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Online Decision Making in VR Application Environments

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ABSTRACT

The aim of this paper is to understand the process by which consumers' perception of online VR environments impact their purchase decision. Combining factor and process models, we propose a transaction framework suggestive of consumer decision-making in VR e-commerce environments. The framework is informed by theory to be validated by an experimental design to understand the antecedents and contingencies that shape decision-making. The study contributes to research by considering a pertinent, yet parsimonious set of factors and processes that culminate in consumer decision making in rich, VR driven environments. The study contributes to practitioners by investigating how consumers perceive virtual environments that organizations are spending enormous amounts to develop and maintain, and whether consumer perceptions do impact the positive purchase decision.

Keywords

Virtual reality, virtual experience, decision making, media richness, direct manipulation, purchasing intention

INTRODUCTION

It is well documented in literature that if consumers' virtual experience of a product or service can match their physical world experiences, the likelihood of purchase increases manifold (Li, Daugherty and Biocca 2001; Suh and Lee 2005; Walsh and Pawlowski 2002). Virtual reality (VR) applications that create 3D renditions, 360-degree views, among many others, are becoming popular tools aimed at increasing virtual experience and inducing consumers' towards a purchase decision.

We are interested in answering questions with regard to the relationship between virtual reality and users' intention to transact. First, how is users' perception of virtual experience influenced by VR application richness and level of direct manipulation? How such perception is moderated by various tasks, such as product types, users' prior experiences, and so on? Second, to what extent does virtual experience affect users' decision-making processes with regard to their intention to purchase online? Combining factor and process models, we are proposing a transaction framework suggestive of consumer decision-making in VR e-commerce environments.

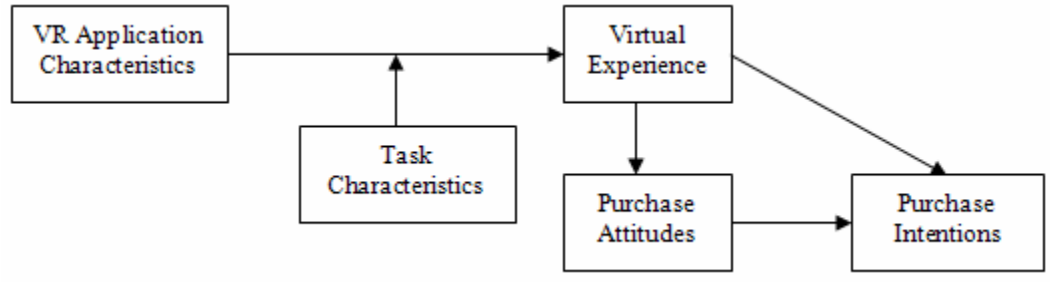

Figure 1 Preliminary Overview of the Model

In this research-in-progress submission, we begin with a literature review for the proposed ontology to develop a model of interest (Fig 1). The model is elaborated as constructs are defined and hypotheses are developed. Finally, we briefly discuss the research design.

LITERATURE REVIEW AND FRAMEWORK DEVELOPMENT

Characteristics of a VR Application Environment

Virtual reality has been traditionally defined either as a medium (Biocca 1992), a system (Coates 1992), a technology (McLellan 1996), or an environment (Jacobson 1993). We define a VR application environment as an interactive application environment providing rich cues from reality to facilitate user learning and decision making. VR application technologies commonly embody high-speed data streams, 3D graphics or animations, and instant interactions in the form of audio, video, and/or physical actions to simulate the real world with computer mediated interactive environments (Bricken and Byrne 1993; Steuer 1992; Suh et al. 2005; Walsh 2001). In e-commerce, VR applications such as 3D video, however, are slowly gaining ground as newer technologies such as Flash, Shockwave, QuickTime, offer embedded VR environments within browsers.

Figure 2 Examples of Two Different VR Application Environments (Courtesy, Garmin®)

Application Richness

One can argue that a VR application is as rich as the media (content) that it can support. As a derivative of Daft and Lengel's (1986) media richness theory (MRT), media richness has been used to define a medium's ability to convey information (Palmer 2002; Suh et al. 2005). Daft and Lengel (1986) used the concept of media richness to explain how managers select particular technologies to meet task requirements. Media richness was originally accounted for by four factors: ability to offer instant feedback, ability to support multiple cues, use of natural language, and use of personal focus. Among the four, the ability of the application to offer instant feedback and its ability to support multiple cues are application-centric and thus relevant factors in the scope of this study. The two factors of natural language and personal focus mainly explain channel selection in managerial communications and are irrelevant to our immediate understanding of VR applications.

