PREDICTING THE USER ACCEPTANCE OF PERSONALIZED INFORMATION SYSTEMS: CASE MEDICAL PORTAL

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Abstract: This paper describes ongoing research, which focuses on the effect of attitudes and intentions in the use of personalized Web Information Systems (WIS). By applying the widely used Technology Acceptance Model (TAM), the theory of planned behavior, innovation diffusion theory and self-efficacy theory, we take an extended view of the factors explaining the individual acceptance and usage of newly emerging personalized Web Information Systems. Many features of personalized WIS differ from the "traditional" information systems, and we believe that this research will shed new light on the research into the acceptance of personalized WIS.

1 INTRODUCTION

Mathieson (1991) states that information systems can be effective and improve organizational performance only if they are used. All technical advances and improvements are negligible if users do not want to use IT. Therefore it is important to understand how people decide to use or not to use given systems. This may vary depending on the system, the people and the context (Mathieson 1991).

As the Internet is growing all the time, easy access to relevant information and management of information space have become major issues for users. Users can get lost when navigating in information space, or they might not find what they are looking for (Brusilovsky 1996a). Personalization tries to reduce the users' workload and respond to their individual needs by providing them with tailored information, services and products. From the business point of view, personalization has the bonus of drawing the users' attention to themselves, their products and services. Personalized Web IS can be a powerful tool for businesses, as well as for organizations, to set them apart from their competitors. Brusilovsky (1996b) defines personalization as a new research direction in the field of user- adaptive systems aiming to increase functionality of hypermedia. In this study personalization is defined as the interaction between users and service providers aiming to offer a user-friendly Web experience, based on the individual user's preferences, background and previous behavior.

According to Davis (1989), perceived usefulness and perceived ease of use are especially important determinants, which have an effect on whether the users accept or reject information technology. The determinants, perceived usefulness and ease of use, represent the beliefs that lead to user acceptance of information technology (Lederer 1998). Davis (1989) defines perceived usefulness, as "the degree to which a person believes that using a particular system would enhance his or her job performance." This definition emphasizes the belief that systems will improve the user's job performance without involving salary raises, promotions, bonuses or other rewards. Perceived ease of use refers to "the degree to which a person believes that using a particular system would be free of effort" (Davis 1989). TAM claims that individuals would use computers if they envisage positive results (outcomes). Thus, by focusing on the preceding factors of usage, - perceived ease of use and perceived usefulness -, TAM pays less attention to external factors, (social influence) individuals' believe in their own capabilities to cope with the task ahead (Igbaria and Iivari 1995). In the analysis of the self-efficacy theory Bandura (1977) distinguishes two expectations, efficacy expectations and outcome expectations. Efficacy expectations mean that one

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can successfully execute the behavior required to produce the outcomes. Outcome expectations refer to a person's judgment that a given behavior will lead to certain outcomes (Bandura 1977; Compeau and Higgins 1995). Bandura (1977) argues that both efficacy expectations and outcome expectations are linked together and have an effect on outcomes.
The theory of planned behavior (TPB) focuses on predicting intentions and explaining human behavior (control beliefs) (Ajzen 1991). Intention to perform a given behavior is the central determinant of TPB. According to Ajzen (1991), "Intentions are assumed to capture the motivational factors that influence behavior; they are indicators of how hard people are willing to try, or how much of an effort they are planning to exert, in order to perform the behavior."
Adopting new ideas and social practices and spreading them within a society, or from on society to another, is an important element in explaining personal and social changes (Bandura 1986). Innovation diffusion theory depicts the process of spreading ideas, practices and issues related to adopting or rejecting new technology (Rogers 1995). Although TAM is widely used for explaining the acceptance of information systems, there are some limitations, which have shown up in prior studies:

- user data is collected mainly from students in a university environment, not in a "real environment";
- the tools under study, like word processing software, spreadsheet software or e-commerce and internet – are general rather than specific;
- they are mostly confined to the US.

This research tries to address these limitations and aims to be more specific by identifying a specific behavior pattern in a specific personalized WIS (medical portal) within a specific context (real environment). By applying the TAM, TBP, innovation diffusion theory and self-efficacy theory this research will take an extended view of both the internal and external factors, that explain user acceptance of personalized WIS.

