention to perform the behaviour ('behavioural intention'). In turn, behavioural intention is influenced by :

- Attitude toward outcomes -- the person's attitudes to the results or outcomes of performing the behaviour. For Web usage this may be the extent to which an individual believed that using the Web would improve his or her performance, the extent to which they believe that using the Web is interesting, enjoyable or a productive experience.
- Social pressure -- the influences from the individuals environment. Sources from which potential users may experience pressure to use the Web. Pressures to use the Web may come from peers, the workplace and the media.
- Perceived behavioural control -- the extent to which a person believes he or she has control over performance of behaviour. For Web usage control may include potential costs of, and barriers to Web usage, such as the cost of using the Web, accessibility to a computer with an Internet connection, understanding of the Internet, legal implications and the fear of being monitored, and poor response time.

These three influences well encapsulate influences on technology use that may be measured directly. However, one important construct is not included in the model: the tasks for which the Web is used. As discussed earlier, usage of the Web is optional; the decision to use the Web may be based on the user's expectation that the Web may have some impact on the task. There must be some degree of fit between the task and the technology that has been chosen to execute the task. The following section presents a model that combines the constructs of the above model with the construct of task.

2.3. An Integration

Goodhue and Thompson (1995) present a model (Figure 1) that incorporates valuable insights from two complementary streams of research: user attitudes as predictors of utilisation, and task technology fit as a predictor of performance. The essence of this model, called the Technology-to-Performance Chain, is the assertion that for an information technology to have a positive impact on individual performance, the technology must be utilised, and the technology must be a good fit with the tasks it supports. Goodhue and Thompson derive this model by analysing the limitations of two streams of research that have proposed models of technology use: utilisation research and task-technology fit research. While each of these perspectives gives insight into the impact of information technology on performance, each alone has some important limitations. First, utilisation is not always voluntary. For many system users, utilisation is more a function of how jobs or tasks are designed than the quality or usefulness of systems, or the attitudes of users toward using them. To the extent that utilisation is not voluntary, performance impacts will depend increasingly upon task-technology fit rather than simple use.

Models focusing on fit alone do not give sufficient attention to the fact that systems must be utilised before they can deliver performance impacts. Since utilisation is a complex outcome, based on many other factors beside fit (such as habit, social norms, and other situational factors), the fit model can benefit from the addition of this richer understanding of utilisation and its impact on performance.

This proposed research argues that the focus of the Goodhue and Thompson model on the optional use of systems and success of usage being dependent on other factors apart from fit matches the environment of Web usage. The Web is a technology for which use is optional and at the same time utilisation is dependent on user perceptions of the impact of the Web on the task, which is dependent on many factors besides fit. The model used in this paper represents a synthesis of usage and task-technology fit models which also incorporates the behavioural aspects of usage as defined in the Theory of Planned Behaviour. This model is the preferred model, as it includes the construct of the task for which technology is used as well as those constructs that influence usage.

