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# What is User Engagement? A Conceptual Framework for Defining User Engagement with Technology<sup>1</sup>

By Heather L. O'Brien and Elaine G. Toms  
Centre for Management Informatics, Dalhousie University,  
6100 University Avenue, Halifax, Nova Scotia, Canada B3H 3J5.

## ABSTRACT

The purpose of this article is to critically deconstruct the term engagement as it applies to peoples' experiences with technology. Through an extensive, critical multidisciplinary literature review and exploratory study of users of Web searching, online shopping, Webcasting, and gaming applications, we conceptually and operationally defined engagement. Building on past research, we conducted semistructured interviews with the users of four applications to explore their perception of being engaged with the technology. Results indicate that engagement is a process comprised of four distinct stages: point of engagement, period of sustained engagement, disengagement, and reengagement. Furthermore, the process is characterized by attributes of engagement that pertain to the user, the system, and user-system interaction. We also found evidence of the factors that contribute to nonengagement. Emerging from this research is a definition of engagement—a term not defined consistently in past work—as a quality of user experience characterized by attributes of challenge, positive affect, endurance, aesthetic and sensory appeal, attention, feedback, variety/novelty, interactivity, and perceived user control. This exploratory work provides the foundation for future work to test the conceptual model in various application areas, and to develop methods to measure engaging user experiences.

## INTRODUCTION

In the past few decades, human-computer interaction studies have emphasized the need to move beyond usability to understand and design for more engaging experiences (Hassenzahl & Tractinsky, 2006; Jacques, Preece, & Carey, 1995; Laurel, 1993). A Web interface that is boring, a multimedia presentation that does not captivate users' attention, or an online forum that fails to engender a sense of community are quickly dismissed with a simple mouse click. Failing to engage users equates with no sale on an electronic commerce site and no transmission of information from a Web site; people go elsewhere to perform their tasks and communicate with colleagues and friends. Successful technologies are not just usable; they engage users. Despite the

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need to engage users and create engaging technologies, there is no agreed upon definition of the construct. Chapman (1997) stated that "... something that 'engages' us is something that draws us in, that attracts and holds our attention" (p. 3). Laurel (1993) emphasizes playfulness and sensory integration in engagement, which she also refers to as "first-person experience." Quesenbery (2003) proposed that engagement is a dimension of usability, and is influenced by users' first impression of an application and the enjoyment they derive from using it. Multiple studies of engagement have described it according to different characteristics, such as media presentation, perceived user control, choice, challenge, feedback, and variety (Jacques et al., 1995; Said, 2004; Webster & Ho, 1997; Chapman, 1997; Chapman, Selvarajah, & Webster, 1999). Cumulatively, these attributes demonstrate the physical, cognitive, and affective components of user experiences.

The objective of this study is to develop an operational definition of engagement and to identify the key components that make up engagement. To do so, we first reviewed and analyzed previous research on engagement, including its use in various application areas and its relationship to other established theories of human-computer interaction. Next we conducted an exploratory study of first-person accounts of engagement with four computer applications: online shopping, Web searching, Webcasting, and video games. We conclude with a model of user engagement.

## **LITERATURE REVIEW**

Engagement is considered "a desirable—even essential—human response to computer-mediated activities" (Laurel, 1993, p. 112). For learning to take place, multimedia presentations should engage their audiences (Webster & Ho, 1997; Jacques et al., 1995) and educators should critically engage students with technology in the classroom (Salvo, 2002). Indeed, researchers speak of "designing engagement" (Hull & Reid, 2003) and achieving a "depth of engagement" (Makkonen, 1997) with computer applications. The fervor of discussion about engagement suggests that engaging interactions are sought after by both users and developers of computer systems and applications. Just as we have worked to identify users' perceptions, actions, and attitudes about how to make a system functional and intuitive to use, we must concentrate on understanding how to make systems more engaging. Given the increased emphasis on user experience, it is no longer sufficient to ensure that a system is merely usable (Blythe, Overbeeke, Monk, & Wright, 2003).

### **Theoretical Underpinnings**

Prior research has suggested that engagement consists of users' activities, attitudes, (Kappelman, 1995), goals and mental models, and motor skills (Said, 2004), and that it manifests itself in the form of attention, intrinsic interest, curiosity, and motivation (Chapman, 1997). Jacques et al. (1995) looked at a limited number of cognitive and affective variables in relation to the format and display of a specific multimedia system. Said's approach was based on children's interactions with video games, and Chapman's research examined university students' reactions to presentation software. Thus existing frameworks are based on research conducted in specific domains and with particular

user groups and applications, with little or no attempt to generalize beyond the individual work and without theoretical foundations to support that work. The exception to this is Chapman and colleagues (Chapman, 1997; Chapman et al., 1999) who related engagement to flow theory (Csikszentmihalyi, 1990). In addition to flow theory, other theories emerged from our analysis of previous research of user experiences in human-computer interaction: aesthetic theory (Beardsley, 1982) play theory (Stephenson, 1967), and information interaction (Toms, 2002). We examine all of these theories—flow, play, aesthetics, and information interaction—to inform our understanding of user experiences.

Flow is the condition “in which people are so involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it” (Csikszentmihalyi, 1990, p. 4). Flow theory has been used to explore situational and personality variables associated with computer-based tasks (Woszczyński, Roth, & Segars, 2002), to predict and design for flow experiences (Finneran & Zhang, 2003), and to understand users' reactions to and motivations for using applications (Ghani & Deshpande, 1994; Konradt & Sulz, 2001). Engagement has been deemed “a subset of flow,” “flow in a more passive state,” and “flow without user control” (Webster & Ahuja, 2004). We suggest that engagement may share some attributes with flow, such as focused attention, feedback, control, activity orientation (i.e., interactivity), and intrinsic motivation (Csikszentmihalyi, 1990). Previous studies indicate that engagement consists of system feedback, user control (Brown & Cairns, 2004), attention, motivation (Chapman, 1997), and the ability of the system to challenge individuals at levels appropriate to their knowledge and skills (Skelly, Fries, Linnett, Nass, & Reeves, 1994). Despite the common threads between engagement and flow, we propose that there are differences. Specifically, flow involves intrinsic motivation, yet engaging experiences may come about as well during the nonvoluntary use of a system. Further, flow requires sustained, long-term focus and loss of awareness of the outside world; engagement should still occur in the midst of today's multitasking and dynamic computer environments.

Jennings (2000) suggested that aesthetic experiences are intrinsically motivating, require focused attention, stimulate curiosity, and are interesting and pleasurable. Some of these attributes, including interest, as well as aesthetics itself, have been associated with engagement (Chapman, 1997). Aesthetics is the visual appearance of the interface as it conforms to design principles (i.e., symmetry, balance, emphasis, harmony, proportion, rhythm, and unity; Beardsley, 1982). Aesthetic theory has been applied by software developers in interface design (Skelly et al., 1994; Lavie & Tractinsky, 2004). Aesthetics has been linked to usability and users' skills and needs, as well as to the sensory aspects or format of the application (Laurel, 1993; Hummels, 2000, as cited in Overbeeke, Djajadiningrat, Hummels, Wensveen, & Frens, 2003). As a result, aesthetics is important to engagement, but clearly is only one aspect of engagement.

Play is the physical activity that encourages learning and creativity, develops and satisfies psychological and social needs, and involves aspects of competition and collaboration (Rieber, 1996). Play has also been associated with having an experience,

such as news reading (Stephenson, 1967) and browsing (Toms, 1998; 2000), and has recently been examined in the context of educational technologies (Rieber, 1996; Said, 2004), video games (Pausch, Gold, Skelly, & Thiel, 1994), and decision making on the Web (Atkinson & Kydd, 1997). Play has been associated with increased frequency and satisfaction of system use (Atkinson & Kydd), and has been attributed to increased motivation, challenge, and affect (Woszczynski et al., 2002). Thus elements of play are intrinsic to engagement.

Interaction pertains to the communication between the user and the computer interface (Schneiderman, 1997), where the interface is the medium enabling user experiences. The interface represents the union of information design (i.e., how data is categorized, presented, and made meaningful to the user), interaction design (i.e., how the information tells a story), and sensorial design (i.e., the techniques employed to stimulate and utilize the five senses; Shedroff, 1994). Information interaction is specifically the “process that people use in interacting with the content” of a system (Toms, 2002, p. 855 ). For the user, this sequence of events or activities occurs when people use systems (Wright, McCarthy, & Meekison, 2003) and is contingent upon attributes of the user (e.g., motivations, expectations), system (e.g., usability), and contextual or environmental (e.g., organizational culture) characteristics (Hassenzahl & Tractinsky, 2006), in addition to task (Marchionini, 1995) and content (Toms, 2002). Information interaction provides the connectivity for engagement. The computer system may be aesthetically appealing with design elements that promote play. The user may be susceptible to the state of flow. However, it is the interaction between users and systems operating within a specific context that facilitates an engaging experience.

Table 1 maps the characteristics that emerge from the literature for flow, aesthetics, play, and information interaction theories. In the final column, we hypothesize which of these attributes may be intrinsic to engagement. Concurrent with these theories, an engaging experience is encouraged by the sensory appeal of the system and the level of feedback and challenge the user receives from the system. Engaged users are affectively involved, motivated, and perceive themselves to be in control over the interaction. However, there are other characteristics inherent in flow, play, aesthetic, and information interaction theories that are unlikely to be present in engagement. Engaging experiences have the attention of the user, but, unlike experiences in flow and aesthetic theories, do not require users to become so focused that they lose their awareness of physical reality. In contrast to flow and play, engagement may not be dependent on the user forming specific goals for the interaction. Users may use an application without any specific purpose or desirable outcome and have an engaging experience. While information interaction focuses on the user experience with content, engagement is an expression of that interactivity. While some of the other frameworks stress the meaningfulness of the experience (i.e., aesthetics and flow), an engaging experience may make a lasting impression but have no more meaning than that the experience was enjoyable or challenging.