2 RESEARCH QUESTION AND CONTEXT

This ongoing research is a continuation of the development work in a completed OWLA-project (OWLA 2002) where we developed a new approach for producing personalized services. In the current research the portal -a personalized medical portal, here "mediport.com" - is a free information channel for doctors and medical personnel. The main objective of the portal is to provide access to a special field information and to facilitate the flow of information. Personalization in a medical portal is designed for certain particular groups with varying duties and preferences. For example, the portal offers up-to-date information (scientific-, medical- and research information) related to the users' work, and information related to different social activities. Up-to-date information, its immediate availability to the users, easy acceptance, and the quality of the information content are priority features in terms of the potential users' responsibilities. It could be vitally important, for example, for the doctors or surgeons to get the latest information related to drugs, diseases or methods of treatment.
As a starting point for this research it was carried out surveys in OWLA-project between 2000-2002. According to the preliminary surveys, the potential users were interested in personalized services but they were not interested in implementing the personalization themselves for different reasons. Basically, the motivation and topic of this research activity arise from the findings of the OWLA-project.

At present there is a lot of research interest in the area of personalized systems. Experimental results confirm that even the minimal use of adaptive hypermedia - based on user modeling - can improve the degree of user satisfaction at low cost (Strachan et al. 1997; Billsus et al. 2002). However, more research is needed to improve our understanding related to personalization (Straub and Watson 1991) and on the factors that are related the acceptance and use of personalized WIS. Alike it is important to pay more attention to the factors, which may concern and cause fear against the usage of personalized WIS. This research even more emphasizes the "user center" view of personalization, which focuses on identifying factors affecting attitudes and intentions to use personalized information systems. The primary research question is: what are the acceptance factors that affect intentions and actual use of personalized hypermedia systems? In order to answer this research question, we must also consider two additional sub questions as follows: (1) what is the significance of the intentions and what are the most important intentions that affect use of personalized WIS? (2) what is the role of predictive factors of intentions in predicting usage of personalized WIS?

3 FACTORS OF THEORETICAL MODEL OF IT USAGE

3.1 Background to personalized web systems

Personalized adaptive hypermedia systems - or here personalized web information systems - are always based on user models (Brusilovsky 1996b). One of the first who used the notion of a user model was Elaine Rich (1979). She suggested that one "major problem to be confronted in the quest for a sympathetic computer system, besides that of man-machine communication, is the question of the system's understanding of its users, their goals, knowledge, preferences, etc. In order to deal effectively with its users a system must have a model of them" (Rich 1979).

The success and advantages of personalized systems depend on user data. It is therefore necessary to have access to sufficient, relevant and updated data about the user. It is essential to discover the users' real needs and collect adequate information about the users. The problem here is that the users' needs may vary depending on several factors such as time, location, cultural background, expertise, knowledge and cognitive skills. In practice, the system's knowledge about the users and its ability to build an accurate user profile/model increases the more the user interacts with the system. On the other hand, when the systems supply information about users issues of privacy are raised. Users like to control what kind of data is collected, for what purposes and for what purposes their data are processed (Kobsa 2001). It is obvious that users have a need to control the information a system has about them. Users' lack of knowledge about how their individual information is collected, how it is used or processed, presents a potential barrier for the intention to use this kind of information in IS.

3.2 Need for control

A need for control is a new determinant, which refers to the users' unwillingness to provide individual information without knowing how the information will be used. Information about the users is an absolute condition for an adaptive hypermedia system. Access to the user data can be accomplished in many ways, it can be requested directly from the users or it can be done in the background without the knowledge of the users. The more the system can supply user information, the better it can help build an accurate profile of the users' behavior. Some people may be willing to give individual information, but for others it can be an obstacle and may turn visitors away from sites. Information can be supplied by the user or by the system both explicitly and implicitly. For example when the user logs into the system for the first time, the system may explicitly ask the user to fill in a registration form. Collecting information 'behind the curtain' may track the users' browsing behavior on an ongoing basis. These implicit and explicit ways of data gathering may make use of information, that is private by nature, which goes against the users' right to privacy.

Individuals' desire for control is an attempt to master their environment. They are keen to master their own acts and to know the causes and consequences of their own and others' acts (Baronas and Louis 1988). Basically, individuals are not willing to accept that they do not have control. When user visit web site that require registration, some may give false registration information and some may leave the web site with concerns about their privacy (Kobsa 2001). Users want to control what kind of data is collected, for what purposes, how long data is recorded for, how and for what purposes their data is processed (Kobsa 2001; Kobsa 2002). Therefore it appears reasonable to hypothesize:

H1. The need for control has a significant influence on attitudes towards personalized WIS.