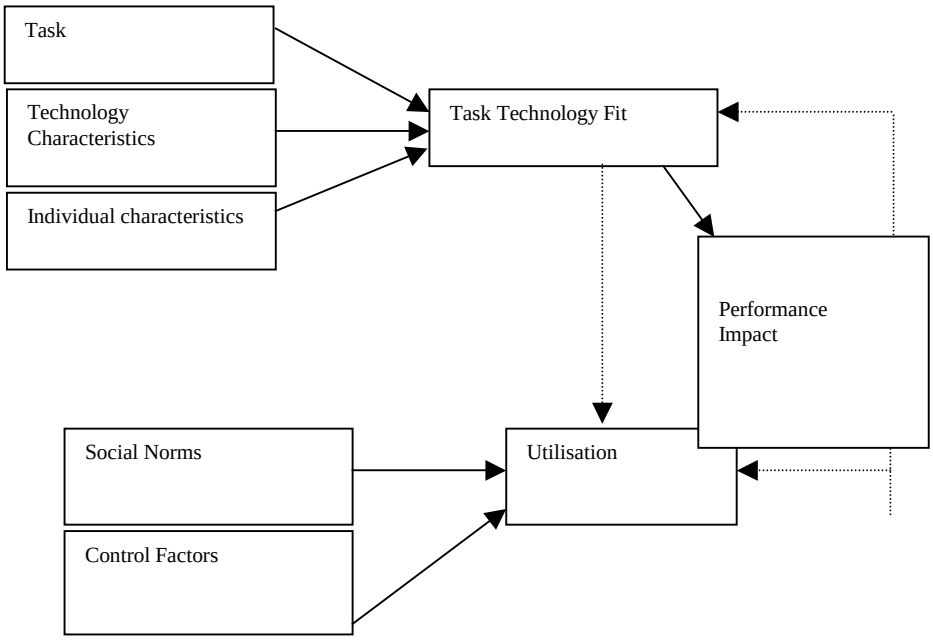

Figure 1: *The technology to performance chain*

The following section discusses the constructs of the model in Figure One and their application to usage and evaluation of the Web.

Tasks are broadly defined as the actions carried out by individuals in turning inputs to outputs. This proposed research focuses on general tasks and activities enacted by users of the Web, primarily to satisfy their information needs. The perspective of task in this paper is a broad one as tasks for which the Web is used are diverse. The authors recognise that refinement of the definition of task is required for further research. Characteristics of the **individual** (knowledge, skills, motivation) could affect how easily and well he or she will utilise the Web. **Technologies** are viewed as tools by individuals in carrying out their tasks. Technology refers to the Web (hardware, software and data). Attributes of technology (accessibility, response time) can also influence the use and evaluation of technology. **Task-technology fit** (TTF) is the degree to which a technology assists an individual in performing his or her tasks. More specifically, TTF is the correspondence between task requirements, individual abilities, and the functionality of the Web. **Social norms** are the factors that influence use of the Web. Users may be influenced by factors such as peer pressure, observation of other adopters, or media coverage. **Control factors** may limit the use of the Web, such as the cost of using the Web, accessibility of hardware and software, local legal restrictions which may deem visiting some sights illegal, and monitoring sites visited and Web usage by an authority. **Utilisation** is the behaviour of employing the Web in completing tasks. The impact TTF on utilisation is shown via a link between TTF and utilisation. This is because TTF should be one important determinant of whether the Web is believed to be useful, be important or give some advantage.

Performance impact is the general benefits of using the technology, and the accomplishment of a portfolio of tasks by an individual. High TTF increases the performance impact of the system. **Feedback** is an important aspect of the model. Once the Web has been utilised and performance effects have been

experienced, there will be feedback. The actual experience of using the Web may lead users to conclude that the Web has a better or worse impact on performance than anticipated, changing their expected consequences of utilisation and therefore affecting future perceived task-technology fit and utilisation.

2.4 Research Issues

To help determine the value of information services offered on the Web the following questions need to be answered:

Q1. What constitutes a valid and reliable scale measuring user evaluation of the Web for non-work based tasks?

Q2. How are the dimensions of such a scale related to the performance impact of Web usage?

3. METHODOLOGY

The derivation of a scale measuring user evaluation of the Web must be ecologically valid. Focus groups provide ecological validity and insightfulness in identifying salient attitudes or perceptions (Lunt & Livingstone, 1996). To this end four focus groups were convened. The participants of the groups were undergraduate and postgraduate students of a major Australian university. This sample is reasonable given that 42% of Internet users are aged 18 – 24 years of age and 56% of persons with a bachelor's degree used the Internet (ABS, 1998). The first focus group had five males and 1 female, with a moderate mean weekly Web usage. Values for the other focus groups were: 7 males/1 female; 4 males/3 females; 2 males/3 females. There was some variation in Web usage across the groups.

The focus groups were facilitated by the researcher and were managed in accordance with "best practice" procedures (Connaway, 1996; Lunt & Livingstone, 1996). The questions asked at the focus groups included influences on Web usage that were summarized above, and dimensions of the Goodhue and Thompson TTF scale which are relevant to Web usage: **Quality** (current enough to meet needs, maintaining necessary data); **Locatability** (determining what data is available, ease of interpretation); **Compatibility** (data from different sources can be consolidated or compared without inconsistencies); **System reliability** (dependability and consistency of access and uptime of systems); and **Ease of use/training** (ease of doing what I want to do using system hardware and software). To assist participants' focus on the tasks, questions related specifically to non-work based tasks.