**TABLE 1. Attributes of flow, aesthetic, play, and information interaction theories, and proposed relevancy to engagement.**

Attributes from the theories	Theories				Attribute of engagement?
	Flow theory	Aesthetic theory	Play theory	Information interaction	
Aesthetics		✓	✓		Yes
Affective appeal		✓	✓	✓	Yes
Attention	✓	✓			Maybe
Challenge	✓	✓	✓	✓	Yes
Feedback	✓		✓	✓	Yes
Goal-directed	✓		✓		Maybe
Meaningfulness	✓	✓			Maybe
Motivation	✓	✓	✓		Yes
Perceived control	✓			✓	Maybe
Sensory appeal		✓	✓		Yes

Based on our exploration of these four theoretical frameworks and previous research on engagement, an understanding of engagement emerges. Like flow, play, aesthetics, and information interaction, engagement builds upon the foundation of a usable system that is effective, efficient, and satisfying. The theoretical framework that informs engagement integrates system attributes (i.e., feedback, challenge, sensory appeal) with the affective propensities of the user. Thus engagement is conceptually a holistic framework for understanding the integration of user and system variables, and how they combine to push the boundaries of user experience from merely perfunctory to pleasurable and memorable.

### **Application Areas**

We chose to explore engagement in four application areas: online shopping, Web searching, educational Webcasting, and video games. Our rationale for this was that studies of engagement exist predominantly in education and video games, while there is sparse research about engagement in online shopping and Web searching. By looking at these four applications, we intended to confirm past findings in the areas of video gaming and education applications, and to see what the areas of Web searching and online shopping would contribute to the understanding of engagement.

Education researchers have emphasized that engagement should be a pleasurable experience that involves intellectual challenge or stimulation (Douglas & Hargadon, 2000; Read, MacFarlane, & Casey, 2002). Read, MacFarlane, and Casey observed children's facial expressions to identify instances of engagement and fun, and linked engagement with the "endurability" of the experience. Endurability is the likelihood of remembering enjoyable situations and intending to perform them again. In addition to fun, researchers have explored the impact of specific technologies, including educational multimedia (Jacques et al., 1995), presentation software (Webster & Ho,

1997), computer-based versus video-based training applications (Chapman et al., 1999), and film and hypertext (Laarni, Ravaja, Kallinen, & Saari, 2004) on engagement. The characteristics of engaging systems that emerge from these studies have included ease of use, aesthetic appeal, and choice (Jacques et al.); feedback, challenge, and variety (Webster & Ho); interactivity (Chapman et al.; Laarni et al.); and sensory appeal through the use of different multimedia components including text, graphics, and sound (Laarni, et al.).

A number of these same attributes (e.g., feedback, intrinsic motivation, fun, user control, and interactivity) have been studied in video games (Carroll & Thomas, 1988; Vorderer, Hartmann, & Klimmt, 2003; Choi & Kim, 2004). Said (2004) varied the amount of control participants had over a video game, i.e., some children took on the role of characters, some manipulated the characters' world, and others watched the game unfold without being able to intervene. Results indicated that immediate feedback from the system, well-defined goals, prior experience, and increasing challenge in proportion to game-playing skills were essential attributes of engagement. Physiological arousal (Ravaja et al., 2004), as well as players' sense of social presence (Champion, 2003) and sensation seeking (Ravaja et al.), were all factors of engagement with video games.

Engagement has rarely been examined in online shopping and search applications. However, given the role of affect in both of these contexts (see, e.g., Nahl & Bilal, 2007; Arnold & Reynolds, 2003), we can extrapolate that engagement in these areas will be not only purposeful but pleasurable, and that this emotional component will make people more likely to return to a specific product or company Web site (Webster & Ahuja, 2004). Qualities of Web sites, such as novelty (Toms, 1998; 2000) and aesthetics (Lavie & Tractinsky, 2004; Skelly et al., 1994), as well as feedback, navigability, control, and interactivity (Huang, 2003), have demonstrated that users' needs for both information and entertainment must be satisfied when it comes to engaging searching and shopping experiences. Poor Web site design and usability may be useful for predicting potential barriers to engagement. For example, when the "fun" of Web searching is hampered by a Web site's poor navigational structure, users are left feeling disoriented and frustrated (Atkinson & Kydd, 1997; Webster & Ahuja, 2004), and that they lack control over the interaction (Rozell & Gardner, 2000).

An examination of these application areas reveals what qualities of video games and educational applications make for an engaging experience; studies in the areas of usability and user affect suggest what factors will predict engagement in searching and online shopping environments. Table 2 summarizes the attributes of engagement that emerge from reviewing research in the areas of education, video games, online shopping, and searching. Of note is that some of these characteristics differ from the earlier theoretical discussion (compare Tables 1 and 2). Our definition of an engagement attribute is a characteristic of the user-computer interaction that influences or is a component of the engagement. Engagement attributes are products of users' interactions with the technology, since they depend on what the user finds innately compelling. Previous research across the four applications areas suggests that challenge, pleasure, endurability, attention, aesthetic and sensory appeal, feedback,

variety/novelty, interactivity, and perceived user control are attributes of engagement. We predict that an engaging experience is characterized by these attributes.

**TABLE 2. Attributes of engagement suggested by previous research in four areas of application.**

Attributes of engagement	Applications			
	Video games	Educational applications	Online shopping	Web searching
Aesthetics appeal <sup>a</sup>		✓	✓	✓
Attention <sup>a</sup>	✓			
Challenge <sup>a</sup>	✓	✓		
Endurability		✓	✓	✓
Feedback <sup>a</sup>	✓	✓	✓	✓
Interactivity	✓	✓	✓	✓
Perceived user control <sup>a</sup>	✓		✓	✓
Pleasure <sup>b</sup>	✓	✓	✓	✓
Sensory appeal <sup>a</sup>		✓		
Variety/Novelty		✓	✓	✓

<sup>a</sup>Indicates that these attributes also appear in Table 1 as characteristics of flow, aesthetic, play, and information interaction theories.

<sup>b</sup>Table 1 summarizes emotions inherent in the theories as “affective appeal.”

## RESEARCH DESIGN

Based on our synthesis of aesthetic, flow, play, and information interaction theories, and on previous work in the application areas of video games, online shopping, Web searching, and educational software, we propose a definition of engagement:

Engagement is a category of user experience characterized by attributes of challenge, positive affect, endurability, aesthetic and sensory appeal, attention, feedback, variety/novelty, interactivity, and perceived user control.

As a result, the research question that guided the design of this study is: Is this definition of engagement complete? In other words, has previous research identified all of the possible attributes of engagement, or are there others that have yet to be recognized?



## **METHODOLOGY**

There are a variety of methods that we might have employed to study this construct, including surveys, participant observation, and so forth. However, due to the exploratory nature of our research, we could not be confident in creating questionnaire items or classifying observed behaviors. Nor could we be certain that studying this phenomenon while participants were actively engaged would not interfere with their experiences. In addition, it was our belief that there is more to engagement than we could garner by studying the activity itself.

We concluded that conducting semistructured interviews was the best method, because it enabled us to delve into the thoughts, behaviors, and feelings of our participants and to allow them to recount a real-life experience. A drawback to this methodology is that stimulated recall is not “a mirror” of an event, but a “selected interpretation” (McCarthy & Wright, 2004), a conclusion reached by Ericsson and Simon (1993) in their analysis of retrospective verbal protocols. As such, it may be biased by users' reflections of events as they relate to other experiences; some details may be withheld or changed since this method relies on accurate recall and depends on what participants deem important or memorable. On the other hand, if an experience was truly memorable, then participants likely remember the details of the experience. Ericsson and Simon further acknowledged that situations of intense cognitive activity, such as that required for the applications we were investigating, tend not to produce useful data when done concurrently with real-time data collection in the form of think-alouds. Given the methodological research in this area, the method we chose was the best given this set of circumstances. Thus, we acknowledge that our interview data is part recall and part interpretation on the part of our participants, but we believe that participants' reflections of their experiences communicate memorable information about the nature of their engagement.

### **Participants**

Participants ( $n = 17$ ; 10 female, 7 male) were recruited in two Canadian cities. Recruitment notices were sent via listservs that solicited interviewees who were online shoppers, searchers, video game players, and distance learners of a specific webcast application. Thus, this was a purposive sample with individuals chosen on the basis of their interaction with the applications of interest to this study. Recruitment continued until the researchers felt there were no new ideas emerging from the interviews (Oppenheim, 1992). Our intention was not to saturate each application area, but to examine engagement in general using a variety of applications.

As a group, the 10 females and 7 males were educated and technologically savvy. All used e-mail on a daily basis and searched the Web daily (95%) or weekly (5%). All had a high school diploma; 88% had some undergraduate education, and 30% held college diplomas; 71% had completed or were currently enrolled in a masters program. Forty-one percent were currently students. Most of the participants were under age 35 ( $n = 13$ ), while the remainder were between 36 and 45 ( $n = 3$ ) and over 55 ( $n = 1$ ).

### **Interview Protocol**

Appendix A consists of the interview questions. Based upon our conjecture that engagement is a quality of user experience, we used McCarthy and Wright's (2004) "threads" of experience in developing our interview questions and, subsequently, as a framework for interpreting our results. The four threads of experience are (a) compositional (i.e., beginning, middle, and end); (b) spatiotemporal (i.e., the subtasks being performed as part of participants' application use, such as searching, browsing, comparing information, and communicating with others, as well as their awareness of themselves and their environments, and characteristics of the technology); (c) emotional, (e.g., pleasure, fatigue); (d) sensual (i.e., cognitive [e.g., problem solving], and behavioral [e.g., interactivity] components of the experience). The interview was designed to elicit participants' reactions to each of these components of experience. Specifically we asked them to recount their affective responses, sensory impressions of their environments and the interface, and perceptions of how much time they spent on the computer-based activity. In accordance with the compositional thread, we allowed our participants to tell us a story.

The same interview questions were used for all applications, with slight modifications made to reflect the specific application. For example, one question for online shopping interviewees read: "Before you began to shop, did you have any expectations about the shopping experience?" The word "shop" was replaced with "search," "play the video game," or "watch the Webcast" to tailor it to the application. Prompting questions were included throughout the protocol, but were used only if participants had difficulty articulating the experience. The interview ended when all of these semistructured questions had been addressed. The order of the questions was allowed to vary so that the interview flowed more like a conversation between the participant and the researcher.

### **Procedure**

In-person interviews were carried out with 15 of the 17 participants in their homes or the researchers' office; two interviews were conducted over the telephone. After they completed the demographics and consent form, individuals were asked to recall a time in recent memory when they felt engaged while using the application they chose to discuss in the interview. The interviews lasted 30–45 minutes. At the end of the interview, participants were thanked for their participation and paid an honorarium of \$15 Canadian.

