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Restoration, Presence And Computer Use: How Computer Displays Incorporating Restorative Environments Effect Users' Sense Of Restoration And Presence

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RESTORATION, PRESENCE AND COMPUTER USE: HOW COMPUTER DISPLAYS INCORPORATING RESTORATIVE ENVIRONMENTS EFFECT USERS' SENSE OF RESTORATION AND PRESENCE

by

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PERMISSION

Title Restoration, Presence and Computer Use: How Computer Displays Incorporating Restorative Environments Effect Users' Sense of Restoration and Presence

Department Communication Program

Degree Doctor of Philosophy

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Jacob Dean Bell
July 18, 2014

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To my mother LaVonne and my father Donald.

ABSTRACT

Recent technological advances provide opportunities for computer users to replace desktop pictures with dynamic, audio-visual recordings. Such advances provide researchers with opportunities to better understand how specific video content may effect users' sense of restoration and presence. As described within Attention Restoration Theory, those perceiving restorative environments, which are found primarily within nature-based environments, experience a sense of restoration. Yet, prior research has largely focused on singular, and to an extent, non-interactive displays of restorative environments. The current research further investigated the restorative potential of environments having incorporated interactive, computer-based displays, with animated audio-visual environments. Participants were assigned to either restorative or non-restorative conditions and completed a computer-based, interactive, word task for 10 minutes. The centrally-located task was surrounded by video which presented either a restorative video for participants within the restorative condition, or a non-restorative video for those within the non-restorative condition. Participants then completed the perceived restoration scale (PRS) and a modified version of the Temple Presence Inventory (TPI) to measure the resulting sense of restoration and presence respectively. Results suggest that, as predicted, those who had completed a word-based task presented as part of a restorative user interface reported greater levels of both restoration and presence compared to those who had completed the same word task within the non-restorative condition.

CHAPTER I

LITERATURE REVIEW

Theory and Problem Solving

One purpose of social science is to solve real-world problems (Hayes, 2005, p. 3), and within communication, “theory is designed to provide conceptual resources for reflecting on communication problems” (Craig, 1999, p. 130). One area of interest to communication researchers is the area of computer mediated communication (CMC), which the National Communication Association (NCA) and the International Communication Association (ICA) have dedicated divisions examining CMC (D’Urso, 2009, p.709).

Communication related theories, such as Social Information Processing (see Walther, 1992) for the foundation and overview of the theory) and other theories, such as presence theory, media richness theory, etc. are often associated with computer mediated communication (D’Urso, 2009). Such theories face challenges in terms of communication research since "operationalizing some aspects of CMC configurations and social arrangements for research which necessitates leaving other aspects fixed and unexamined, making generalization from study to study most difficult” (Walther, Van Der Heide, Hamel, & Shulman, 2009, p. 749). Such challenges can be readily met by first considering the communication process to then understand the potentially complex, intersecting elements of communication and technology. Addressing communication research methods, Hayes (2005) states “It is the process that we are making inferences

about, not some population, either real or hypothetical" (Hayes 2005, p. 233). Process is what communication researchers endeavor to explore and discover.

Further, Hayes (2005) addresses the idea of science purposefully examining problems within a narrow scope of application within the real world:. That world need not be the entire world, in the sense of the planet Earth. That 'world' may be a very confined one -a business for example" (2005, p. 3).

Cybernetics and Boundaries

"Modern communication theory originated with the cybernetic tradition (Craig, 1999, p. 141), including theories such as Social Information Processing and other theories such as Uncertainty Reduction Theory are considered to be cybernetic-based theories(Griffin, 2006). As Craig (1999) summarizes this approach:

> Communication in the cybernetic tradition is theorized as information processing and explains how all kinds of complex systems, whether living or nonliving, macro or micro, are able to function, and why they often malfunction. Epitomizing the transmission model, cybernetics conceives of communication problems as breakdowns in the flow of information resulting from noise, information overload, or mismatch between structure and function and, as resources for solving communication problems, offers various information-processing technologies and related methods of systems design and analysis. (Craig, 1999, p. 141)

Walther's (2009) call for considering boundary conditions relates to communication both in terms of theory and application. Considering boundary conditions serves the purpose of not only testing the applicability of the examined communication

process but also to understand where boundary limits may intersect with other, sometimes incongruent, theories, concepts and models. This is a necessity, as Walther (2009) mentions, due to the proliferation, variation and inherent complexity of technology and CMC:

> Boundary conditions stipulate the contextual conditions in which different theoretical chains-of-events are expected to occur. Boundary specifications will help us understand when one theoretical process applies, or when a different one applies, or even — and this is no easy task— precisely when communicators shift from one type of process to another. (Walther et al., 2009, p. 748)

Cybernetics and Communication

According to Craig (1999), some theorists and researchers may believe that cybernetics lacks explanatory power and should be dismissed. Further, Craig (1999) states that an impenetrable, theoretical misunderstand occurs at the intersection of semiotics and phenomenology, because "mixtures of semiotics and phenomenology can produce a theoretical compound that is deconstructively explosive if not impenetrably dense" (Craig, 1999, p. 140). Applied to the current study, researchers who favor a semiotic approach are likely to see the current research as being unclear, lacking theoretic justification within communication, and "impenetrably dense" (Craig, 1999). Notably, researchers utilizing a semiotic approach may ultimately problematize theoretical aspects of communication utilizing cybernetic and/or phenomenological approaches. While differences exist between perspectives, it is beyond the scope of the current research to attempt to solve debate regarding the many and diverse perspectives within the field of communication. Rather, the current research seeks to heed Craig's (1999) call to "look at

the communication process from a broader, systemic viewpoint, and not to hold individuals responsible for systemic outcomes that no individual can control" (p. 142).