The transcripts of the focus groups were analysed using content analysis. The output from the content analysis is an untested set of potential items that could be included in a scale for measuring evaluation of the Web for information-based tasks. The 70 items that emerged from the content analysis demonstrate that the issues operationalised under the taxonomy used are of interest to the sample that participated in the focus groups. From the original seventy items duplicate items were dropped, and statements were reworded to reflect common issues. The following items were also generated by the researchers, to include other relevant concepts from the Task-Technology to Performance Chain model: compatibility, system reliability, ease of use/training, and individual performance impact. The following controls were also included in the pilot survey: Web usage, location where the Web was accessed, respondent's sex, number of years using a PC, overall expertise with PCs/applications/Internet/Web, and respondent's age.

The draft instrument was pre-tested by 11 Master's students at a major American north-eastern university. The scale items were ranked on a five-point scale (from strongly disagree to strongly agree). The following changes were made based on comments and responses to the draft: further duplicate items were dropped, "double barreled" questions were modified, and ambiguities were resolved. The survey was then administered to two samples at the same university: sample one comprised 295 respondents, sample two 178 respondents. Two revisions of the instrument were made based on the results of the two samples as well as addressing the problems of disappointing reliabilities. The revisions included the generation of additional items both for the evaluation scale and the performance scale.

To assess the robustness of the results and address validity issues of a sample that is composed entirely of students a Web based version of the final version of the instrument was developed using the Lotus Notes tool, Domino. Domino enables the capturing of responses in a Lotus Notes database that could then be up-loaded into the statistical analysis tool, SPSS. Advertising time was purchased through the major Australian Microsoft Network portal provider. The advertising campaign consisted of 80,000 impressions of a .gif file that displayed the prize of a Digital camera that was offered as an incentive for Web users to participate in the study. This Web based version of the instrument resulted in 720 responses from Web users. The results of this fourth sample are discussed below.

4. ANALYSIS AND RESULTS

Table One provides descriptive statistics for the sample. Table two shows factor loadings and reliability of the evaluation , access, usage and performance scales. Usage, expertise and years experience of using a PC loaded on one factor with an alpha of .53. The access variables loaded on two factors: friend's place, educational institution and other locations on the first factor (alpha .53); with work and home (loading negatively) on the second factor. The seven performance items loaded on one factor (alpha .83).

The evaluation scales emerging from the sample include:

- F1 (Locatability) *I'm more likely to find specific kinds of information on the Web than from other information sources, It is easier to find information I need on the Web than in a library, The Web provides information that's important to me*
- F2 (Training) *I need to develop my skills more to use search engines on the Web better, More training would make my Web use more effective, I would use the Web more if I had greater computer or Internet knowledge*
- F3 (Anonymity) *I prefer visiting sites on the Web that do not require me to identify myself, Being anonymous on the Web is important to me*
- F4 (Use control) *I have complete control over how I use the Web, I have complete control over how I use the Web*
- F5 (Social Influence*), I use the Web because many of my friends do, I use the Web because of all the attention it receives in the media*
- F6 (Shopping cost/mediation) *By using the Web I can avoid in-store sales people, By using the Web I can avoid in-store sales people*
- F7 (Fun*) I use the Web for entertainment, Using the Web is fun*
- F8 (Usefulness/quality) *Free information is not as reliable as that you pay for, It's not easy to find very specific information on the Web*

Variable and Category	Frequency	Percent
Accessed at work		
No	236	32.8
Yes	406	56.4
Accessed at home		
No	89	12.4
Yes	605	84.0
Accessed at friend's place		
No	284	39.4
Yes	310	43.1
Accessed at educational		
No	302	41.9
Yes	294	40.8
Accessed other		
No	354	49.2
Yes	198	27.5
Sex		
Male	355	49.3
Female	364	50.6
Years computer experience		
Less than 1yr	63	8.8
1 to 2 yrs	73	10.1
2 to 4 yrs	128	17.8
4 to 6 yrs	141	19.6
More than 6 yrs	314	43.6
Computing expertise		
None	10	1.4
Novice	39	5.4
Somewhat familiar	155	21.5
Familiar	271	37.6
Very familiar	244	33.9
Age		
Under 25 yrs	326	45.3
26 to 35 yrs	172	23.9
36 to 50 yrs	155	21.5
51 and above	66	9.2