### **Data Analysis**

We practiced theoretical sampling in that we decided to interview users of four different applications. Our goal was to generate a strong theoretical foundation for the construct of engagement; as such our coding scheme was theoretically sensitive and concerned with validating or refuting past research. Interviews were audio recorded, transcribed, and analyzed using a qualitative software package, Qualrus. Fifty-two codes (see Appendix B) were generated from the data using Strauss' grounded theory, which is systematic in its approach (Strauss & Corbin, 1990). As such, we acknowledge that we

approached the data with preconceived ideas based on our review of the research, and that our reading of previous research may have influenced some of our coding categories.

The interview transcripts went through five iterative examinations. We used McCarthy and Wright's (2004) threads of experience to organize the data. The first pass through the data focused on emotional representations in the data and incidences of positive, negative, or neutral affect. The sensual thread examined the qualities of the system, such as its appearance and the interactivity of the technology. Lastly, the spatiotemporal thread described what the participant was doing (e.g., browsing, comparing products, etc.) and their perceptions and awareness of their physical environments. The compositional thread was woven around these other threads and identified the beginning, middle, and end of the experience. In addition, we also coded the data for the attributes of engagement suggested by previous research, and for the new attributes that emerged in this analysis.

The coded segments were subjected to interrater reliability by an independent coder. The coder was provided with the complete list of codes and their definitions, as well as the interviews. The coder was asked to apply the codes to all of the interviews, or to create new codes if none were appropriate. Once this was complete, the primary researcher compared the codes assigned by the coder with her own, noting discrepancies in the assignment of codes and any new codes that the independent coder had created. The researcher then met with the independent coder to discuss the analyses, focusing on the missed and disputed codes. The result of this process was a 92% agreement. For the coded segments in which an agreement was not reached between the researcher and the independent coder, the second researcher was asked to weigh in.

## **RESULTS**

The results of this study follow the “threads” of experience (McCarthy & Wright, 2004). To reiterate, these are: (a) compositional (i.e., narrative structure); (b) spatiotemporal (i.e., time and space); (c) emotional; and (d) sensual (i.e., cognition and behavior). Because the findings indicated a common trajectory for engaging experiences, we start our discussion with this path as a process with distinct stages. Subsequently, we describe the findings according to the threads of experience.

### **The Process of Engagement**

From the systematic analysis approach, engagement emerged as a process with distinguishable attributes inherent at each stage in that process. The steps in this process are the point of engagement (engagement is initiated), period of engagement, disengagement, and reengagement. In this section we describe each of these stages and indicate the attributes and manifestations of the experiential threads present during each stage

**Point of engagement.**

Participants described how engaging experiences began. In some cases, they had a particular goal in mind. Shoppers wanted to locate “a particular item or information about a particular item” (P13) “out of personal interest” (P11); webcast viewers tuned in to hear a particular speaker or about a topic that resonated with their research interests. Web searchers talked about wanting to stay up-to-date with favorite television shows or local/world news items. Video gamers played games based on the recommendations of others or the genre of the game (P12). In other cases participants' objectives were less tangible and more experiential. One shopper described the experience as “letting myself go” (P13). Video gamers commented on the previews released to advertise games. Said one person, “If the intro looks good and has good graphics, well, you think the game's got to be amazing cause if you spend a lot of time in this game, the graphics, animation, sound—they all enhance the experience ... you are so enthralled that [you say] ‘I can't wait to play that!’” (P05).

Interviewees also described social motivations for initiating interactions or tasks with applications. One shopper described reading book reviews from “certain reviewers that I know I can trust that have similar taste to me” (P2), while shoppers and gamers consulted other people, both friends and anonymous reviewers, to select a product that best suited their needs. Web searchers described browsing news, technology, and television network Web sites to share information with others at a later time. In fact, one searcher discussed searching for information explicitly for others.

Some participants became engaged by the layout or aesthetics of the interface. They talked about being attracted to images and features that first caught their attention, like homing in on the search box on the screen (P2). Shoppers and searchers discussed being carried away from their original task to look for a specific product or Web site. This was sometimes intentional. Information seekers browsed sites specifically to “see what catches my eye” by “scan[ning] the page to see if there is anything new” (P1). Sometimes a news story was a launching pad for further browsing of online newspapers: “... if I read a story, and I find it interesting, I will use that as a basis to search for more information on that study” (P4). Webcast viewers left the webcast they were watching temporarily to look for more information on the Web pertaining to the content of the presentation.

The point of engagement was often triggered when something resonated with participants' interests. For some video gamers, the engagement was built up through the use of story: “So what they do is they say, ‘Here's the history,’ then they thrust you in and say ‘This is where you start in history’ and you are thrust in there knowing the past now, not knowing the future, and you have to kind of develop it on your own” (P5). Webcast viewers talked about becoming engaged by something the speaker said that was relevant to their interests or captured their attention, or by the use of multimedia. One webcast viewer described watching an archived webcast while tidying her office where “... every now and then I might be ... away from my desk, when I heard something interesting. So I would have to go back and rewind” (P15); another was “drawn in” when presenters “use[d] humor” or revealed “their personalities” or “[made]

funny comments reflecting themselves ... Things like that tend to stick out in my mind” (P17).

In summary, the engagement process was initiated by the resonance of the aesthetic or informational composition of the system interface with users'. These elements captured participants' attention and interest and moved them forward into engagement. In some cases, interviewees were motivated for social reasons, while at other times they were looking to satisfy a specific goal (i.e., buy a product) or simply open themselves up to having an engaging experience.

#### **Period of engagement.**

After discussing the point at which they became engaged, participants described what was taking place and what they felt and thought while engaged. This stage was marked by the attention interviewees were able to focus on their task and the application, the novelty of the experience, their level of interest, and their perceptions of challenge, feedback, and user control inherent in the interaction.

Attention, the concentration of mental activity (Matlin, 1994), was evident during this stage. At times participants were highly focused and remarked that they were frequently “surprised at how much time passes” (P13). Webcast participants described the presenters, depending on their ability to “communicate their message,” and the topic of the broadcast, as what maintained their attention. One interviewee described a speaker who was “just a very engaging speaker” with “a very commanding voice and presence ... It is really easy to get wrapped up in his speech” (P14).

Novelty is the tendency to seek out elements that are new, interesting, or unusual in one's environment (Huang, 2003). It is also defined as sudden and unexpected changes that occur on the interface that evoke a reaction from the user (Aboulaflia & Bannon, 2004). Shoppers and searchers said they liked “browsing” and getting “sidetracked” (P11, P13) by items for which they did not originally search. One Web searcher browsed television network Web sites “just to see what was going on, what was happening this week” (P6). For one webcast viewer, the novel features of presentations (e.g., humor, graphics) made the content “stick out in [her] mind” (P17). Engagement was sustained for video game players by “the fact that you can play for so far and so long and still get new things. I think that's the major appeal” (P8).

Engagement continued when interviewees' interest was sustained. Shoppers indicated that looking at one product led to looking at others and comparing items across different sites because “it's just a matter of clicking on [a link]” (P11). One interviewee said that he found interesting stories on a news site he frequented and uses these as “a basis to search for more information” (P4). Said one shopper, “... of course, when you look at one, others tend to come to mind, so that's where the ‘losing yourself’ comes into play” (P2). A webcast viewer emphasized maintaining intellectual interest in the presentation, saying “Part of what makes it engaging is that if you are an active listener, you are not only taking everything at face value ... you can also take much of what you already know or what you have heard from other people [and] you can decide whether you agree with the speaker or with what they are saying” (P14). For another, interest was

maintained by topics that “touch[ed] on the human side of things (P17).

Challenge pertains to the amount of effort users perceive they are expending (Webster & Ahuja, 2004). Shoppers, searchers, and Webcast viewers preferred computer applications that were easy to use, saying that this influenced their “feelings of success” (P10). Shoppers talked about online stores that were well organized and enabled them to “see through it fairly quickly” (P10), as well as purchases that were convenient and straightforward. Though webcast viewers preferred less functional challenge in their use of the application, they did want to be intellectually challenged by the content. Video gamers referred to challenge positively: “If I'm not challenged, why bother?” (P12). One participant described maintaining patience to see a challenging situation through: “You do one scenario three or four times, you keep failing, and you think ‘I can do it, I can do it,’ and then when you actually do it, you get a sense of gratification ... it's a sense of challenge and satisfaction from overcoming the challenge that it makes you feel good ...” (P5). Other gamers indicated their enjoyment of video games that adjust the level of difficulty to match the player's increasing skill: “ ... you can say it's a linear relationship almost, and as you get better, the game gets difficult, probably at about the same rate” (P5).

Feedback is the information communicated to users about actions that have occurred and results that have been achieved. Feedback may be visual, auditory, or tactile (Stone, Jarratt, Woodroffe, & Minocha, 2005). For webcast participants, feedback was derived from the ability to “hear the speaker” and “the people in the room asking questions” (P14); feedback also came from communicating with other remote viewers through the text-chat feature, which one participant equated with “being sort of at the back of the class and whispering” (P17). In addition, an exchange over a muffin and “video-close up” of the snack with viewers at another location had the affect of “reaching across and making me feel like I was there” (P17). Gamers used sound to keep track of background elements of the game that were separate from the ones currently on the screen and in focus, but that required attention from time to time (P8).

Participants expressed the desire to perceive they were in control of the interaction (Schneiderman & Plaisant, 2005) and to assert that they had the skills and abilities to meet the challenges of particular circumstances (Mandel, 1997). According to one interviewee, it was the “do-it-yourself” (P10) nature of online shopping and not relying on salespeople that was appealing. The need for control was embedded in the interaction: “The page doesn't change unless I want it to, so I'm controlling what items I'm looking at—to a certain degree. I am aware of the fact that [the online store] is desperately trying to influence those decisions, but still they are mine ... I get to make those choices. And sometimes I won't [purchase]” (P13). Video gamers described their ability to direct some things, but not others. One participant felt “in control of the car” he was driving in a race game, but not of other things that were part of the game such as “traffic, pedestrians, people you are competing against—they are certainly way out of your control—and that's the whole point. It seems to mimic reality quite closely” (P9). Another talked about the games he played as controlling some aspects, and leaving the player to determine others. According to one gamer, things do not “always work out the

way you plan" (P7), but the unpredictability was not identified as a reason to disengage these interviewees.

In summary, the period of sustained engagement was marked by participants' attention and interest being maintained in the interaction. This was achieved by the presentation of feedback and novel information and features on the interface. Interviewees were also more likely to stay in the engagement when they perceived that they were in charge of the interaction and appropriately challenged.