Instant feedback is the capacity of the VR application to send and receive prompt feedback from users (Daft et al. 1986). The ability to support multiple cues is another quality of the VR application, referring to the various ways that information can be represented and transmitted to the user, such as textual cues, verbal cues, image cues, 3D cues, or a combination. Multiple cues work like "smiley faces" that enrich communication with semantic signals such as emphasis and emotions (Dennis and Kinney 1998). A VR medium can be rated high or low on any of these two factors, so it the combination of theses two factors that offer an understanding of VR application richness.

Direct Manipulation

The other characteristic useful in defining a VR application is the degree of direct manipulation that it offers to the end user. In order to successfully simulate the real world, VR applications must have offer consumers as end users the ability to directly interact and manipulate the content using the application technology (Nilan 1992).

Shneiderman (1982) defines direct manipulation as the ability of interfaces and designs to replace complex syntax with "rapid, incremental and reversible" designs immediately visible to the users. Shneiderman's definition of direct manipulation emphasizes on simulating the real world by dynamic representations. For example, using a mouse to press the shutter button of a camera on screen is direct manipulation, while typing a syntax command to "press" the shutter is not (Schlosser 2003).

In implementing direct manipulation interfaces (DMI) in user training, Davis and Bostrom (1993) identified two distinct factors that lead to perceptions of direct manipulation: semantic distance and articulatory distance. Semantic distance is a measurement of the distance between a user's conceptualization of an environment and the environment that the VR application represents. Semantic distance is reduced if the representation is closer to reality. (Davis and Bostrom 1993). Articulatory distance is a measure of how straight-forward an interface language is in presenting the meaning of expressions (Davis et al. 1993). Application environments that provide "firm", non-arbitrary meaning allow for greater sensemaking and reduce articulatory distance. Adding a product to a "shopping cart" is more coherent compared to adding it to an "array of saved items;" similarly, being able to turn a camera on a 3D wireframe is more coherent than static images from different angles.

Virtual Experience

Li et al (Li et al. 2001) define virtual experience as "psychological and emotional states that consumers undergo while interacting with products in a 3D immersive environment." Virtual experience is an indirect immersive experience, understood in terms of the following four properties (Li et al. 2001; Walsh 2002): virtual involvement, virtual affordance, virtual presence, and virtual enjoyment.

Virtual involvement is the level of closeness that consumers feel to a product or service in a VR application environment (Li et al. 2001; Walsh 2002). Virtual affordance defined as consumers' expectations of experiencing a product or service in a VR application environment. (Li et al. 2001). Virtual presence is a core concept in defining virtual reality which emphasizes human experience rather than technological hardware (Steuer 1992).Virtual enjoyment is the extent to which consumers are satisfied with the virtual environment compared with the real world. Increasing virtual enjoyment will potentially impact consumers' attitude and behavior and facilitate decision making process (Li et al. 2001).

Task Characteristics

In technology mediated domains, the fact that task characteristics potentially influence user perceptions and decision making is well founded, especially in the literature on task technology fit (Goodhue 1995; Goodhue and Thompson 1995; Guimaraes, Igbaria and Lu 1992; Lai 1999). The literature asserts that decision-making is optimized when a task that is apropos with the technology used to support it.

We define task characteristics as the nature of the purchase activity that a consumer is involved in arriving at a transaction decision. In VR application environments, different tasks may require different levels of representational demands. For example, trading stocks may need multiple types of representation to truly capture a stock's characteristic. However, bill payment is a simpler task, where representational demands on an application are relatively lower, and perceptions of virtual experience will be subsequently different. In summary, whatever the VR application may offer, virtual experience will be duly influenced by the deliberated task.

H1a: Higher VR application richness will lead to an increase in virtual experience.

H1b: Increase in direct manipulation offered by a VR application will lead to an increase in virtual experience.

H1c: For any particular VR application, task characteristics will influence virtual experience.

Purchase Attitudes and Purchase Intentions

An increase in virtual experience has been positively affiliated to decision-making behavior (Li et al. 2001). In an online environment, consumers are faced with decision making in order to make a purchase. If consumers have a higher virtual experience, it may facilitate their purchase decisions. If a consumer were to experience a car from all angles rather that a static snapshot from one particular angle, it would facilitate their purchase decision-making. The same view is echoed by Suh and Lee (2005) who find that consumers' facing VR environments are likely to develop a more informed purchase attitude in comparison with static application environments.

H2: Consumer virtual experience is directly related to consumer purchase attitude.