In sum, the applicability associated with the communication process is a legitimate means of conducting communication research. Conceptually considering and predicting the outcomes of process precedes the extent of generalizability within communication research. Walther's (2010) boundary conditions may assist in mindfully applying both communication theory and application, and Craig's (1999) call to action requests that scholars take the perspective of a systems-level approach to studying communication.

The current study heeds Walther's and Craig's requests to consider a systems level approach, and to consider boundary conditions in order to better understand CMC-based aspects of presence and restoration. The current study endeavors to provide additional research data for scholars wishing to increase the effectiveness of communication as "technologies endowed with physical and social presence affordances might provide an experiential setting to train and empower interpersonal communication processes" (Mantovani, Agliati, Mortillaro, Vescovo, & Zurloni, 2006, p. 12).

Advances in computing technology allow computer users to integrate animated audio-visual desktop backgrounds. Rather than having static, desktop background images, computer users now have technological means to customize the computer desktop backgrounds adding high definition audio-visual movies. One particular example of software allowing such customization is *My Living Desktop*. The effect on users of such backgrounds is tested in the current study. Specifically, the current study examined

how animated audio/visual restorative and non-restorative audio-video backgrounds influenced perceived levels of both interface transparency and attention restoration.

The following section includes information and research related to both presence and restoration, and then proceeds with the hypotheses for the current study. Presence, which examines how mediated experiences are perceptually rendered as "non-mediated", is described within the following section. Next, restorative environments and Attention Restoration Theory, which theorizes that environmental factors can either provide or inhibit restorative effects within individuals, is then described.

Presence

Presence Concepts and Definitions

Presence is relevant in terms of understanding how technology, as an intermediary to the experience, is perceptually diminished when experiencing presence:

> Presence is described as a psychological state or subjective perception in which even though part or all of an individual's current experience is generated by and/or filtered through human-made technology, part or all of the individual's perception fails to accurately acknowledge the role of the technology in the experience. (International Society for Presence Research, 2000, para. 1).

Presence is thought of as a multidimensional concept (International Society for Presence Research, 2000 para. 7; Lombard, Ditton, & Weinstein, 2009).

According to Lombard and Ditton (1997), "For an illusion of non-mediation to be effective, the medium should not be obvious or obtrusive - it should not draw attention to itself and remind the media user that she/he is having a mediated experience" (Obtrusiveness of medium section, para. 1). Riva (2003) provides an example that

illustrates the concept of presence and reveals the how aspects of importance of continuity, transparency and taking action are important considerations for achieving and maintaining presence, stating that "in the same way disruptions or breaks to the illusion of film break spectators' experience, disruptions or breaks to the illusion of interacting within a mediated environment potentially break a user's experience." (Riva, Loreti, Lunghi, Vatalaro, & Davide, 2003, p. 92). Gamberini and Spagnolli (2003) states that "the environment is not considered as a physical space, but as a place organized by humans according to their practical goals"(p. 105). Pertaining to the provided movie theater example, anecdotal evidence suggests potential annoyance with any disruption to the movie-going experience. If such disruptions impede or break the experienced sense of presence, then movie-viewers may likely take action to reduce disruptions. Regardless of the point of origin of the distractions, ultimately, achieving unbroken or sustained presence may likely be dependent upon an individual's level of attention. Marsh (2003) describes how "transparency" is associated with attention:

> Transparency ensures users' focus of attention is not diverted to the use of the interface. Disruptions to the interface shift users' focus of attention and may potentially impede the task at hand. Hence, transparency can be described as the antidote to disruptions. (p. 89)

Although the experience of "being there" may be as "invariant" in the real world (Lessiter, Freeman, Keogh, & Davidof, 2001, p. 283), according to Marsh (2003) and as described in the movie example above, it is the "shift" in attention that creates the break in presence. Additionally, media characteristics are subcategorized variables of media form and media content. (Ijjsselsteijn, 2002). As Lessitter et al. (2001) explain, "presence

is relevant to understanding users' experiences of media in that an illusion is generated whereby a user senses that she/he is located somewhere other than her/his physical environment" (p. 283). Researchers have also examined interactive media for any potential of presence, including "virtual reality/environments, computer games, the Internet, multi-media,[and] interactive television…" (Marsh, 2003, p. 93). Presence researchers have further examined a number of interfaces across a spectrum of "reality", including virtual reality, mixed reality (Wagner et al., 2009) and augmented reality (see for example Sylaiou, Mania, Karoulis, & White, 2010). Researchers have not fully agreed upon a single definition of presence. As Schubert (2009) states,

> While the cognitive processes underlying presence are unconscious spatial cognitive processes, the experience itself is conscious. There seems to be a consensus in the literature on both claims, yet it is unresolved how the conscious experience emerges from unconscious processes. (p. 162)

However, a greater consensus of understanding has emerged, after various researchers have independently identified specific components associated with such perceptions of non-mediation (e.g. Presence), including spatial presence, attention focusing, perceived realness (Schubert, 2009, p. 163), as well as "involvement in the sense of focusing attention on the virtual environment" (Schubert, 2009, p. 163).