### **Disengagement.**

Disengagement occurred when participants made an internal decision to stop the activity, or when factors in the participants' external environment caused them to cease being engaged.

With regards to internal disengagement, participants chose to "cut themselves off" (P13). At other times, the fact that the task was not urgent precipitated the disengagement. One shopper indicated that she had not put a great deal of energy into the search, and "knew that I could do it at home, or I could do it the next day, there wasn't a timeline or anything really strenuous attached to it" (P11). Another interviewee described the influence of others in curtailing her shopping experiences: "... people argue that I have way too many books. So really, do I need anymore?"(P13). Webcast viewers also indicated they simply were not able to sustain their attention over the course of a three-hour broadcast: "At certain points you are really intently engaged and then some of the time I am listening and doing other things at the same time ... and then you sort of lose interest; other things within your own mind do interfere so you start thinking 'Oh, I have to remember to do this or do that'..." (P17). Thus participants stopped because other things came into their minds, such as having to turn their attention to their job or school work. Interviewees also discussed physiological circumstances that brought about their disengagement, such as eye fatigue, or needing to eat/drink or use the washroom.

At other times, disengagement was the result of external factors, such as being interrupted. The source of interruptions was from environmental factors, such as a kitchen timer going off, e-mail alerts, or other people who were sometimes there in person. For instance, interviewees mentioned contending with coworkers' questions, the phone ringing, or the presence of others in their physical space. Disengagement was also brought about by technological issues. A webcast viewer stated that broadcasts "were not particularly compelling" because the interface had a small video window and "a lot of other things going on" (P16). Video gamers said that the difficulty level of the game was something that would make them stop playing: "... some of those scenarios are so difficult, you've tried ten times and you're 'I give up. I'll just put it away for a couple of days'" (P5). Another factor for the participants was lack of novelty: "I did enjoy it, but at the same time it doesn't offer anything new. It's still the same old stuff, there's no real perk" (P9).

To summarize, disengagement was precipitated by internal and external factors. Interviewees sometimes made a conscious decision to stop their activity because they

lost interest or felt pressures associated with the opinions of others, time, or other tasks. External issues, such as distractions and interruptions, lack of novelty in the application, and usability issues with the technology, also made participants disengage.

### **Reengagement.**

Interviewees indicated that disengaging from a task or interface was not necessarily the end of their engagement. Shopping, for example, was described as a “broken” process because it was temporarily dropped or stretched out over an extended period of time. Even when shoppers and searchers were engaged, they did not remain on one Web site, but “flip[ped] back and forth between several Web sites” to compare product costs and features. Webcast viewers indicated that they checked out of broadcasts from time to time to pursue other activities, such as checking e-mail, but would “keep an ear out” and return to the webcast “... when I heard something interesting (P15). Video gamers took breaks from playing, finding “a convenient place” (P9) to pause in order to eat, drink, or adjust the lighting and temperature in the room.

At times, the computer application brought about the reengagement because participants were disengaged before they were ready. For example, a video game player described several attempts to get through a stage of a game successfully where he had to “have the patience to retry and keep trying.” As a result he got back into the game: “You have to win; if you don't win, you restart; if you do win, you go on” (P5). A Web searcher frequently interrupted by elements in her environment indicated that she had adopted strategies to help her reengage: “I've taken to also writing notes on a piece of paper too in case something happens and I end up losing the search screen, or I log out by accident, and I erase what I've done” (P3).

Participants talked about their likelihood of returning to use an application. Positive past experiences were indicative of reengagement. One video gamer said he was considering purchasing a game after having rented it because he thought “This game is so good, I enjoy thinking back to when I was playing it and I think ‘That was a good time.’ I don't know how to describe it” (P9). Another gamer talked about returning to games with a “good story component,” and another mentioned acquiring all of the games in a particular series “... because I remember fondly back on the other ones” (P5). Shoppers discussed browsing online shopping sites for pleasure (P13) or returning to debate a purchase (P10). Interviewees also emphasized convenience: “I don't need to be at the box office to buy tickets for a theatre performance ... Convenience is a really big thing. Who's got time to go down to the [box office] in the middle of the day?” (P10). Another shopper described receiving incentives to return to an online store that sent her news about sale items and coupons as incentives to purchase products: “They are always sending like 'go to [online store] and receive \$5 off with this coupon, which I'm a sucker for ... I probably get one or two e-mails from them a week” (P13). For Webcast participants, it was the “nuggets of knowledge” or interest in the content/topic of the broadcasts that encouraged them to tune in again. This was also the case for a Web searcher who returned each week to network Web sites to see previews for her favorite shows saying “... it increases the anticipation of watching my shows” (P6). For a gamer, it was the novelty of seeing both what she could accomplish in her next session with the game, but also what it had done in her absence.



Thus reengagement with these applications occurred in both the short- and long-term. Participants reengaged if the system disengaged them before they were truly ready. They also reengaged after they had abandoned their tasks to see to personal needs, take time to consider and compare information, or switch tasks. Returning to an application in future was the result of positive past experience with that application. These motivations were about having fun, being rewarded with convenience and incentives, and learning or discovering something new.

### **Nonengagement.**

There was evidence in the interviews that participants were not always engaged or encountered barriers to becoming engaged. In some cases, this was because the online experience was not as enjoyable as the real-life experience: “[online shopping is] not as much fun as walking home with a shopping bag” (P10). Webcast viewers noted the differences between watching a broadcast and sitting in a physical lecture hall: “I have a hard time feeling like I am part of the audience ... Part of it is probably the distance. Part of it may just be the scale” (P15). Some participants stated that they did not allow themselves to become engaged because they did not feel that had enough time to take in the experience. At times, multitasking or being interrupted during a computer-based task prevented engagement with a primary task. For example, interviewees said they checked e-mail, communicated with others in the same room or online, searched for information, and dealt with interruptions, and that these activities prevented them from becoming engaged (P4).

The content of the application was also cited as a reason for not engaging. For shoppers and searchers, the abundance of information available to peruse was daunting and produced uncertainty. Said one shopper, “... there is a lot of information out there, a lot of different product information, you can't go through it all, so you have to choose and ‘What about that one?’ or ‘Is this a better deal?’, but that wasn't quickly [obvious] ... ‘Did I pick the right one?’” (P11). Of a Web site that kept allowing pop-ups, a web searcher stated, “I'm like ‘forget it,’ and I never went back to it ... It's not that important. Really, if it's that much work for me to get to see it, then it's not worth it. Because ... it's entertainment and I can always go and look somewhere else” (P6).

Poor usability was a barrier to engagement. Shoppers were influenced by the “ease of finding [a product] and sometimes the purchase seems like too much trouble” (P10); another commented that “hurdles or more data entry” would “dissuade” him from online shopping (P2). Webcast viewers experienced frustration when they attempted to use communication technology to chat with other viewers or the speaker, citing the delay in transmitting their message, since their comments were tied to specific points in time. Two other interviewees remarked that viewing a webcast lessened their awareness of other viewers, noting “the loss of the physicality” that was “very hard to replicate through technology” (P15), as well as their inability to control where and what they looked at due to the size of the video window. Said one viewer, “In a real lecture hall ... if a lecturer says something funny then you are going to laugh and you are going to see other people laughing. And you are going to be looking at them laughing. Or if there is

something on the chalkboard as well you might glance over there. Even if it was something written long ago you might look, glance at it again” (P14).

Therefore, engagement was not always part of users' experiences with the applications. At times it was because participants would have preferred to shop in a physical store or sit in real classroom. At other times lack of time or having to multitask deterred engagement. Content that overwhelmed or failed to interest users and usability issues with the technology were barriers to engagement.

## **Experience Threads**

### **Compositional thread.**

In following the compositional thread of experience, engagement as a process emerged from the data. As previously discussed, engaging experiences consist of a point of engagement, a period of sustained engagement, disengagement, and, sometimes reengagement. In addition, we discovered that engagement did not always take place. As a result, engagement is a quality of user experience and it may be embedded in a larger event or experience. The other threads of experience, sensual, emotional, and spatiotemporal, were present in the engagement experience. Although some examples of these threads are embedded in our discussion of the engagement process, we summarize them in the following sections.

### **The sensual thread.**

The sensual thread pertains to the visual, auditory, and interactive components of the users' experiences with the application. Applications used aesthetics (as defined by Jennings (2000)) and multimedia to engage users' senses. Online shoppers talked about the importance of viewing products from multiple perspectives (P12), while graphics were also essential to video gamers for evoking realism in the game (P5, P9). Searchers and webcast viewers focused their attention on the salient attributes of the interface (P6, P17). For example, presentation materials were deemed more engaging if they had “lots of graphics” (P17) indicating a preference for images over text in some cases.

Webcast viewers wanted “rich” interfaces that provided them with aural and visual awareness of other online learners (P17). One participant said she felt like “I am almost there” and “more involved” when she used headphones and when the presentations incorporated other media such as videos. The auditory aspects of video games, such as “car engines, things speeding by, car crashes” (P9) contributed to the experience for gamers.

Interactivity was also part of the engagement. Video game players customized features of the video games (P8, P9) and felt that they were “part of a story” (P5) —whether as a member of a war campaign in a strategy game, or as a race car driver. Another gamer described playing a simulation game in which she created characters and their environments and manipulated both of these through game play. The many features of the webcast interface—video, presentation slides, and chat—failed to engage some of the webcast viewers (P15, P16). One participant wanted to be able to manipulate the

size and placement of the features, which were fixed (P15); another commented that "... the technology is getting in the way of my enjoyment of the class" (P16). This was in part due to the time lapse in communication tools that prevented truly synchronous feedback between the learners and the speaker. Thus, for the webcast viewers, some of the interaction was of a social nature. Lastly, Web users experienced interactivity in their ability to select information. Shoppers talked about zooming in on and rotating products (P10).

In summary, interviewees' visual, auditory, and tactile senses were engaged during their interactions with the applications. At times the application facilitated the engagement with its presentation of information or graphics and multimedia features; at other times it deterred engagement with its inability to meet the customization and communicative needs of participants.

#### **The emotional thread.**

The emotional thread accounts for the affective experiences of users' interactions, as well as the motivations that influenced and maintained their use of the application.

Participants expressed a range of positive emotions, including enjoyment, satisfaction, and fun. Web searchers, shoppers, webcast viewers, and video gamers all expressed their enjoyment of their tasks—be it browsing for information (P6) or products (P13), interacting with others during an online class (P17), or playing games (P5, P8, P12). One gamer related his physiological response during the gaming experience to his emotional involvement: "... As you are playing you can feel your heart rate going up and gets you jacked up if you are winning" (P5).