However, it is also contended that virtual experience has a direct bearing on purchase intention (Lee and Kozar 2004). (Schlosser 2003) observed that immersive virtual experiences from object interactivity increased user perception of reality and enjoyment, enhancing purchase intentions.

H3: Consumer virtual experience is directly related to consumer purchase intentions.

The theory of reasoned action (TRA) separates decision making into beliefs, attitudes, intentions and behaviors, where attitudes shape intention (Fishbein and Ajzen 1975). Consumers' attitudes towards a product have a positive relationship with their purchase intention (Jarvenpaa, Tractinsky and Vitale 2000).

H4: For consumers, favorable purchase attitudes will lead to favorable purchase intentions.

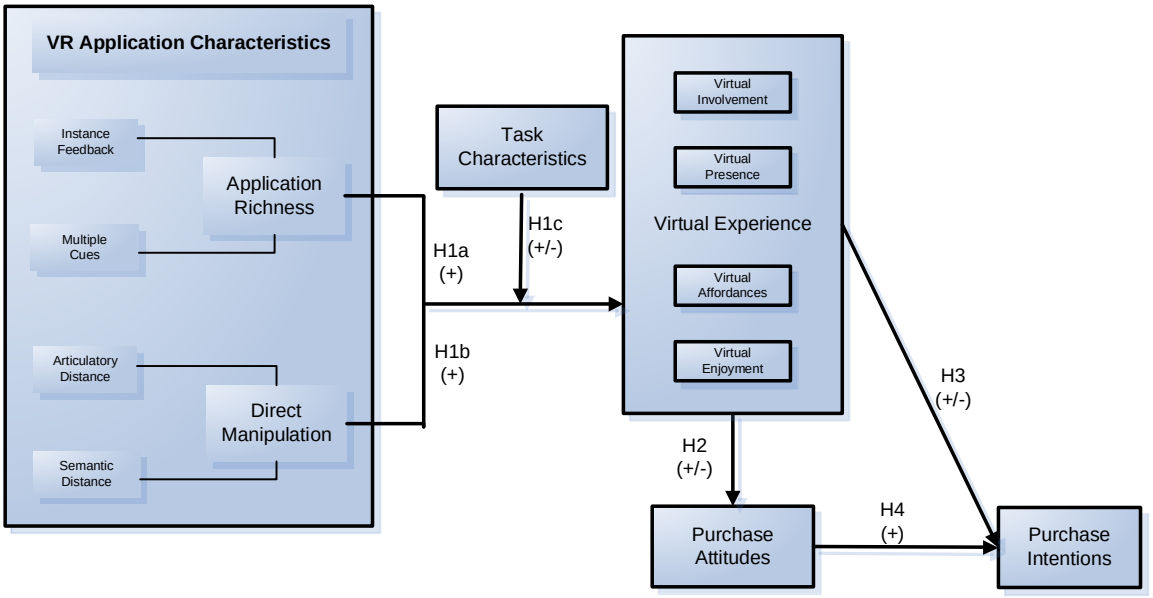

Figure 3 Elaborated Model of Consumer Purchase Decision in VR Application Environments

RESEARCH DESIGN

A lab experiment will be conducted to investigate consumer behavior in VR application environments and empirically validate the proposed framework. In developing the experimental design, we will create manipulations in VR application interfaces and the task characteristics. Since prior experience (Carlson and Zmud 1999) and product types (Suh et al. 2005) can unduly confound consumer behavior, we will control for these attributes.

A 2 x 2 experimental design will be implemented to test the hypotheses. The two factors are VR application richness (low richness versus high richness; between subjects) and task characteristics (less intellective versus more intellective; between subjects). Participants will be asked to complete an initial pretest that captured demographic and individual differences (efficacy, experience…). Subsequently, they will complete their GPS experiencing task using one of the two VR applications.

A GPS finding task will be used in this study to simulate an automotive GPS acquisition decision. Vignettes are provided for each task and subjects are asked to identify whether the VR application does fulfill their query criteria to lead to an involved decision making. Subjects can interact with the VR application environment as much as they need to in order to reach their decisions based upon respective vignettes without any time restrictions.

CURRENT STATUS AND CONFERENCE PRESENTATION

The questionnaire has been developed and data collection is expected to commence in May. The conference presentation will include a data analysis and discussion of preliminary results.