Is it possible, then, to enhance the sense of presence experienced by communicators interacting with computer user interfaces? As Horvath and Lombard (2010) describe, "the ideal user-interface would put the user within a computing environment that allows them to concentrate on the task at hand and not the computer itself" (p. 88).

One theory which may further advance the goal of creating an "ideal user interface" (Horvath & Lombard, 2010, p. 88), providing further information pertaining to how attention is related to the experience of presence, is Attention Restoration Theory. Examining the underlying theoretical aspects of Attention Restoration Theory may facilitate a deeper understanding of attention as a process as related to presence,

Attention Restoration Theory

Restoration Concepts

Restorative experiences, as described within Attention Restoration Theory (Kaplan, 1995), occur when depleted levels of attention are replenished and restored. Restoration reestablishes effective functioning, problem solving, interaction and communication through the pathway of voluntary attention, referred to as "directed attention" within Attention Restoration Theory. (Kaplan, 1995, pp.169-171). Restorative environments "can help to restore depleted emotional and functional resources and capabilities" (Kjellgren & Buhrkall, 2010, p. 464). Essentially, Attention Restoration Theory explains that natural environments have restorative properties that are effortless to perceive, and through viewing restorative environments, one's voluntary attention can rest and recover (Kaplan, 1995).

Restoration and Attention

Directed attention is used for perception and is necessary for cognition. Directed attention requires effort and exists in only finite amounts before needing to be replenished (Kaplan, 1995). Directed attention is important for problem-solving, minimizing distractions and facilitating focus, is essential for inhibiting impulsiveness,

and facilitates the necessity of combining action with thought needed for social interaction (Kaplan, 1995, p. 169). Fatigued directed attention results in impairments of perception, inhibition, problem solving, reflection, and emotion (Kaplan, 1995). Individuals may also exhibit negative emotions and interpersonal impairments (Hartig, Korpela, Evans & Gärling, 1997), and seek isolation (Kaplan, 1995). While directed attention requires effort, involuntary attention (which is referred to as "fascination" within Attention Restoration Theory (Kaplan, 1995)), does not require any expenditure or effort in order to perceive (Kaplan, 1995, p. 172; Kjellgren & Buhrkall, 2010, p. 464).

Attention Restoration Theory Components and Definitions

Restorative environments are important in reducing directed-attention fatigue (Kaplan, 1995), and Attention Restoration Theory identifies and explains the specific components associated with the sense of restoration. The components necessary for achieving restoration include being away, extent, fascination, and compatibility.

Being Away

"Being away", according to Kaplan (1995) "frees one from mental activity that requires directed attention support to keep going" (p. 173). The term "being away" can be thought of as a vacation, and being away, according to Kaplan, is often associated with natural settings (Kaplan, 1995). Being away involves a change, or shift to another destination, which alleviates the need to direct attention (Kaplan, 1995, p. 173). Being away may happen primarily as a conceptual shift, represented by a "movement to another situation" (Hartig, 1997, p.177).

Extent

To qualify as having "extent", an environment "Must be rich enough and coherent enough so that it constitutes a whole other world. An end-less stream of stimuli both fascinating and different from the usual would not qualify as a restorative environment for two reasons. First, lacking extent, it does not qualify as an environment, but merely an unrelated collection of impressions. And second, a restorative environment must be of sufficient scope (Kaplan, 1995, p. 173).

Fascination

Fascination (a.k.a. involuntary attention) has two elements, both hard and soft fascination. "Fascination" represents an essential component of restoration. The term "fascination" (a.k.a. Involuntary attention) (Kaplan, 1995, p. 172) provides rest for, and recovery of, directed attention, existing as "extremes along a 'soft-hard' dimension" (Kaplan, 1995, p. 172). "Fascination" can be compared to "auto racing" (Kaplan, 1995, p. 172) as an example of hard fascination, and "walking in a natural setting" (Kaplan, 1995, p. 172) as an example of soft fascination. Such elements "readily hold the attention, but in undramatic fashion" (Kaplan, 1995, p. 172), and environments having the component of fascination "do not require any mental resources" (Kjellgren & Buhrkall, 2010, p. 464), and importantly, fascination does not deplete, or tax resources of directed attention (Kaplan & Kaplan, 1995). Soft fascination in natural settings includes "clouds, sunsets, snow patterns, the motion of the leaves in the breeze-these readily hold the attention, but in an undramatic fashion" (Kaplan, 1995, p. 174). Kaplan (1995) states that "attending to these patterns is effortless, leave ample opportunity for thinking about other things"(p.

174). The component of fascination "attracts people and keeps them from getting bored" (Kaplan & Kaplan, 1995, p. 184).