There were also a number of negative emotional reports from interviewees. Participants expressed uncertainty and doubt when they encountered "a lot of information" that made them wonder if they had made the best decisions about purchases (P11) or information (P4). Participants also felt frustration towards the technology (P4, P16) and anxiety about how much time they had spent on their tasks (P17, P4). Boredom was mentioned by the gamers as a reason to disengage (P12). There was also an interesting facet of guilt across interviewees; participants described feeling guilty about having put other things off to use an application (P13, P6, P8, P9).

Interviewees described their motivations for using the applications. Getting what one wanted made interviewees reflect on their experience as a success. For instance, a shopper noted that: "When I was in [city] last time I went on[line] in the morning and ordered a single ticket to go to [a play] and I got a great deal, got a great seat, had the best seat I've ever had at a theatre, so it was perfect and fast" (P10). In addition, participants talked about receiving purchases in the mail, finding information they had been looking for, learning, and accomplishing specific levels in a video game. Another factor for perceived success pertained to doing one's homework and arriving at a purchase decision that, as one participant put it, "made sense for me, and I felt pretty good about it" and "confident that I looked around" (P11).

**The spatiotemporal thread.**

The spatiotemporal thread pertains to the time and space of the interaction. Included in this thread are participants' perceptions of time, their internal states, and their external environments.

Interviewees remarked about the passage of time during their interactions, including their impression that it took a lot of time to decide on products (P11), make contact with other learners (P16), or to “develop things” in a game (P7). In other instances, time went by quickly and participants were “surprised by how much time had passed” (P13, P5, P6).

Emerging from the data was the concept of awareness. Awareness is defined as cognizance of one's environment (self) or concentration on particular (external) stimuli (Merriam-Webster Online, 2006). Examples of both of these types of awareness were found in the data. During the engagement, participants indicated losing consciousness of their physical surroundings—much like the flow state. A searcher stated that she was “so engrossed” in what she was doing that “I didn't notice really that it was getting darker,” while others noted that, while aware of their physical surroundings, they were concentrating on what they were doing while using the application. A webcast viewer described herself as “intently engaged” (P17), and a video gamer said that the demands of a game on his attention were so great that “you have to almost seclude yourself because this is what I have to do for the next couple of hours”(P5).

Others were responsive to their real and virtual environments and the people in them. Webcast viewers mentioned their awareness of other people, both those on camera at the host institution, or other remote viewers, and that this awareness made things “a little more intriguing” (P15).

**Summary.**

The threads of experience framework (McCarthy & Wright, 2004) provides an effective means of organizing the findings of this study. Table 3 shows the attributes that emerged during each stage of the engagement process; the compositional thread reflects the process and is used to structure the attributes according to the emotional, spatiotemporal, and sensual threads of experience. Reengagement was not included in this table because this part of the process shares the same attributes as the point of engagement.

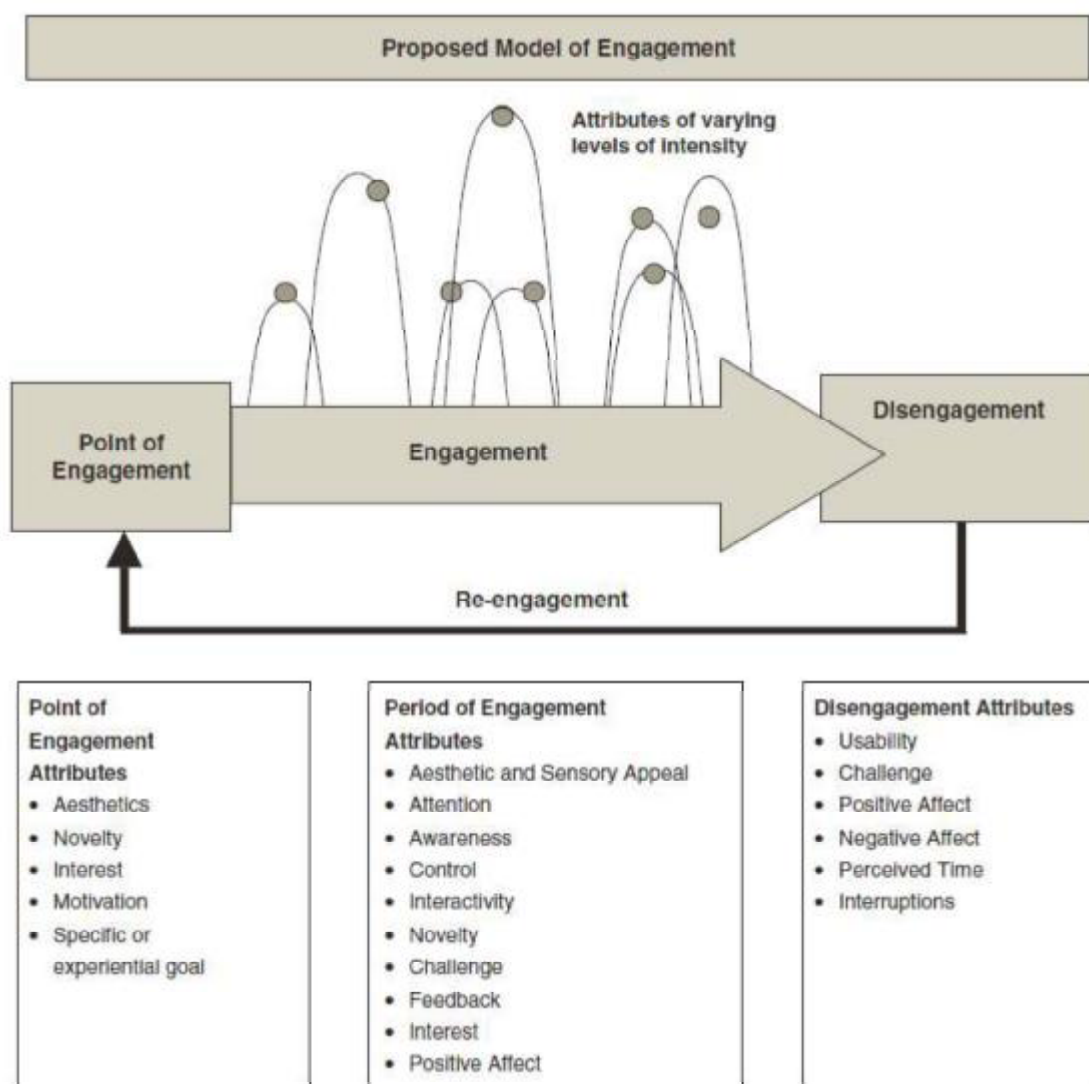
**TABLE 3. Summary of the engagement attributes according to the threads of experience.**

<b>Compositional thread Process of Engagement</b>			
<b>Threads of experience</b>	<b>Point of engagement (and Reengagement)</b>	<b>Engagement</b>	<b>Disengagement</b>
<b>Sensual</b>	<p>Aesthetic elements are pleasing or attention getting</p> <p>Novel presentation of information</p>	<p>Graphics that keep attention and interest to evoke realism</p> <p>"Rich" interfaces that promote awareness of others or customized views of information</p>	<p>Inability to interact with features of the technology or manipulate interface features (usability)</p> <p>Lack of too much challenge</p>
<b>Emotional</b>	<p>Motivation to accomplish a task or to have an experience</p> <p>Interest</p>	<p>Positive affect: enjoyment, fun, physiological arousal</p>	<p>Negative affect: Uncertainty information overload, frustration with technology, boredom, guilt</p> <p>Positive affect: Feelings of success and accomplishment</p>
<b>Spatiotemporal</b>	<p>Becoming situated in the "story" of the application</p> <p>Ability to take one's time in using the application</p>	<p>Perception that time passed very quickly</p> <p>Lack of awareness of others when the engagement revolved around social interaction</p> <p>Feedback and control</p>	<p>Not having sufficient time to interact with or time to devote to the application</p> <p>Interruptions and distractions in physical environment</p>

**A PROPOSED MODEL OF ENGAGEMENT**

The outcome of this exploratory study is the identification of four distinct stages of engagement and the attributes that characterize each stage. The point of engagement is initiated by the aesthetic appeal or novel presentation of the interface, the users' motivations and interests, and users' ability and desire to be situated in the interaction and to perceive that there is sufficient time to use the application. Engagement is

sustained when users are able to maintain their attention and interest in the application, and is characterized by positive emotions. Users want to customize the interface to meet their needs and receive appropriate and timely feedback from the application. In addition, they want to lose their perception of time and others during some interactions, but keep their awareness of others in cases where engagement is enhanced by social interaction. Users disengage for many reasons such as the usability of the technology (i.e., challenge and interactivity), and distractions in their environments. This stage, depending on the outcome, resulted in either positive or negative emotions. Figure 1 illustrates the model.



**FIGURE 1. Proposed model of engagement and its attributes.**

The fact that our participants were not always engaged, and that they described disengaging and reengaging in the same session, indicates that a single session contains a range of engaging experiences that vary in intensity. Users may be engaged or not engaged, but engagement itself operates on a continuum. In this way it is similar to the construct of usability in that it may be poor, average, or high.

The point of engagement may occur at any point during the interaction when users delve beyond the mechanistic or routine level (Norman, Ortony, & Russel, 2003) and invest themselves in the interaction. We propose that, at this stage, the interface must present information in a novel or aesthetically pleasing way in order to capture users' motivation and interest and situate them in the interaction.

Our research suggests that once engaged, users' attention and interest must be maintained. Users must be made to feel part of the interaction through an awareness of what the system is doing (feedback) and feeling connected to the technology (interactivity) or to other people (social awareness), and in control over what is happening. The richness of the application generates positive emotions in users. A representation of attributes during this stage is depicted in Figure 1 to convey the dynamic interaction that is taking place during this period. The intensity of these attributes may vary depending on the users' expectations of and experience with the technology, the type of interaction, and the nature of the technology itself.

To disengage is to "sign off" by ceasing to be engaged, or to stop using the system altogether. In this case the user slips back into a mechanistic interaction with the system, devoid of affective or cognitive stimulation. Disengagement is associated with positive emotions (users' needs and motivations are satisfied and they feel successful) or with negative feelings of frustration, uncertainty, being overwhelmed by challenges or information, loss of interest or motivation, and lack of novelty or challenge.