3.3 Self-efficacy and perceived behavioral control

In a computer environment, two kinds of control can be identified: people can control their own beliefs and behavior, and they can control their environment. They want to control different resources such as time, money, and so on; and/or they want to control information. Self-efficacy emphasizes the individual's ability, or judgment of their capabilities to cope with the task ahead (Bandura 1977). The self-efficacy theory suggests that, if organizations can increase employees' self-efficacy, judgment about their abilities to cope successfully with the tasks ahead, this can improve their efficiency. Self-efficacy could have a positive impact on acceptance because users feel more comfortable with the computers and the use of computers (Venkatesh and Davis 1996). Moreover self-efficacy can be a strong and significant predictor of use over a lengthy time period, even though users have gained more experience (Compeau 1999). In short, self-efficacy deals with both the individual's beliefs in their own capabilities

to use computers and their own behavior (Bandura 1977).

The primary objective of the theory of planned behavior is to predict intentions and explain human behavior (control beliefs) (Ajzen 1991). Perceived behavioral control (PBC) is a determinant of TBP construction. It refers to barriers in behavioural performance. PBC is compatible with Bandura's (1977; 1982) concept of perceived self-efficacy. PBC reflects perceptions of internal and external constraints on behavior, for example with reference to skills, self-respect, time, opportunities, co-operation with others and resources needed to use the system. It can be applied, together with behavioral intention, to predict behavioral performance (to use personalized WIS). The more resources and opportunities individuals believe they possess, and the fewer obstacles they expect, the stronger their perceived control over their behavior (Ajzen 1991).

To sum up, it is likely that the individual with higher behavioral control should also have a stronger intention to perform (Ajzen 1991). Internal factors of perceived behavioral control refer both to the individual's beliefs about having enough resources such as time and money. External factors refer to self-efficacy, the individual's self-confidence about his or her ability to perform an activity. Moreover, past experiences, positive or negative have an effect on the perceived behavioral control (Bandura 1977; Bandura 1982; Ajzen 1991). Thus:

H2. Computer self-efficacy will have a positive influence on the perceived behavioral control.

H3. Perceived behavioral control will have a significant influence on behavioral intentions to use personalized IS.

H4. Perceived behavioral control will have a significant influence on actual use of personalized IS.

3.4 Computer anxiety

Computer anxiety refers to computer users' apprehension and resistance to computer use of technology (here, resistance to personalized WIS). It describes the individual's internal fear or phobia of making mistakes or causing damage when using computers (Sievert et al. 1988). Self-efficacy affects both emotional reactions and behavior (here, computer usage). This concerns anxiety especially. The self-efficacy theory suggests that the relationship is reciprocal. In other words, the higher the computer anxiety, the lower the computer self-efficacy. Furthermore, increasing computer self-efficacy level may lead to decreasing computer anxiety (Bandura 1977). Igbaria and Chakrabarti found a significant correlation between computer anxiety and attitudes towards computers (Igbaria and Chakrabarti 1990). Instead they found no significant correlation between education/age, and computer anxiety and attitudes toward microcomputers. Data for the research was gathered from questionnaires to MBA students. Thatcher and Perrew (2002) carried out research on the effect of anxiety to self-efficacy. Their findings indicate that computer anxiety has a significant negative effect on computer self-efficacy. Their sample consisted of university students, as in the Igbaria and Chakrabarti study. According to the literature, the users' psychological state may affect the adoption of technology. Thus:

H5. Computer anxiety has a negative influence on self-efficacy.

H6. Computer anxiety has a negative influence on attitudes to use personalized WIS.

3.5 Perceived ease of use and usefulness

TAM asserts that two beliefs - perceived usefulness and perceived ease of use - are relevant determinants and have a significant impact on computer acceptance behavior (Davis 1989). The theoretical background to Davis's TAM model is based on Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA), and is especially tailored for modeling user acceptance of information systems. Davis (1989) defines perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance". This definition emphasizes the user belief that systems will improve a user's job performance without the need for salary raises, promotions, bonuses or other rewards. Perceived ease of use refers to "the degree to which a person believes that using a particular system would be free of effort." Davis (1989) asserts that an application perceived to be easier to use than another is more likely to be accepted by users. Although expertise is not a variable of TAM, it may be represented indirectly via ease of use, since a person with high expertise may feel a system is easier to use than a person with low expertise (Mathieson and Chin 2001).