Compatibility

"Compatibility can be found in situations in which what one wants to do matches what the environment demands and supports"(Hartig, Korpela, Evans, & Gärling, 1997, p. 178) "There should be compatibility between the environment and one's purposes and inclinations. In other words, the setting must fit what one is trying to do and what one would like to do. (Kaplan, 1995, p. 173) Describing environmental requirements necessary for achieving specific outcomes, Kaplan (1995) describes the environment component of compatibility, stating that "the setting must fit what one is trying to do and what one would like to do . . . In a compatible environment one carries out one's activities smoothly and effortlessly" (p. 172). According to Kaplan (1995), compatibly is further enhanced by means of feedback provided by compatible environments: "One's purposes are more readily achieved when one has prompt and useful feedback from the environment" (p. 172).

Restoration, Attention and Environments

Indeed, signs of fatigued directed attention are similar to "certain deficits in the frontal lobe" (Kjellgren & Buhrkall, 2010, p. 464). Not surprisingly, in physical environments, natural environments (a.k.a. green spaces) have been shown to assist with those with Attention Deficit Hyperactivity Disorder (ADHD). Kuo and Taylor (2004) compared the environments that children with ADHD reside in both after-school and weekends. Their findings indicate that, compared to children spending time in conditions including both parking lots and neighborhood areas with little green spaces, children spending time in

green, natural outdoor spaces were shown to have a significant reduction in ADHD symptoms, and these findings were consistent across gender, household income and geographical regions within the U. S. (Kuo & Taylor, 2004). Natural settings have been shown to provide restorative effects to visitors of wilderness trailheads, who reported a reduction of stress and mental rejuvenation (Cole & Hall, 2010). Some individuals have indicated natural settings as being on their list of favorite places (Korpela, Hartig, Kaiser, & Fuhrer, 2001, p. 585). Examining environmental preference for those subject to fatigue, participants viewing slides of either urban or nature-based forest scenes preferred nature-based walks over walks within urban environments (Hartig & Staats, 2006). Restoration, however, does not occur exclusively within wilderness/natural environments; it can occur within urban areas (VanDenBerg, 2007) and indoor environments (Bringslimark, Hartig, & Patil, 2007).

In indoor settings, the presence of indoor plants correlates with both the amount of worker sick leave taken and productivity in the workplace (Bringslimark et al., 2007). Apartments containing window-based views of natural settings provide opportunities for restoration as well, including both well-being and satisfaction (Kaplan, 2001), and "contributes substantially to residents' satisfaction with their neighborhood and with diverse aspects of their sense of well-being" (Quote from abstract, Kaplan, 2001, p. 507).

Similar to window-based views within natural settings, restoration can occur when viewing *representations* of restorative environments (such as photos, videos, and even simulations). Berto, Baroni, Zainaghi, and Bettella, (2010) asked mentally-fatigued participants to complete computer-based activity overlaid against the display's background. Participants who viewed high-fascination photographs of restorative

environments had lower performance-based costs compared to mentally-fatigued participants viewing photographs of low-fascination environments. As Berto et al. (2010) state, "fascinating patterns are inherently gripping and people do not spend energy in suppressing distracting stimuli because they do not have to pay attention to less than interesting stimuli" (p. 495).

In the case of the Berto et al. study (2010), scenes rated as possessing low levels of fascination were reported to tax directed attention: "when interest fails, as in low fascination scenes, people are forced to pay directed attention because the environmental stimuli are not inherently gripping"(Berto et al., 2010, p. 499). According to Berto (2005), simultaneous exposure to the on-screen task and photograph is "'more ecological'" (p. 496).

Further support for Attention Restoration Theory has been provided by comparing representations of various environments. The restorative potential of viewing either geometric shapes, urban environments, or natural environments indicate that cognitively-fatigued participants who viewed photos of natural environments experienced improved performance on attention-based tests, whereas those viewing photos of geometric patterns, or photos of urban environments, did not show improved performance on attention-based tests. Additionally, restorative effects were found to occur after viewing restorative environments for six minutes (Berto, 2005).

Why do certain environments influence perceptions of restoration within individuals? From the perspective of Attention Restoration Theory, restorative environments allow for attention to rest and recover. Within Attention Restoration Theory, Kaplan (1995) conceptualizes directed attention (a.k.a. Voluntary attention) as a

mechanism with specific properties: “it requires effort, plays a central role in achieving focus, is under voluntary control (at least some of the time), is susceptible to fatigue, and controls distraction through the use of inhibition” (p. 170). Additionally, this mechanism of attention is subject to influence by particular components, when collectively present, to facilitate restoration. The components necessary to facilitate restoration include being away, extent, fascination and compatibility. When all of the elements are present, directed attention can recover. Environments lacking these components are not likely to facilitate restoration and recovery of directed attention.

Presence and Attention Restoration Theory: Together Can “Non-mediate”

Restoration and Presence may be separate constructs (with presence being conceptual and restoration supported via Attention Restoration Theory), yet both contain overlapping areas of importance, including attention and interaction. Both presence and Attention Restoration Theory can be examined at the level of the computer-user interface, due to the overlap between aspects of presence and Attention Restoration Theory. That is, incorporating mediated representations of restorative environments facilitate a sense of both presence and restoration within the individual.