Users may cycle through the stages of engagement several times during a single session; thus reengagement is intrinsic to the model. Reengagement may be short-term. During Web searching, a user may engage with a particular page, disengage, and then return to the same or a different page. Web searching illustrates that engagement may continue with a topic, but not with a website; likewise, a website may be so engaging that the user abandons their original task. Reengagement may also be long-term, for example, when a search is extended over time.

Previous frameworks of engagement have emphasized what users are doing and thinking (e.g., Said, 2004) or feeling (Kappelman, 1995). The first contribution of our model is that it is holistic and presents the behaviors, cognitions, and emotions of users in the context of content, design, and interactive features of the application. In addition,

engagement has not been explicitly identified as a process. Chapman (1997) examined “influences on engagement” —which may equate with our point of engagement stage— but most researchers have not articulated engagement as having a beginning, middle, and end, nor what attributes might characterize each of these stages. The idea of reengagement that may occur during the same session with an application or at a future time is novel. The second contribution of this model is that we have linked attributes of engagement to each stage of the process. We have considered all of the disparate studies on engagement and their findings about what might belong in the “pool” of engagement attributes, and we have identified which attributes are most significant to particular stages of the engagement process.

## **DISCUSSION**

The research objectives of this study were to conceptually and operationally define engagement. We proposed that engaging systems extend beyond usability of the application. Using flow, aesthetic, play and information interaction theories as our foundation, we discovered that the attributes of engagement—challenge, affect, endurability, aesthetic and sensory appeal, attention, feedback, variety/novelty, perceived control, and interactivity—are products of the user-system interaction. Previous work suggested that challenge, pleasure, endurability, attention, aesthetic and sensory appeal, feedback, variety/novelty, interest, interactivity, and perceived user control were attributes of engagement. We confirmed the presence of these attributes in the engagement process. In addition, we discovered that awareness of others and one's environment, and perception of time, were also part of engaging experiences. Thus, we have expanded our original definition of engagement to include these additional attributes:

Engagement is a quality of user experiences with technology that is characterized by challenge, aesthetic and sensory appeal, feedback, novelty, interactivity, perceived control and time, awareness, motivation, interest, and affect.

In the midst of conceptually and operationally defining engagement, we have articulated a process model of engagement.

### **Process Model of Engagement**

The experience threads, in particular the compositional thread, clearly delineated a systematic process that depicts engaging experiences. Engagement consists of a point of engagement, a period of sustained engagement, disengagement, and (possibly) reengagement. In prior research, engagement was associated with a variety of attributes: feedback, control, focused attention, motivation, challenge, aesthetic and affective appeal, and novelty (Jacques et al., 1995; Said, 2004; Webster & Ho, 1997; Chapman, 1997; Chapman et al., 1999). Previous models of engagement have viewed



engagement as a process (defined as a task) or product of information-system development (Kappelman, 1995), rather than a quality of users' experience with technology. Chapman (1997) investigated engagement influences and outcomes, but his results are limited to a specific educational software package and user group. In addition, he concluded that some of the measurement items could have been improved in order to ensure that they measured what they were intended to (p. 123). In addition, both Kappelman (1995) and Chapman (1997) look at dimensions of engagement (i.e., product versus task, influences versus outcomes), but they do not define engagement as a process with a beginning, middle, and end, or state that there is an iterative component to engagement.

Participants indicated that interest in and attention to the content and aesthetics of the computer application were present during the point of engagement, and that they typically had a goal (sometimes well-defined, sometimes social, and sometimes to have an experience) in mind when initiating an interaction with a computer application. Goal setting was put forward by Said (2004) as an untapped variable to consider for engagement. Whereas this study identified interest, attention, motivation, and aesthetics as attributes at the point of engagement, Chapman (1997) found that feedback and control were influences on engagement. These latter variables were more prominent in this study during the engagement phase. The experience of being engaged was perpetuated by the interactivity of the computer environment—sometimes physical, social, or cognitive—and the usability of the interface as they matched the users' attention, motivation, interest, and need for aesthetic and sensory appeal, novelty, control, and challenge. Like Said (2004), we found behavioral and cognitive manifestations of engagement during this phase, as demonstrated in users' appraisals of the challenge, novelty, and control afforded to them by the system, and their actions, mediated by the system's ability to provide feedback and customization options. However, we also saw the role of affect in positive and negative emotions, a finding similar to Kappelman (1995), who identified attitude as a major component of his product/process matrix of system involvement. However, unlike Kappelman, our interest was in engagement as an experience; he studied it as an outcome of participants' level of involvement in software development.

Interviewees disengaged for internal reasons that were physiological or based on time pressures and their inner voices to move on to other activities. External reasons for disengaging included interruptions in the environment and technology issues. During this phase, there was a mixture of positive and negative emotions expressed; at the same time, some participants mentioned that their emotions were dependent upon the situation and influenced by the interaction.

Original to this study is the concept of reengagement. Participants described reengagement as both a short-term and long-term activity. Short-term reengagements were precipitated by interviewees' decisions to pause the activity to attend to other needs or stretch the task out over time, and by the technology or environmental factors disengaging them before they were ready. With regard to reengagement, attributes

such as convenience and ease of use, the need for information, and novelty were most salient. Users returned to the application because they had past success with it, or it offered them something new (a product or an experience) that could not be obtained elsewhere, and was able to provide adequate levels of control, challenge, and feedback to ensure interviewees were neither bored nor frustrated. Overall, positive experiences influenced participants' likelihood of returning to an application (Rozell & Gardner, 2000; Webster & Ahuja, 2004).

Participants described several factors that prevented engagement from taking place, or caused their engagement to lapse; nonengagement has not been addressed in previous studies. These included the inability of the online experience to emulate a real-life encounter, technology issues such as information overload and pop-ups, communication tools that delayed feedback, and being required to multitask or manage interruptions. Although Webster and Ho (1997) found evidence for higher levels of engagement with more interactive applications, the amount of interactivity was not indicative of engagement in this study. Rather, it was the quality and appropriateness of the interactivity to the user's task that precipitated engagement. This is supported by Jacques et al. (1995), who found that students' preferences for visual- or text-based educational multimedia depended on the task they needed to perform, and by Skelly et al. (1994), who warned that more interface features and choices do not necessarily lead to engagement.

Overall, when engagement occurred, participants described cycling through a dynamic process of initiating and sustaining their engagement until internal or external circumstances disengaged them. However, they often experienced multiple engaging episodes during the same session, or returned to the application in subsequent sessions. This likelihood of return is a strong predictor of systems success (DeLone & McLean, 1992), and likely of whether systems are engaging.

#### **Attributes of engagement.**

Central to this research was identifying the attributes of engagement. Interwoven throughout the engagement process were a variety of attributes: attention, novelty, interest, control, feedback, and challenge. In addition, we found evidence for emotional (affect and motivation), sensory (aesthetics and interactivity), and spatiotemporal (perception of time, and self- and external awareness) threads of experience. These findings both confirm and dispute previous research. We found evidence for more attributes during the engagement phase than Webster and colleagues (Webster & Ahuja, 2004; Webster & Ho, 1997) and Jacques et al. (1995), who concluded that engagement was composed of three elements: attention focus, curiosity, and intrinsic interest. Skelly et al. (1994) suggested that engaging experiences were comprised of curiosity, feedback, and challenge, while Webster and Ho (1997) concluded that feedback, challenge, and novelty, but not perceived control were attributes of engaging presentation software. However, we found evidence to suggest that users do need to

perceive they are in control of the interaction (see, e.g., Said, 2004), though some of our participants were comfortable with some unpredictability, which likely is application-specific.

Our findings are inline with other research that has emphasised self-directed, meaningful involvement with materials or applications based on cognitive challenge and motivation (Kearsley & Schneiderman, 1999) because participants across applications needed personal (e.g., interest) or external incentives (e.g., tangible product, rewards in a game) to continue their tasks and adequate levels of physical or cognitive challenge. Like Carroll and Thomas (1988) and Pausch et al. (1994), our study found that engagement failed to begin or was curtailed when systems were perceived by the user as either too difficult or too easy to use.

Wells and Matthews (1994) state that attention may be based on the cognitive judgements people make about the relevance of specific stimuli to themselves or their tasks. This was the case with our participants who attended to interface features that would enable them to efficiently complete a task or to content on the interface that resonated with their personal interests.

Novelty played an important role in this study in sustaining users' engagements with the applications. For video gamers, this took the form of unexpected auditory or visual stimuli (Aboulafia & Bannon, 2004); shoppers were interested in seeing new products, and webcast viewers and Web searchers sought new content. However, there was a ceiling for novelty (Webster & Ho, 1997), because participants did not wish for so much variety that they became “lost” while trying to complete their tasks.

Feedback was shown to be an essential component for inciting and maintaining engagement. Feedback is inextricably linked to communication—whether between a human and an artefact, or between several humans using the technology—and awareness of others. In the webcast environment, for example, participants underscored their ability to interact with other remote viewers and individuals at the host institution. This is not surprising given people's strong bias for socialization (Picard, 1997). Participants also demonstrated a need for tangible feedback (e.g., textual, visual, or aural) (Pausch et al., 1994) that allowed them to orient themselves in a Web search or game, gauge their success in completing a shopping transaction, and see that their messages were received by others in the Webcasting environment.

However, it is apparent that the attributes of engagement identified in this study—interest, motivation, affect, attention, challenge, feedback, aesthetics and sensory appeal, awareness, novelty, perceived control, perceived time, and interactivity—are products of the user-system interaction. Some of these attributes are associated with usability variables of effectiveness, efficiency, and satisfaction. This demonstrates that usability is intricately woven into the experience of engagement; while an application may be usable, it may not be engaging, but engaging applications do appear to have an inherent baseline of usability.

## **Limitations**

The current findings are based on a selected sample of individuals at a specific point in time. As in most exploratory research, we cannot make absolute conclusions. However, the findings are, for the most part, in accordance with previous literature, leading one to speculate about the potential for generalization.

## **Future Work**

The purpose of this study was not to compare engagement across the four applications, and we make no attempts, given our sample size per application, to do so. We observed all participants moving through the engagement process on much the same trajectory, and being impacted upon by the same attributes. However, we noted some differences among the groups. For example, video gamers seemed to have more difficulty disengaging than users of other applications, and were more likely to want more challenging experiences. One area of future research is examining the model more systematically within each of the application domains. Potentially, for example, the intensity of an attribute may vary with the application. In addition, the specific notion of disengagement is also of interest and pertains to computer addiction Charlton (2002). When, if ever, does intense engagement cross the line into addiction?