Self-efficacy research supports Davis's perceived ease of use definition. The self-efficacy theory distinguishes two types of expectations, self-efficacy expectations and outcome expectations. Outcome

expectations are similar to perceived usefulness (Davis 1989; Venkatesh and Davis 1996). Venkatesh and Davis showed in their empirical research that self-efficacy is associated with ease of use and it has a significant impact on users' perceptions of ease of use of computer system (Venkatesh and Davis 1996). By applying TAM relationships in the personalized WIS context:

H7. Perceived ease of use has a positive influence on the perceived usefulness of personalized WIS.

H8. Perceived ease of use has a positive influence on the behavioral intention to use personalized WIS.

H9. Perceived usefulness has a positive influence on the behavioral intention to use personalized WIS.

H10. Perceived usefulness has a positive influence on the attitude to use personalized WIS.

H11. Attitudes towards usage will have a positive influence on the behavioral intention to use personalized WIS.

H12. Behavioral intentions to use personalized WIS have a positive influence on actual use of personalized WIS.

3.6 Information Quality

User information satisfaction is widely accepted among researchers as the most significant criterion for measuring IS success. User information satisfaction factors are difficult to define as much as they are also difficult to measure. Therefore, there is a significant discrepancy in the different measures (DeLone and MacLean 1992). Whether the system is good or bad depends on how the user feels about the system. If the users do not rely on the system and its information, their behavior against the system can be negative. Although success is not necessarily dependent on the technical quality of the system (Ives et al. 1983), it is obvious that if the system cannot provide the needed information the user will feel dissatisfied and will leave the site. DeLone and MacLean (1992) have identified the following six different features for information success: system quality, use, user satisfaction, individual impact, organizational impact and information quality. Information quality was seen as one key determinant for identifying the factors, which may affect the success of information systems. Previous research has developed numerous measures of information quality and identified varying constructs. Information quality examines user satisfaction of the usefulness of the provided information. Larcker and Lessig (1980) developed a measure consisting of two dimensions, namely, perceived importance of information and perceived usefulness of information. Perceived importance of information identifies factors such as relevance, informativeness, meaningfulness, importance, helpfulness and significance. Perceived usefulness consists of factors such as unambiguity, clarity and readability. McKinney et al. (2002) examined web-customer satisfaction by separating web site quality from information quality and from systems quality.

In personalized web information systems, information is provided by the system based on the user information recorded in the user profile. This provides tailored information content which is dependent on the users' preferences and their web behavior. It is important to find out if the provided information really reflects the needs of user. Furthermore, understanding the factors that affect information quality satisfaction will provide significant information for developing better personalization methods and techniques. The information quality of Web IS is included in our construction of terms of perceived ease of use and information quality.

H13. The information quality of personalized IS has a positive influence on the perceived usefulness.

3.7 Compatibility

Understanding how individuals adopt new ideas and social practices, and spread them within a society or from one society to another, are important elements in explaining personal and social changes (Bandura 1986). The process of spreading ideas and practices has been examined extensively by Rogers (Rogers 1995) in the book "Diffusion of Innovations". Diffusion of innovation can be seen as a social process, in which subjectively perceived information about a new idea is communicated. According to Rogers diffusion can be defined as "a process by which an innovation is communicated through certain channels over time among the members of the system" (Rogers 1995). This definition indicates that diffusion can be seen as communication in a social context, spreading messages, which are concerned with new ideas, practices, or devices.

Web information systems, systems that are linked and related systems of entities providing access to knowledge as a communication mechanism, provide a unique channel for disseminating information (Scharl 2000). Simultaneously they offer the advantages of mass media channels, organizational channels and personal channels. In the course of

time, users will lose consciousness of the medium and, instead of a document or computer screen, will recognize the power of the text itself (Scharl 2000). Rogers (1995) categorizes the characteristics, which could promote IT usage and the decisions to adopt new technology into the following five attributes: relative advantage, compatibility, complexity, trialability, observability. Compatibility of the innovation (here, personalized WIS) indicates "the degree to which an innovation is perceived as consistent with the existent values, past experiences, and needs of potential adopters" (Rogers 1995). According to Tornatzky and Klein (1982), there are three attributes of innovation; relative advantage, complexity and compatibility, which are related to innovation adoption and IT usage. Chen et al. (2002) found in their research that compatibility correlates significantly with the perceived usefulness. Their finding is consistent with Moore and Benbasat's (1991) finding. Moore and Benbasat suggest that the relationship of compatibility to relative advantage is significant. When we consider Taylor and Todd's (1995) suggestion that relative advantage - "the degree to which an innovation is perceived as better than the idea it supersedes" (Rogers 1995) - is compatible with the determinant perceived usefulness of TAM's construct, we can then conclude in the personalized WIS context that:

H14. Compatibility will have a positive influence on perceived usefulness of the personalized IS.