The focus, in part, of presence-based research involves the use of media to portray an environment and, also, to portray an environment without being overtly noticeable. Lombdard and Ditton (1997) state that “the medium should not be obvious or obtrusive - it should not draw attention to itself and remind the media user that she/he is having a mediated experience” (Obtrusiveness of medium section, para. 1). To be “unnoticed” is the key factor according to Lee (2004), who states that “physical presence occurs when technology users do not notice either the para-authentic nature of mediated objects (or

environments) or the artificial nature of simulated objects (or environments)" (p. 45). "New media engage old brains, and to the extent that new interactions mimic real life, then the principles that explain perception in real life can be applied straightforwardly to computers and other media" (Reeves & Nass, 2000, p. 68). Attention Restoration Theory, then, can provide specific, categorical aspects of media content.

Both presence and Attention Restoration Theory also consider the role of attention. Presence-based research has, according to Schubert (2009), entered a phase considering cognitive-based theories (p. 162). Attention Restoration Theory may provide a timely consideration for understanding presence. Further, presence researchers wish to achieve presence by means of a sustained experience (Lombard & Ditton, 1997; Marsh, 2003, p. 9). The underlying mechanisms required to achieve presence-based goals may be further illuminated by way of Attention Restoration Theory. How? Restorative environments experienced over time permit the rest and recovery of directed attention over time as well. Since restorative environments are perceived involuntarily, a sustained unburdening of attention across time facilitates continual experience of non-mediation on an equally ongoing basis. From the perspective of presence, and pertaining to portrayed media environments, the portrayed physical space may be related to Attention Restoration Theory's "being away" and "extent" (Kaplan, 1995), and a sense of engagement may be related to Attention Restoration Theory's element of "fascination" (de Kort, Meijnders, Sponselee, & IJsselsteijn, 2006, p. 312). In particular, Attention Restoration Theory can reveal additional understanding pertaining to the underlying mechanisms that addresses attention, environment, individuals and interactions. It is

within the role of interaction that Attention Restoration Theory and presence research may serve to not only facilitate but also enhance communication.

In sum, Attention Restoration Theory may be used to better understand the underlying components described within presence research, and in an applied sense, attention restoration theory may facilitate and enhance what Lombard and Ditton (1997) define as the "perceptual illusion of non-mediation" (Presence Explicated section, para. 1), also known as presence. In other terms, Attention Restoration Theory provides detail describing how elements within natural settings can result in perception that requires no effort to perceive and does not tax directed attention. From the perspective of the perceiver, then, viewing such elements is, in lay terms, a "no brainer" as these components do not require effort to perceive. In an applied sense, incorporating these components within the user interface would result in perceptually rendering the media as unobtrusive.

Hypotheses

Therefore, based upon aspects described above, the current study hypothesized the following: 1) Participants viewing the restorative media frame would report greater perceived restoration than reported by those viewing the non-restorative clip. 2) Participants viewing the restorative media frame would report a greater sense of presence than reported by those viewing the non-restorative clip.

CHAPTER II

METHOD

Participants attending a Midwestern university were recruited to participate in the current study in exchange for extra credit. The resulting convenience sample consisted of 50 participants (26 men and 24 women, mean age = 21 years, age range:19-28years).

Participants were randomly assigned to one of two conditions. Prospective participants were given a consent form (SEE APPENDIX A) to read and review. The researcher asked if there were any questions. Prospective participants then chose to either accept or decline to participate within the study. Those who opted to participate signed and dated the consent form and were then directed to the computer workstation.

Next, participants in both conditions completed a computer-based word task for 10 minutes (SEE FIGURE 1). The word task was located within the center of the display, and surrounded by video with sound. The displayed video varied based upon the two conditions (SEE FIGURES 2 & 3). Within the restorative condition, the video, which surrounded the word task, displayed a restorative environment with sound (SEE FIGURE 3). The restorative environment video displayed a beach scene, looking out into the ocean. Within the non-restorative condition, the video which surrounded the word task displayed a non-restorative environment with sound. (SEE FIGURE 3)