There are attributes (e.g., challenge, feedback, perceived control) that are components of not only engagement, but also usability. Future work will examine the relationship between these two constructs. Quesenbury (2003) suggests that engagement, along with effectiveness, efficiency, ease of learning, and error tolerance, are dimensions of usability. It is our conjecture that usability facilitates engagement, but a usable system may not be engaging. Thus we view engagement as a higher order experience that encompasses more than usability. The fact that our participants described aesthetics, novelty, endurability, and so forth supports this.

One of the major gaps in the literature on engagement is in empirical evidence about how it should be measured (Webster & Ho, 1997; Jacques et al., 1995). Thus far attempts have been incomplete, nongeneralizable, or one-dimensional. Our future goals are to develop and rigorously test an instrument to assess users' perceived engagement. In addition, we intend to triangulate this subjective measure with behavioral and physiological (e.g., heart rate, galvanic skin response) methods. Studies have been conducted to explore entertainment and emotion (cf. Mandryk, 2004; Mandryk, Atkins, & Inkpen, 2006) using these techniques. This will provide a holistic view of engagement that encompasses all of the threads of user experience.

## **CONCLUSION**

This research provides insights into the phenomenon of engagement and is a foundation for further research. We have confirmed and expounded a conceptual model that views engagement as a process in which computer users initiate and sustain engagement, disengage with the application or task, and potentially reengage several times during a single interaction with an application. The process is defined by the presence of multiple attributes that vary in intensity depending on a combination of user and system attributes that emerge during the interaction. We have put forward a model

that defines which attributes of engagement are most prominent during each phase in the process. We have highlighted attributes including attention, aesthetics, interest, challenge, control, motivation, novelty, and feedback as the user, system, and interaction components of the compositional, emotional, sensual, and spatiotemporal aspects of users' experience that predict and facilitate engagement. Our work has acknowledged the derivation of engagement from other constructs, such as flow, aesthetic experience, play, and information interaction and concluded that, while it shares attributes with these other frameworks, its combination and expression of components is unique. We have also demonstrated that engagement is consistent across different types of applications in terms of the attributes present and the trajectory followed by users through the process.

## REFERENCES

- Aboulafia, A., & Bannon, L.J. (2004). Understanding affect in design: An outline conceptual framework. *Theoretical Issues in Ergonomic Science*, 5(1), 4–15.
- Arnold, M. J., & Reynolds, K.E. (2003). Hedonic shopping motivations. *Journal of Retailing*, 79, 77–95.
- Atkinson, M., & Kydd, C. (1997). Individual characteristics associated with World Wide Web user: An empirical study of playfulness and motivation. *The DATA BASE for Advances in Information Systems*, 28(2), 53–62.
- Beardsely, M. (1982). *The aesthetic point of view*. Ithaca, NY: Cornell University Press.
- Blythe, M., Overbeeke, K., Monk, A.F., & Wright, P.C. (2003). Funology: From usability to enjoyment (Vol. 3). Dordrecht, The Netherlands: Kluwer.
- Brown, E., & Cairns, P. (2004). A grounded investigation of game immersion. In *Proceedings of the Conference on Human Factors in Computing Systems* (pp. 1297–1300). New York: ACM.
- Carroll, J.M., & Thomas, J.C. (1988). Fun. *SIGCHI Bulletin*, 19(3), 21–24.
- Champion, E. (2003). Applying game design theory to virtual heritage environments. In *Proceedings of the First International Conference on Computer Graphics and Interactive Techniques* (pp. 273–274). New York: ACM.
- Chapman, P. (1997). Models of engagement: Intrinsically motivated interaction with multimedia learning software. Unpublished master's thesis, University of Waterloo, Waterloo, Canada.
- Chapman, P., Selvarajah, S., & Webster, J. (1999). Engagement in multimedia training systems. In *Proceedings of the 32nd Hawaii International Conference on System Sciences* (p. 1084). Washington, DC: IEEE.
- Charlton, J.P. (2002). A factor-analytic investigation of computer 'addiction' and engagement. *British Journal of Psychology*, 93(3), 329–344.

- Choi, D., & Kim, J. (2004). Why people continue to play online games: In search of critical design factors to increase customer loyalty to online contests. *Cyber Psychology and Behavior*, 7(1), 11–24.
- Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper & Row.
- DeLone, W.H., & McLean, E.R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research*, 3(1), 60–95.
- Douglas, Y., & Hargadon, A. (2000). The pleasure principle: Immersion, engagement, flow. In *Proceedings of ACM Hypertext 2000* (pp. 153–160). New York: ACM.
- Ericsson, K.A., & Simon, H.A. (1993). *Protocol analysis: Verbal reports as data*. (Rev. Ed.). London: MIT Press.
- Finneran, C.M., & Zhang, P. (2003). A person-artefact-task (PAT) model of flow antecedents in computer-mediated environments. *International Journal of Human-Computer Studies*, 59(4), 475–496.
- Ghani, J.A., & Deshpande, S.P. (1994). Task characteristics and the experience of optimal flow in human-computer interaction. *The Journal of Psychology*, 128(4), 381–391.
- Hassenzahl, M., & Tractinsky, N. (2006). User experience: A research agenda. *Behaviour and Information Technology*, 25(2), 91–97.
- Huang, M. (2003). Designing Web site attributes to induce experiential encounters. *Computers in Human Behavior*, 19(4), 425–442.
- Hull, R., & Reid, J. (2003). Designing engaging experiences with children and artists. In M.A.Blythe, A.F.Monk, K.Overbeeke, & P.C.Wright (Eds.), *Funology: From usability to enjoyment* (pp. 179–187). Dordrecht, The Netherlands: Kluwer.
- Jacques, R., Preece, J., & Carey, T. (1995). Engagement as a design concept for multimedia. *Canadian Journal of Educational Communication*, 24(1), 49–59.
- Jennings, M. (2000). Theory and models for creating engaging and immersive ecommerce Web sites. In *Proceedings of the 2000 ACM SIGCPR Conference on Computer Personnel Research* (pp. 77–85). New York: ACM.
- Kappelman, L.A. (1995). Measuring user involvement: A diffusion of innovation perspective. *Database Advances*, 26(2/3), 65–86.
- Kearsley, G., & Schneiderman, B. (1999). Engagement theory: A framework for technology-based teaching and learning. 5 April, 1999. Retrieved 15 February, 2005, from <http://home.sprynet.com/~gkearsley/engage.htm>
- Konradt, U., & Sulz, K. (2001). The experience of flow in interacting with a hypermedia learning environment. *Journal of Educational Multimedia and Hypermedia*, 10(1), 69–84.

- Laarni, J., Ravaja, N., Kallinen, K., & Saari, T. (2004). Transcendent experience in the use of computer-based media. In *Proceedings of the Third Nordic Conference on Human-Computer Interaction* (pp. 409–412). New York: ACM.
- Laurel, B. (1993). *Computers as theatre*. Reading, MA: Addison-Wesley.
- Lavie, T., & Tractinsky, N. (2004). Assessing dimensions of perceived visual aesthetics of Web sites. *International Journal of Human-Computer Studies*, 60(3), 269–298.
- Makkonen, P. (1997). Does collaborative hypertext support better engagement in learning the basics of informatics? *SIGCSE Bulletin*, 29(3), 130–132.
- Mandel, T. (1997). *The elements of user interface design*. New York: Wiley.
- Mandryk, R.L. (2004). Objectively evaluating entertainment technology. In *Proceedings of the Conference on Human Factors in Computing Systems* (pp. 1057–1058). New York: ACM.
- Mandryk, R.L., Atkins, M.S., & Inkpen, K. (2006). A continuous and objective evaluation of emotional experience with interactive play environments. In *Proceedings of the Conference on Human Factors in Computing Systems* (pp. 1027–1036). New York: ACM.
- Marchionini, G. (1995). *Information seeking in electronic environments*. New York: Cambridge University Press.
- Matlin, M.W. (1994). *Cognition* (3rd ed.). Orlando, Florida: Harcourt Brace.
- McCarthy, J., & Wright, P. (2004). *Technology as experience*. Cambridge, Massachusetts: MIT Press.
- Miriam-Webster Online (2006). Retrieved May 20, 2006 from <http://www.m-w.com/>
- Nahl, D., & Bilal, D. (Eds.). (2007). *Information and emotion: The emergent affective paradigm in information behavior research and theory*. Medford, NJ: Information Today
- Norman, D.A. (1986). Cognitive engineering. In D.A.Norman & S.W.Draper (Eds.), *User centred system design* (pp. 31–61). Hillsdale, NJ: Lawrence Erlbaum.
- Norman, D.A., Ortony, A., & Russel, S M. (2003). Affect and machine design: Lessons for the development of anourmous machines. *IBM Systems Journal*, 421(1), 38–44.
- Oppenheim, A.N. (1992). *Questionnaire design, interviewing, and attitude measurement*. London: Printer Publishers.
- Overbeeke, K., Djajadiningrat, T., Hummels, C., Wensveen, S., & Frens, J. (2003). Let's make things engaging. In M.A.Blythe, A.F.Monk, K.Overbeeke, & P.C.Wright (Eds.), *Funology* ( pp. 7–17). Dordrecht, The Netherlands: Kluwer.

Pausch, R., Gold, R., Skelly, T.C., & Thiel, D. (1994). What HCI designers can learn from video game designers. In C.Plaisant (Ed.), *Proceedings of the Conference on Human Factors in Computing Systems* (pp. 177–178). New York: ACM.

Picard, R.W. (1997). *Affective computing*. Cambridge, MA: The MIT Press.

Quesenbery, W. (2003). Dimensions of usability. In M.Albers & B.Mazur (Eds.), *Content and complexity: Information design in technical communications* (pp. 81–102). Mahwah, N.J.: Lawrence Erlbaum.

Ravaja, N., Salminen, M., Saari, T., Laarni, J., Holopainen, J., & Jarvinen, A. (2004). Emotional response patterns and sense of presence during video games: Potential criterion variables for game design. In *Proceedings of the Third Nordic Conference on Human-Computer Interaction* (pp. 339–347). New York: ACM.

Read, J., MacFarlane, S., & Casey, C. (2002, August 28–29). Endurability, engagement and expectations: Measuring children's fun. In *Proceedings of the International Workshop on 'Interaction Design and Children'* (pp. 189–198). Eindhoven, The Netherlands: Shaker Publishing.