The factors in the research model are presented in Figure 1.

4 METHODOLOGY

Our intention is to execute a field study by using a quantitative approach based on Web questionnaire. The number of potential users of the given portal is about 10000. Developing the instruments for measuring each of the factors of the presented model is based on the prior research and the literature adapted to the IS technologies and organizations. According to Straub (1989) and Boudreau et al. (2001) using validated and tested questions will improve the reliability of the findings.

Scale items perceived ease of use, perceived usefulness, attitude and behavioral intention are based on the Davis' (1989) studies. These will be measured using seven point scales. Measuring actual use is also based on the Davis' (1989)

Computer self-efficacy will be measured by using item scale, developed by Compeau and Higgins (1995). Items to measure information quality are based on the questionnaire items developed by Larcker and Lessig (1980). Computer anxiety will be measured by using seven point scale based on the research of Igbaria and Chakrabarti (1990). Perceived behavioral control will be measured by using the item scale developed by Taylor and Todd (1995). Items to measure for compatibility are based on the scales developed by Moore and Benbasat (1991). Need for control items will be generated by asking respondents their concern in giving demographic information to a system, their concern in filling out registration forms and their concern about how their individual information is collected, used and processed.

After completing the questionnaire depicted above, we will perform a pilot test in a real portal environment with the focus group consisting of 7-10 portal users. Definite responses of the field study will be collected in a database for statistical analysis.

5 CONTRIBUTIONS

Our focus is to study the acceptance factors that may affect intentions and actual use of personalized web information system. Although many empirical studies have been carried out into the field of technology acceptance, we feel that the issues described in this paper need further examination. Many features of personalized web information systems differ from the "traditional" information systems, and we believe that this research will shed light on the research into the acceptance of personalized WIS.

Understanding users' psychological and behavioral incentives, their attitudes and intentions to use IS, will be a step towards increasing the acceptance of personalized WIS. Moreover, identifying the factors for predicting and explaining system use are important and have a high practical value for practitioners, researchers and IS managers in general.

The main contributions of our future work will be:

- to provide useful information to IS practitioners, researchers and IS managers studying the voluntary adoption of specific personalized WIS
- to shed light on possible individual barriers to the use of personalized WIS
- to find out the significance of the factors presented in our model with regard to the acceptance of personalized WIS
- to help organizations understand why a particular system may be unacceptable and may need some corrective work.