Table 1 *- Descriptive Statistics*

	F1	F2	F3	F4	F5	F6	F7	F8
I'm more likely to find specific kinds of information on the Web than from other information sources	.61	-.07	-.03	-.07	-.05	.08	-.00	.03
Web search engines are useful if I don't know which sites to go to directly for specific	-.45	.00	-.05	-.02	.01	.07	-.80	-.08
The information on the Web is current enough to meet my needs	.47	.09	.01	.16	.03	.40	-.06	-.28
It is easier to find information I need on the Web than in a library	.70	-.05	-.03	.05	.09	.13	-.12	-.06
I can find information related to my hobbies and interests on the Web	.49	.01	-.05	.03	-.05	.00	.02	-.02
I see that other people benefit from using the Web	.38	.11	-.01	.10	-.10	.07	.13	-.84
Web search engines (Alta Vista, Yahoo, Lycos, etc.) are useful in helping me find the	.45	-.01	.12	.05	-.05	.01	.13	.10
By using the Web I can avoid going to a store	.34	-.02	-.06	.10	-.00	.77	.02	.14
It's easy to know which Web sites to go to directly to find the information I need	.47	-.17	-.07	.29	.34	.17	-.03	.00
Free information is not as reliable as information that you pay for	.01	-.02	.15	.06	.25	-.00	-.13	.81
I use the Web because it's necessary for my work or classes	.22	-.05	.00	.00	-.01	.04	-.01	.03
By using the Web I can avoid in-store sales people	.06	-.05	.04	.07	.05	.89	.05	-.01
The Web is useful for finding information that is difficult to locate elsewhere	.54	-.05	-.03	.14	-.04	.13	.09	-.11
I have complete control over what sites I visit on the Web	.15	-.05	-.01	.91	-.04	.10	.04	-.01
It's not easy to find very specific information on the Web	-.40	.19	-.01	-.05	-.23	.80	.11	.60
The Web provides information that's important to me	.61	-.03	.01	.00	-.11	.10	.09	-.11
I would use the Web even if none of the people I know were using it	-.26	.01	-.18	-.12	.37	-.09	-.03	.02
I have very easy physical access to a computer with Web connections	.24	-.10	.03	.10	-.01	-.05	-.01	-.05
I prefer visiting sites on the Web that do not require me to identify myself	-.04	.02	.86	-.01	-.04	-.04	.06	.08
I have complete control over how I use the Web	.11	-.12	.00	.73	-.04	.04	.01	.02
I need to develop my skills more to use search engines on the Web better	-.06	.88	.08	-.11	-.00	-.05	-.14	.09
Being anonymous on the Web is important to me	.00	.16	.87	.00	-.00	.03	-.05	.03
More training would make my Web use more effective	.00	.82	.11	-.12	.07	-.03	-.10	.00
I use the Web because many of my friends do	-.13	.14	.06	-.02	.82	.05	.13	-.09
I use the Web for entertainment	.14	-.01	.02	-.03	.09	.02	.90	.01
I would use the Web more if I had greater computer or Internet knowledge	-.06	.83	.00	.01	.17	-.00	.19	-.03
Using the Web is fun	.31	-.05	-.01	.11	.06	.05	.51	-.07
The Web gives me access to information that I cannot find elsewhere	-.51	.02	.06	.00	-.04	-.07	-.21	.08
If my Web usage was monitored I would not visit certain sites	-.01	.01	.17	-.04	.11	-.03	.06	.07
I use the Web because of all the attention it receives in the media	.04	-.17	-.01	.02	-.62	-.04	-.07	-.30
I use the Web to get information about products or services	.36	-.09	-.17	.07	-.12	.17	.12	.09
Eigenvalue	5.9	4.1	2.8	2.2	2.0	1.9	1.7	1.6
Pct. Var.	15.4	10.6	7.2	5.6	5.4	4.9	4.5	4.1
Cronbach's Alpha Reliability	.60	.89	.73	.67	.37	.73	.57	.35

Accessed the Web from:	**F1**	**F2**
Work	-.23	.79
Home	-.15	-.40
Friend's place	.74	.29
Educational institution	.64	-.02
Other	.71	.46
Eigenvalue	1.62	1.18
Pct. Var.	32.44	23.59
Alpha	.53	

Usage variables:	
Weekly hours	.46
Years using a PC	.82
Computing expertise	.85
Eigenvalue	1.61
Pct. Var.	53.67
Alpha	.53