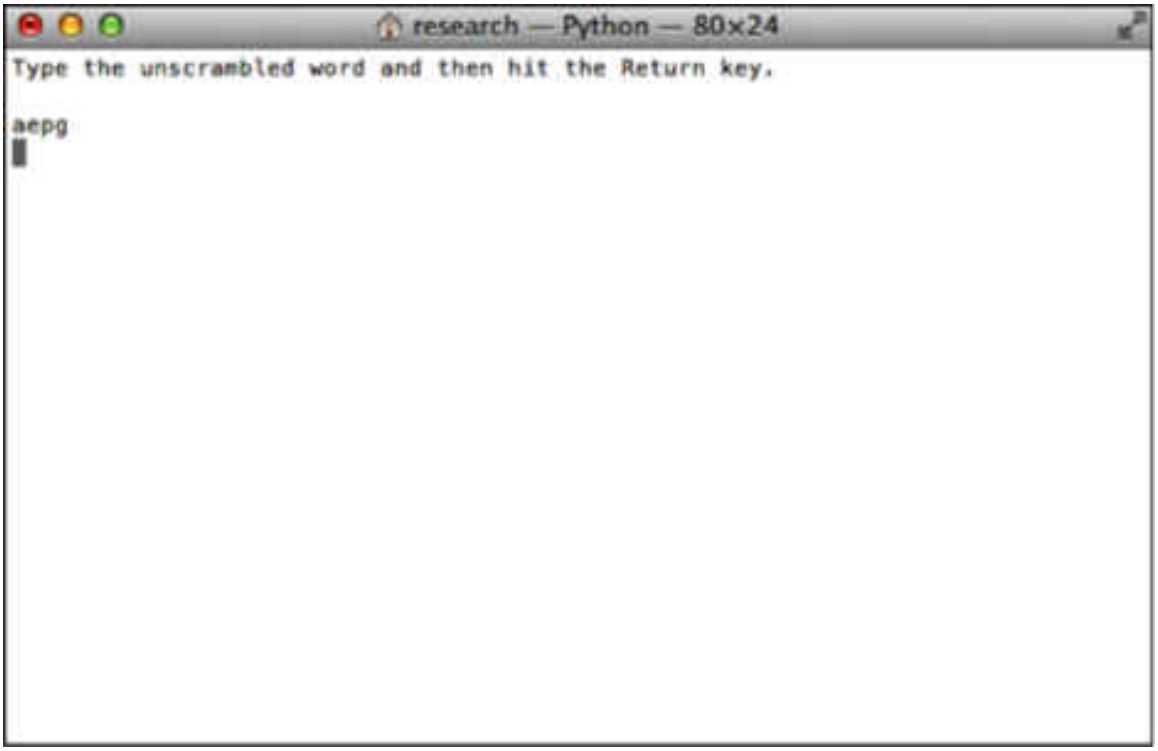

Figure 1. Word-Based Task Completed by Participants. Window displayed centrally within the user interface. See Figures 2 and 3 to view as integrated within the user interface.

Task Description

This word based task (SEE FIGURE 1) consisted of a collection of letters which, once correctly sequenced revealed one of two possible correct words (SEE APPENDIX B). The word list source, which included two possible, correct anagrams along with sequenced letters. Participants attempted to unscramble the correct word by typing their guesses for the correct words. The wordlist and scrambled words were displayed in the same order as provided on the list (SEE APPENDIX B), and as displayed to all participants.

Conditions

Participants were randomly assigned one of two conditions. Within both conditions, participants completed the above-mentioned, computer-based task (a.k.a the "word jumble"). In both conditions, the task window was located in an application window located approximately within the middle of the desktop display. An animated audio-visual "frame" or "desktop background" surrounded the centrally-located task window in both conditions. The two conditions were determined by the content of the surrounding media frame. Participants were assigned to one of the two following conditions:

Restorative Condition

The desktop background, categorized as a "restorative environment," consisted of an animated audio-visual recording of a seaside beach.

Non-Restorative Condition

The desktop background, categorized as a "non-restorative environment," consisted of an animated audio-visual recording of production factory.

Questionnaires (5-10 minutes)

Following completion of the computer-based task, participants then completed two questionnaires to determined sense of presence and perceived restoration. (SEE APPENDICES C & D)