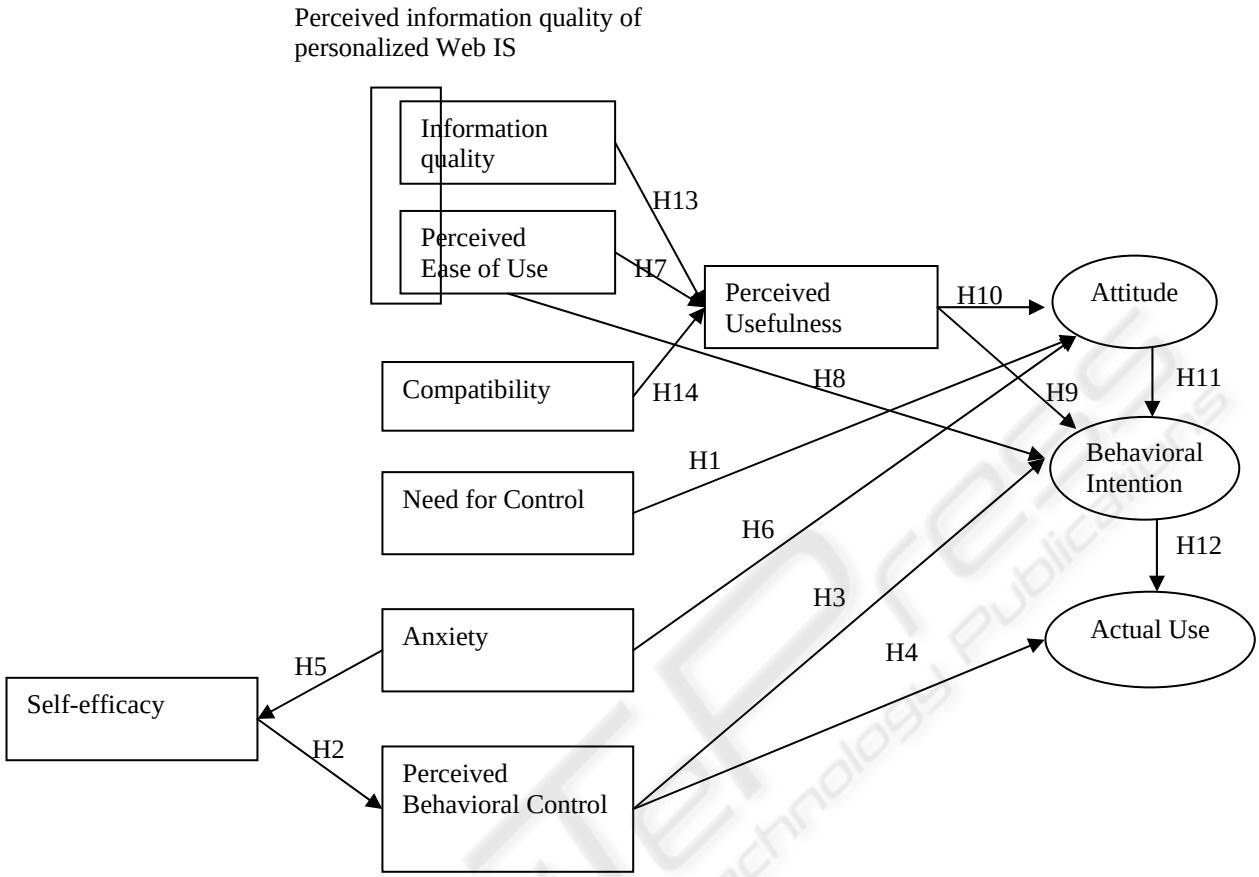

Figure 1: Research model.

6 CONCLUSIONS

This research has attempted to identify users' perceptions when they come into contact with the system, which is based on the use of individual information, and users' prior net behavior when providing tailored information and experiences. Our next step is to test presented model and later carry out the field study. The field study is based on questionnaires located on the web. Answers will be collected in a database for future analysis. Our target group will consist of the users of a personalized medical portal.

REFERENCES

Ajzen I (1991) The Theory of Planned Behavior. Organizational Behavior and Human Decision Processes 50(2): 179-211.

Bandura A (1977) Self-Efficacy: Toward a Unifying Theory of Behaviour Change. Psychological Review 84(2): 191-215.

Bandura A (1982) Self-Efficacy Mechanism in Human Agency. American Psychologist 37(2): 122-147.

Bandura A (1986) Social Foundations of Thought and Action. A Social Cognitive Theory. New Jersey, Prentice Hall. Englewood Cliffs.

Baronas A & Louis M (1988) Restoring a Sense of Control During Implementation: How User Involvement Leads to System Acceptance. MIS Quarterly 12(1): 111-124.

Billsus D, Brunk CA, Evans C, Gladish B & Pazzani M (2002) Adaptive Interfaces for Ubiquitous Web Access. Communication of ACM 45(5): 34-38.

Boudreau M-C, Gefen D, Straub DW (2001) Validation in Information Systems Research: A State-of-the-Art Assessment. MIS Quarterly 25(1): 1-16.

Brusilovsky P (1996a) Adaptive hypermedia: An Attemp to Analyze and Generalize. In Multimedia, Hypermedia and Virtual Reality, Lecture Notes in

Computer Science 1077, Eds. Brusilovsky, P., Kommers, P., Streitz, N. Springer Verlag: 288-304.

Brusilovsky P (1996b) Methods and Techniques of Adaptive Hypermedia. User Modeling and User Adapted Interaction. 6: 87-129

Chen L-d, Gillenson ML & Sherrell DL (2002) Enticing Online Consumers: an Extended Technology Acceptance Perspective. Information & Management 39(8): 705-719.