REFERENCES

1. Biocca, F. "Virtual Reality Technology: A Tutorial," Journal of Communication (42:4), Autumn 1992, pp 23-72.
2. Bricken, M., and Byrne, C. M. "Summer Students in Virtual Reality: A Pilot Study on Educational Applications of Virtual Reality Technology," in: Virtual Reality Applications and Explorations, A. Wexelblat (ed.), Academic Press Professional, Boston, 1993, pp. 3-44.

3. Carlson, J. R., and Zmud, R. W. "Channel Expansion Theory and the Experiential Nature of Media Richness Perceptions," Academy of Management Journal (42:2), April 1999, pp 153-170.
4. Coates, G. "Program from Invisible Site - a Virtual Show, a Multimedia Performance Work Presented by George Coates," Performance Works, San Francisco, CA, 1992.
5. Daft, R. L., and Lengel, R. H. "Organizational Information Requirements, Media Richness and Structural Design," Management Science (32:5), May 1986, pp 554-571.
6. Davis, S. A., and Bostrom, R. P. "Training End Users: An Experimental Investigation of the Roles of the Computer Interface and Training Methods," MIS QUARTERLY (17:1), March 1993.
7. Dennis, A. R., and Kinney, S. T. "Testing Media Richness Theory in the New Media: The Effects of Cues, Feedback, and Task Equivocality," Information Systems Research (9:3), September 1998, pp 256-274.
8. Fishbein, M., and Ajzen, I. "Beliefs, Attitude, Intention and Behavior: An Introduction to Theory and Research," Addison-Wesley, Reading, MA, 1975.
9. Goodhue, D. L. "Understanding User Evaluations of Information Systems," MANAGEMENT SCIENCE (41:12) 1995, pp 1827-1844.
10. Goodhue, D. L., and Thompson, R. L. "Task-Technology Fit and Individual Performance," MIS QUARTERLY), June 1995, pp 213-236.
11. Guimaraes, T., Igbaria, M., and Lu, M. "The Determinants of Dss Success: An Integrated Model," Decision Sciences (23) 1992, pp 409-430.
12. Jacobson, L. "Welcome to the Virtual World," in: On the Cutting Edge of Technology, R. Swadley (ed.), 1993, pp. 69-79.
13. Jarvenpaa, S. L., Tractinsky, N., and Vitale, M. "Consumer Trust in an Internet Store," Information Technology & Management (1:1) 2000, pp 45-71.
14. Lai, V. "A Contigency Examination of Case - Task Fit on Software Developer's Performance," European Journal of Information Systems (8:1) 1999, pp 27-39.
15. Lee, Y., and Kozar, K. A. "Music Composition Theory and Web Purchases: Can We Sing Our Way to Greater Revenues?" MANAGEMENT SCIENCE), April 2004.
16. Li, H., Daugherty, T., and Biocca, F. "Characteristics of Virtual Experience in Electronic Commerce: A Protocol Analysis," Journal of Interactive Marketing (15:3), Summer 2001, pp 13-30.
17. McLellan, H. "Virtual Realities," in: Handbook of Research for Educational Communications and Technology: A Project of the Association for Educational Communications and Technology, D. H. Jonassen (ed.), Macmillan, New York, NY, 1996, pp. 457-487.
18. Nilan, M. S. "Cognitive Space: Using Virtual Reality for Large Information Resource Management Problems," Journal of Communication (42:4), Autumn 1992, pp 115-135.
19. Palmer, J. W. "Web Site Usability, Design, and Performance Metrics," Information Systems Research (13:2) 2002, pp 151-167.
20. Schlosser, A. E. "Experiencing Products in the Virtual World: The Role of Goal and Imagery in Influencing Attitude Versus Purchase Intentions," Journal of Consumer Research (30:2), September 2003, pp 184-198.
21. Steuer, J. "Defining Virtual Reality: Dimensions Determining Telepresence," Journal of Communication (42:4), Autumn 1992, pp 73-93.
22. Suh, K.-S., and Lee, Y. E. "The Effects of Virtual Reality on Consumer Learning: An Empirical Investigation," MIS QUARTERLY (29:Forthcoming) 2005.
23. Walsh, K. R. "Virtual Reality for Learning: Some Design Propositions," Seventh Americas Conference on information Systems, 2001.
24. Walsh, K. R. "Reducing Distance in Ecommerce Using Virtual Reality," in: The E-Business Handbook, P. B. Lowry, J. O. Cherrington and R. J. Watson (eds.), Saint Lucie Press, 2002, pp. 457-466.
25. Walsh, K. R., and Pawlowski "Virtual Reality: A Technology in Need of Is Research," Communication of the Association for Information Systems (8) 2002, pp 297-313.