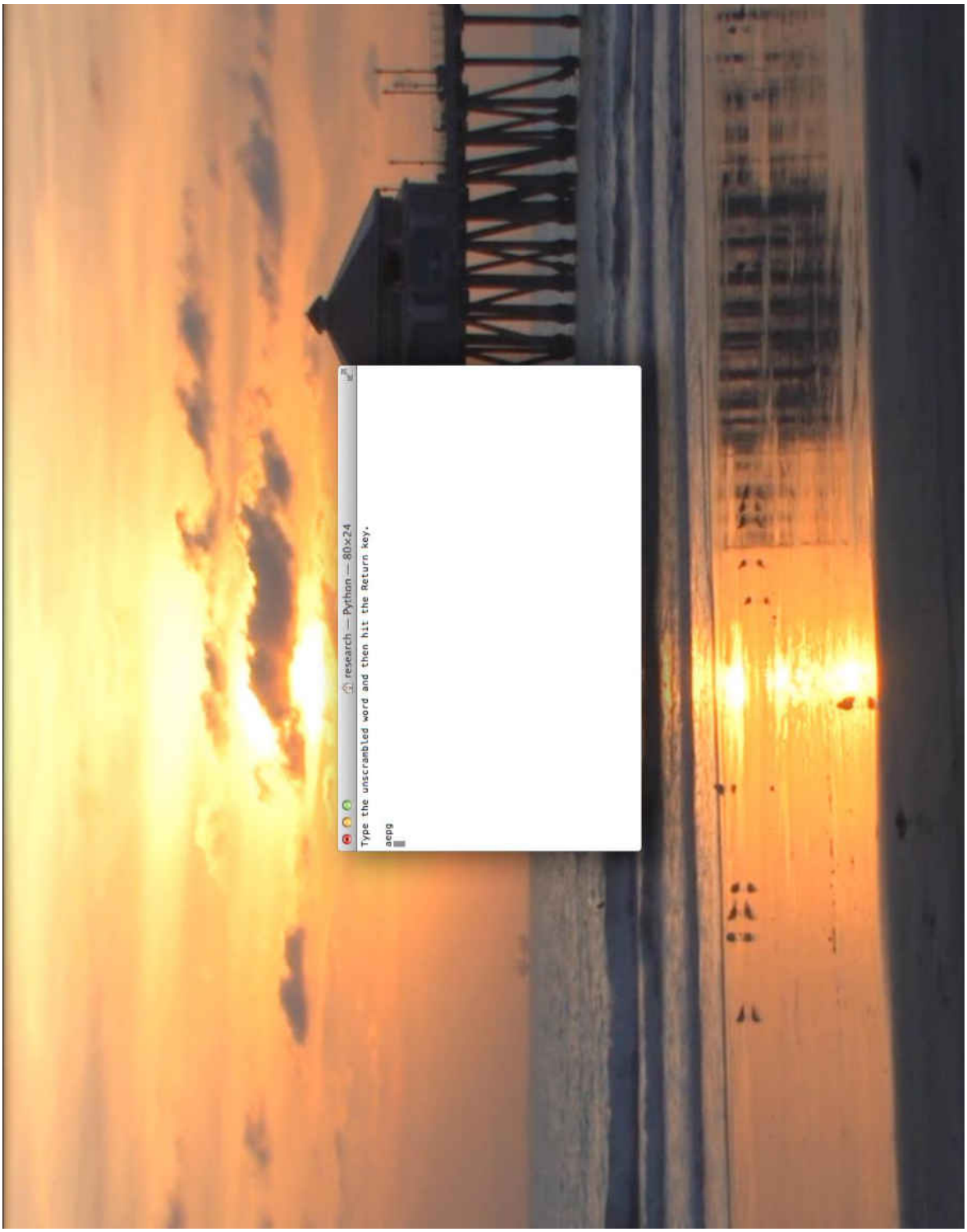

Figure 2. Screen Shot of Restorative User Interface and Centrally Located Task.

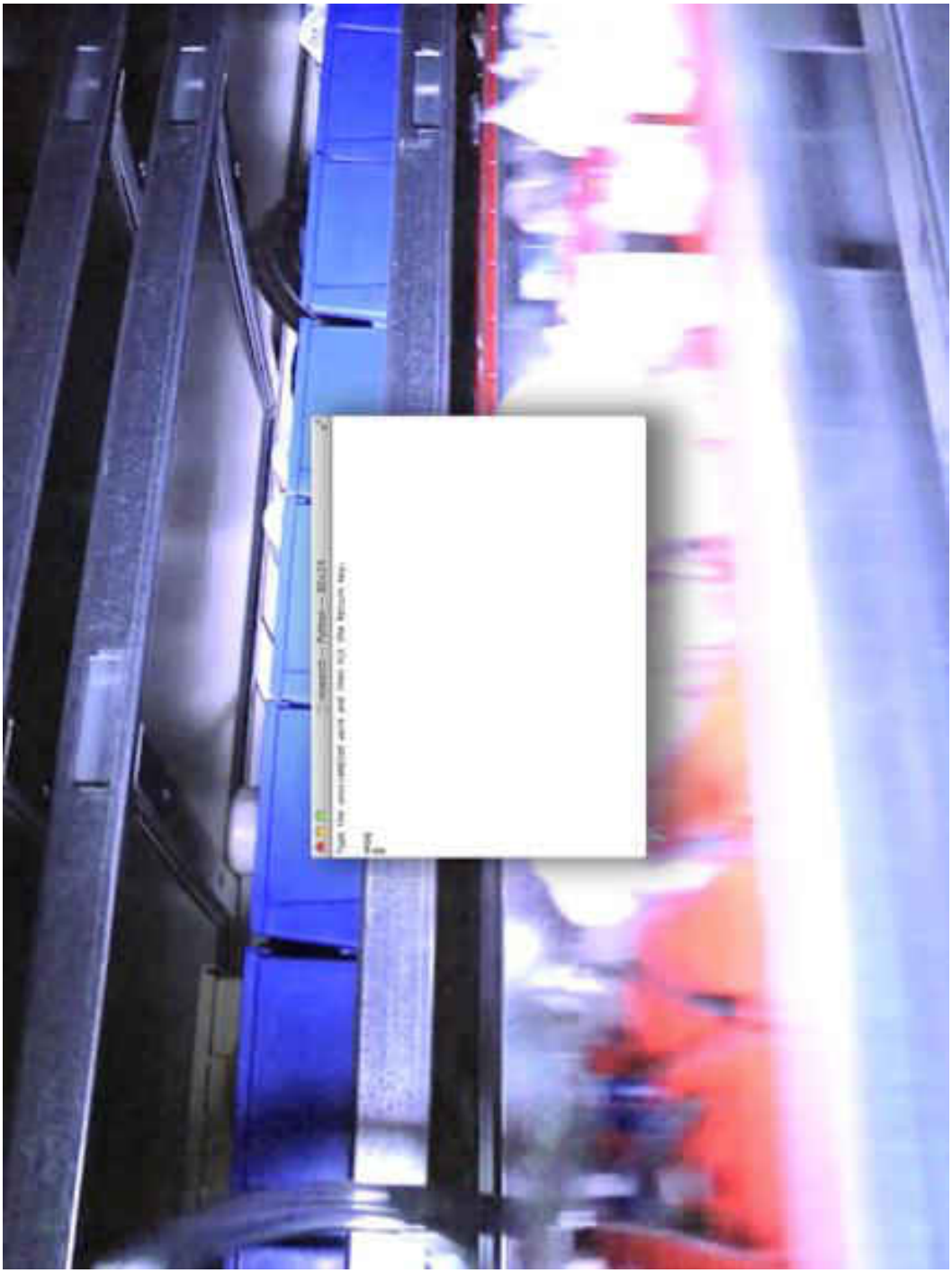

Figure 3. Screen Shot of Non-Restorative User Interface and Centrally Located Task.