Compeau R, D & Higgins A, C (1995) Computer Self-Efficacy:Development of a Measure and Initial Test. MIS Quarterly 19(2): 189-211.

Compeau R, Deborah, Higgins, A, Christopher, Huff, Sidd (1999) Social Cognitive Theory and Individual Reactions to Computing Technology: a Longitudinal Study. MIS Quarterly 23(2): 145-158.

Davis DF (1989) Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. MIS Quarterly 13(3): 319-340.

DeLone W & MacLean E (1992) Information Systems Success: The Quest for the Dependent Variable. Information Systems Research 3(1): 60-95.

Fishbein M & Ajzen I (1975) Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research. MA, Addison-Wesley.

Igbaria M & Chakrabarti A (1990) Computer Anxiety and Attitudes Towards Microcomputer Use. Behaviour & Information Technology 9(3): 229-241.

Igbaria M & Iivari J (1995) The Effects of Self-efficacy on Computer Usage. Omega. The International Journal of Management Science. 23(6): 587-605.

Ives B, Olson MH & Baroudi JJ (1983) The Measurement of User Information Satisfaction. Communications of ACM 26(10): 785-793.

Kobsa A (2001) Tailoring Privacy to User's Needs (Invited keynote). User modeling: 8th International Conference, Berlin-Heidelberg, Springer Verlag**:** 303-313.

Kobsa A (2002) Personalized Hypermedia and International Privacy. Communication of ACM 45(5): 64-67.

Larcker DF & Lessig VP (1980) Perceived Usefulness of Information: a Psychometric Examination. Decision Sciences 11(1): 121-134.

Lederer L, Albert., Maupin, J, Donna., Sena, P, Mark., Zhuang (1998) The Role of Ease of Use, Usefulness and Attitude in the Prediction of World Wide Web Usage. Conference on Computer Personnel Research, Boston, Massachusetts, United States**:** 195-204.

Mathieson K (1991) Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior. Information Systems Research 2(3): 173-191.

Mathieson K & Chin WW (2001) Extending the Technology Acceptance Model: The Influence of Perceived User Resources. The Data Base for Advances in Information Systems 32(3): 86-112.

McKinney V, Yoon K & Zahedi FM (2002) The Measuement of Web-customer Satisfaction: An Expectation and Disconfirmation Approach. Information Systems Research 13(3): 296-315.

Moore GC & Benbasath I (1991) Development of an Instrument to Measure the Perception of Adopting an Information Technology Innovation. Information Systems Research 2(3): 191-222.

OWLA (2002) Open Web/Wireless Adaptive Hypermedia Applications [online]. Oulu, University of Oulu. Available from: http://owla.oulu.fi/ [Accessed 25 september 2003]

Rich E (1979) Building and Exploiting User Models. Department of Computer Science. Pittsburg, Canegie-Mellon University**:** 193.

Rogers EM (1995) Diffusion of Innovations. New York, The Free Press.

Scharl A (2000) Evolutionary Web Development. J. P. Ray, J. P. Thomas and J. Kuljis, Springer-Verlag.

Sievert ME, Albritton RL, Roper P & Clayton N (1988) Investigating Computer Anxiety in an Academic Library. Information Technology and Libraries. 7(9): 243-252.

Strachan L, Anderson J, Sneesby M & Evans M (1997) Pragmatic User Modeling in A Commercial Software System. Sixth International Conference on User Modeling (UM-97), Chia Laguna, Italy, Springer**:** 189-200.

Straub DW (1989) Validating Instruments in MIS Research. MIS Quarterly 13(2): 147-169.

Straub DW & Watson RT (2001) Research Commentary: Transformational Issues in Researching IS and Net-Enabled Organizations. Information Systems Research: 12(4): 337-345

Taylor S & Todd PA (1995) Understanding Information Technology Usage: A Test of Competing Models. Information Systems Research 6(2): 144-176.

Thatcher JB & Perrewé PL (2002) An Empirical Examination of Individual Traits as Antecedents to Computer Anxiety and Computer Self-efficacy. MIS Quarterly 26(4): 381-396.

Tornatzky LG & Klein KJ (1982) Innovation Characteristics and Innovation Adoption-Implementation: A Meta-analysis of Findings. IEEE Transactions on Engineering Management 29(1): 28-45.

Venkatesh V & Davis DF (1996) A Model of the Antecedents of Perceived Ease of Use: Development and Test. Decision Sciences 27(3): 451-481.