Rieber, L.P. (1996). Seriously considering play: Designing interactive learning environments based on the blending of microworlds, simulations, and games. *Educational Technology Research and Development*, 44(2), 45–58.

Rozell, E.J., & Gardner, W.L. (2000). Cognitive, motivation, and affective processes associated with computer related performance: A path analysis. *Computers in Human Behavior*, 16(2), 199–222.

Said, N.S. (2004). An engaging multimedia design model. In *Proceedings of the 2004 Conference on Interaction Design and Children* (pp. 169–172). New York: ACM.

Salvo, M.J. (2002). Critical engagement with technology in the computer classroom. *Technical Communication Quarterly*, 11(3), 317–337.

Schneiderman, B. (1997). Direct manipulation for comprehensible, predictable and controllable user interfaces. In *Designing the user interface* (3rd ed., pp. 33–39). Reading, MA: Addison-Wesley.

Schneiderman, B., & Plaisant, C. (2005). *Designing the user interface* (4th ed.). Boston, MA: Pearson.

Shedroff, N. (1994). Information interaction design: A unified field theory of design. Retrieved 12 September, 2005 from <http://www.nathan.com/thoughts/unified/>

Skelly, T.C., Fries, K., Linnett, B., Nass, C., & Reeves, B. (1994). Seductive interfaces: Satisfying a mass audience. In C.Plaisant (Ed.), *Proceedings of the Conference on Human Factors in Computing Systems* (pp. 359–360). New York: ACM.



- Stephenson, W. (1967). Play theory. In *The play theory of mass communication* (pp. 45–65). Chicago: University of Chicago Press.
- Stone, D., Jarrett, C., Woodroffe, M., & Minocha, S. (2005). *User interface design and evaluation*. London: Morgan Kaufman.
- Strauss, A.L., & Corbin, J. (1990). *Basics of qualitative research*. Thousand Oaks, CA: Sage.
- Toms, E.G. (1998). What motivates browsing? In T.D.Wilson & D.K.Allen (Eds.), *Exploring the contexts of information behaviour* (pp. 191–208). London: Taylor Graham.
- Toms, E.G. (2000). Understanding and facilitating the browsing of electronic text. *International Journal of Human Computer Studies*, 52(3), 423–452.
- Toms, E.G. (2002). Information interaction: Providing a framework for information architecture. *Journal of the American Society for Information Science and Technology*, 53(10), 855–862.
- Vorderer, P., Hartmann, T., & Klimmt, C. (2003). Explaining the enjoyment of playing video games: The role of competition. In *Proceedings of the Second International Conference on Entertainment Computing* (pp. 1–9). Pittsburgh, PA: Carnegie Mellon University.
- Webster, J., & Ahuja, J.S. (2004). Enhancing the design of Web navigation systems: The influence of user disorientation on engagement and performance. Unpublished manuscript.
- Webster, J., & Ho, H. (1997). Audience engagement in multimedia presentations. *The DATA BASE for Advances in Information Systems*, 28(2), 63–77.
- Wells, A., & Matthews, G. (1994). Attention: Selection of complex, personally significant and emotional stimuli. In *Attention and Emotion: A Clinical Perspective* (pp. 45–60). Hove, UK: Lawrence Erlbaum.
- Witmer, B.G. & Singer, M.J. (1998). Measuring presence in virtual environments: A presence questionnaire. *Presence*, 7(3), 225–240.
- Woszczynski, A.B., Roth, P.L., & Segars, A.H. (2002). Exploring the theoretical foundations of playfulness in computer interactions. *Computers in Human Behavior*, 18(4), 369–388.
- Wright, P.C., McCarthy, J., & Meekison, L. (2003). Making sense of experience. In M.A.Blythe, A.F.Monk, K.Overbeeke, & P.C.Wright (Eds.), *Funology* (pp. 43–53). Dordrecht, The Netherlands: Kluwer.

## APPENDIX A: SEMISTRUCTURED INTERVIEW QUESTIONS

*Note: These questions were used for the Web searching interviews and were modified slightly to accommodate users of the other three applications.*

There are times when we become so involved surfing the Web that nothing else seems to matter; we lose track of time and our surroundings because we become so focused on the search experience.

1. Can you recall a time when you felt this way while using the Web?

Probes:

- a) What topic were you searching?
- b) What Web site were you looking at?
- c) Where were you when you were using the Web?
- d) Can you estimate how long you were on the Web for?

2. In this particular situation, was looking for information on the Web a voluntary or mandatory activity for you?

3. Before you began to search, did you have any expectations or goals in mind? What were they?

4. Please describe how the experience began.

Probes:

- a. Did you begin with a known Web site or a search engine? What does this opening screen look like? (ask about text and graphics)
- b. Was the screen appealing visually? In what way?
- c. What kinds of things did you have to do to begin searching (e.g., type in a query, browse a list, and click on a link)?
- d. How did you make decisions at this stage of the search?

5.What was it about surfing the Web that made you continue?

Probes:

- a. How focused were you on what you were doing?
- b. How aware were you of your physical surroundings?
- c. Did you feel distracted at all while searching? What distracted you?
- d. How challenging was browsing the Web for you?
- e. During this Web search, would you describe yourself as a novice or an expert?
- f. Did using the Web require a lot of effort on your part? How so?
- g. When you made an error or a wrong turn while navigating, how did the Web let you know?
- h. Did the Web always respond how you expected it to? Yes: How did it provide you with feedback? No: What was surprising about it?
- i. Did you feel "in charge" while browsing for information? Why or why not?

6.How or why did you decide to stop searching?Probes:

- a. Did you feel positive or negative as the search drew to a close? Why?
- b. What kind of reward did you get out of surfing the Web?
- c. Did you return to this search or a Web site found during this session after this particular episode? Why or why not?
- d. Did you use any of the information gathered during this session? In what circumstance?

## APPENDIX B: INTERVIEW CODES

Access	This refers to accessing a Web site, link, resource, etc. where access may be referred to as easy or difficult.
Branding	Mention of a specific Web site, product, company, etc.
Browsing	Perusing the screen for information that cannot be articulated but will be recognized once seen
Chaining	One piece of information triggers examination of more information, another site, etc.
Communication	Use of the technology for the purpose of communicating with others, or a preference for communicating with others while using technology
Community	The use of the technology is associated with fostering (or not fostering) a sense of community.
Comparing	Comparison of two sites, products, companies, items of content, etc.
Searching	Goal-directed perusal of content or screen
Aesthetics	Visual beauty or the study of natural and pleasing (or aesthetic) computer-based environments
Attention (divided)	The concentration of mental activity; attending to multiple stimuli simultaneously, i.e., multitasking
Attention (selective)	The concentration of mental activity; concentrating on one stimulus only and ignoring all others
Awareness (physical)	The participant's consciousness of physical surroundings and bodily functions (e.g., hunger, thirst)
Awareness (social)	The participant's consciousness of others in the same room or the online environment.
Challenge (cognitive)	The level of cognitive effort experienced by the participant in performing an online task
Challenge(navigability)	Degree of effort experienced in navigating the interface
Control	How "in charge" users feel over their experience with the technology
Curiosity	"The desire to know" (Merriam-Webster Online)
Customization	"To build, fit, or alter according to individual specifications" (Merriam-Webster Online)
Feedback	Response or reaction from the task environment or system that communicates the appropriateness of the users'past actions or demonstrates progress toward a specific goal; serves as a basis for future action
Interest	"Feeling that accompanies or causes special attention to an object or class of objects" (Merriam-Webster Online)

Motivation (intrinsic)	The feeling of satisfaction and pleasure one derives from an activity, where the reward is the activity itself and not dependent on external reinforcements
Motivation (extrinsic)	Motivation that originates in factors outside of the individual; behavior that is motivated by rewards and/or punishments administered by outside forces is extrinsically determined.
Novelty	Inquisitiveness; tendency to seek the new, unusual, or interesting in one's environment
Sensory	The interface appeals to or utilizes one of the participant's five senses.
Content	The participant makes a comment, judgement, or assessment based on the content of the technology.
Context technology.	The participant makes a comment, judgement, or assessment based on the context in which they are using the
Convenience	"Fitness or suitability for performing an action or fulfilling a requirement" (Merriam-Webster Online)
Prior knowledge (declarative)	Content-based prior knowledge
Prior knowledge (procedural)	Task- or activity-based prior knowledge
Problem solving	The participant employs analytical thinking in using the technology.
Relevance	"The ability (as of an information-retrieval system) to retrieve material that satisfies the needs of the user" (Merriam-Webster Online)
Time	Estimated time spent on task; may also refer to having sufficient or insufficient time to complete a task
Predictable	The participant asserts or estimates that something will occur based on past experience.
Serendipity	The participant makes an unexpected discovery while using the technology.
Ease of use	The participant describes the technology as being usable or easy to use.
Fantasy	"The free play of creative imagination; a creation of the imaginative faculty whether expressed or merely conceived" (Merriam-Webster Online)
Immersion	"Psychological state characterized by perceiving oneself to be enveloped by, included in, and interacting with an environment that provides a continuous stream of stimuli and experiences" (Witmer & Singer, 1998, p. 227)
Interactivity	The degree of information exchange between systems and users (Huang, 2003)

Social	The participant describes social or community aspects of using interface or performing task.
Disengagement (external)	The participant stops task due to an event in the external environment.
Disengagement (self)	The participant stops a task voluntarily or for internal reasons.
Engagement	The participant describes being engaged or involved with the interface or task.
Likelihood of return	The participant indicates they would use the technology in future.
Point of engagement	The point at which the participant experienced becoming engaged in a task or interface attributes
Genre	Acategory of technology composition characterized by a particular style, form, or content; e.g., newspaper as a form of document
Organization	The participant comments on the arrangement and structure of the technology.
Affect (negative)	Affect is the emotional investment a user makes in order to be immersed in an environment and sustain their involvement in the environment; this variable describes a negative response.
Affect (neutral)	Affect is the emotional investment a user makes in order to be immersed in an environment and sustain their involvement in the environment; this variable describes a neutral response.
Affect (positive)	Affect is the emotional investment a user makes in order to be immersed in an environment and sustain their involvement in the environment; this variable describes a positive response.
Fatigue	Weariness, exhaustion
Interruptibility	The participant describes him/herself as being susceptible to distraction.
Learning preference	The participant points out something about the technology that fits or does not fit the way they prefer to process information.
Pleasure	Delight, joy, gratification (Merriam-Webster Online)