Performance constructs:	
Using the Web has a positive impact on my ability to get things done	.74
Because of my Web use, the number of people I communicate with has increased	.66
The quality of my work has improved because of using the Web	.74
I make better decisions because of information I get from the Web	.79
I can accomplish things quickly because of my Web use	.79
I have increased my knowledge about topics of interest to me because of my Web use	.53
Because of my Web use, I am better informed in general	.71
Eigenvalue	3.57
Pct. Var.	50.96
Alpha	.83

Table 2: *Factor Loadings of Evaluation, Usage, Access and Performance scales*

Due to space limitations correlations among the items and scales are not shown. The bivariate predictors of performance in a final multiple stepwise regression were selected for inclusion in a final multiple stepwise regression. Table 3 shows the regression predicting 28% of the variance in the performance scales. Predictors include factor 1, computing expertise, factor 7, factor 6, and usage (hours per week).

	Standardized Coefficients	Sig.	Factor
Factor 1	.32	.000	Training
Factor 7	.17	.000	Fun
Years exp. Comp	.14	.000	
Factor 6	.16	.000	Mediation (shopping cost)
use hours/week	.11	.002	

Table 3: *Regression of Performance Effects of using Web(Scale) on Task-technology scales and usage variables*

Adj R-sq .28).

3. CONCLUSION

This paper has presented some perspectives as well as some research issues on measuring the evaluation and impact of the Web on non-work based activities. The research has taken a triangulation approach in developing general scales that cover most relevant domains through considering the current literature, candidate models of the impact of information technology, and the users themselves.

This exploratory work demonstrates that it is possible to develop preliminary scales for measuring user evaluation of the Web, and that such scales are multidimensional. The factors that have been identified by this research may be of interest to other researchers and providers concerned with the evaluation of Web-based services.

The items identified in the factors are derived from and consistent with the contextual models discussed and prior study sources. The factors of training, quality and locatability are consistent with the three of the four constructs derived from the TTF model. The TTF model involves perceived attributes of a technology tool and the perceived fit of those attributes to information-based tasks by users of the technology. This research suggests that currency of the data on the Web, determining what data is available on the Web, and the ease of use to do what they want to do, are all perceptions of the Web as a technology tool that users perceive as attributes which fit a variety of Web-based tasks.

The factors of mediation, fun, anonymity and control, as well as training, are consistent with the hypermedia model presented by the Hoffman and Novak (1996). In their model, flow is a critical factor for success in the usage of hyper-mediated environments. The factors of fun, anonymity and control may represent different dimensions of flow or engagement with the Web environment. In discussing the reliable measure and valid measurement of flow, Hoffman and Novak note that flow can be inferred from its antecedents and consequences. The two primary antecedent conditions that are necessary for the flow state to be experienced are skills and focused attention. If skills and focused attention is present two additional antecedents – interactivity and telepresence – enhance flow. Outcomes associated with flow would include increased learning, and increased perceived behavioural control. The factors emerging from this research are consistent then with the above antecedents and outcomes of flow, suggesting that flow is a pivotal factor in Web usage. The factor of training relates to skills; control to focused attention; and mediation, fun and anonymity to interaction and telepresence.

This consistency of the results with these two models, one emphasizing the effectiveness of information systems for information-based tasks and the other describing the behaviour of users of hyper-mediated environments, suggests that use of the Web is broad and encompasses usage issues related to the technology as a tool as well as the behavioural aspects of using the tool.

Overall, then, the results support a model whereby web usage as well as web expertise influence several intrinsic and extrinsic task-technology fit factors, and those factors, along with web usage, directly influence

positive performance outcomes. The intrinsic task-technology fit factors seem dependent on prior usage and expertise, while the extrinsic, instrumental factors seem to be more general information purposes. Finally, some factors seem to be primarily socially- or individually-oriented traits unrelated to performance outcomes, and possibly related to greater susceptibility due to low levels of prior expertise. A simpler model (and set of survey items) would remove the factors of training, social influence, identity control, and use control. Further analysis needs to be undertaken to extend and refine the relationships and the tentative model suggested in Figure 1. In the end, however, this study indicates that real performance benefits accrue from non-work related Web usage and intrinsic purposes, and that task-technology fit factors substantially mediate the influence of web usage and web expertise on those benefits.

The reliabilities for some of these scales were low, however, so the scales need further development. However, considerable variance in performance impacts of using the Web for information needs was explained by a set of several task-technology factors, along with number of hours of using the Web per week. Further analysis needs to be undertaken to refine and confirm the findings presented so far.

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