CHAPTER III

RESULTS

Chronbach's alphas were calculated for the modified Temple Presence Inventory and for the Perceived Restoration Scale. The modified Temple Presence Inventory was found to be reliable (13 items; $\alpha = .86$), and the Perceived Restoration Scale was also found to be reliable (26 items $\alpha = .959$).

Two hypotheses were tested in the current study. As a reminder, the first hypothesis predicted that participants viewing the restorative media frame would report greater perceived restoration than reported by those viewing the non-restorative clip. The second hypothesis predicted that participants viewing the restorative media frame would report greater sense of presence than reported by those viewing the non-restorative clip.

Restoration Hypothesis

An independent samples t-test was conducted to compare mean scores of perceived levels of restoration reported by individuals within the non-restorative-media-frame condition and a second condition restorative-media-frame condition. As hypothesized, participants viewing the restorative media frame reported greater sense of restoration than reported by those viewing the non-restorative clip. There was a significant difference in reported levels of restoration between the restorative media group (M=18.87, SD=3.60) and the non-restorative media group (M=12.80, SD=4.76); $t(44.665)= 5.084$, $p =.001$. Consequently, the null hypothesis was rejected, and the alternative hypothesis was accepted. These results suggest those who completed a word-

based task presented as part of a restorative user interface/media frame reported significantly greater levels of restoration compared to those who completed the same word task within a non-restorative condition.

Presence Hypothesis

An independent samples t-test was conducted to compare mean scores of perceived levels of presence reported by individuals within the non-restorative-media-frame condition and a second condition restorative-media-frame condition. As hypothesized, participants viewing the restorative media frame reported greater sense presence than reported by those viewing the non-restorative clip.

There was a significant difference reported levels of presence between the restorative media group (M=9.67, SD = 1.52) and the non-restorative media group (M=7.94, SD=1.86) conditions; t(46.19)= 3.59, p= .001. Consequently, the null hypothesis was rejected, and the alternative hypothesis was accepted. These results suggest that those who completed a word-based task presented as part of a restorative user interface/media frame reported greater levels of presence compared to those who completed the same word task within a non-restorative condition. As predicted, those experiencing the restorative user interface reported greater levels of presence than those within the non-restorative condition. Considered together, the results suggest that restorative user interface may modulate user perceptions of both presence and restoration.

CHAPTER IV

DISCUSSION

As hypothesized, those experiencing the restorative user interface condition reported greater levels of restoration compared to those within the non-restorative user interface condition. Furthermore, restorative interface users also reported greater levels of presence compared to those within the non-restorative interface condition.

The current study adds further support to prior research indicating that restorative effects occur not only through perceiving real-world restorative environments, but that restorative effects occur even by perceiving representations (such as photographs and video) of actual restorative environments. In line with prior research, including research implicating attention as a common factor within experiences of presence and restoration, as well as research having examined the computer user interface in both presence and restoration, the current study further examined the role of potential user interface-based restoration through incorporating audio-visual recording of environments as part of the user interface. These findings indicate that specific audio-visual content containing restorative or non-restorative representations of environments effect the users' sense of both presence and sense of restoration.

While attention is described as important within presence research, attention plays a central role in Attention Restoration Theory. The concept of presence and the theory of attention restoration are similar, but not identical. While the former is a mode

used to further the understanding of presence, in particular, the sense of presence that occurs in various media, computer interfaces and virtual environments etc., the latter comes from real-world analysis of natural environments that facilitate restoration from those experiencing restorative environments. Prior researchers have described potential overlap between restoration and presence (with attention implicated as important within both Attention Restoration Theory and presence.

Presence Implications

"Presence", as stated in the introduction, has been defined as the "perceptual illusion of non-mediation" (International Society for Presence Research, 2000, Presence Explicated section, para. 1), and presence researchers believe that attention may be a specific and necessary component to perceive environments as non-mediated (Schubert, 2009, p. 163). Although the current research included predictions of restoration as described within Attention Restoration Theory, based on the tenets within Attention Restoration Theory, the role of attention within presence is made clear in terms of media. That is, the resulting sense of presence may occur when the media itself "does not draw attention to itself" (International Society for Presence Research, 2000, Obtrusiveness of medium section, para. 1). Additionally, considering elements of Attention Restoration Theory may further reveal the implications of the current study.

Similar to the construct of presence, Attention Restoration Theory includes descriptions of attention, environments and resulting effects on human cognition. Also similar to the concept of presence, Attention Restoration Theory describes environments that can be perceived without being obtrusive; restorative environments are environments that contain elements that cost nothing for an individual to perceive. Such restorative

environments can be attended to without any burden or taxing of attention, and are subsequently rendered as non-attention grabbing.

With user interfaces designed for computer interfaces and various other interfaces, designs that facilitate effective human computer interaction are important. For those wishing to optimize clarity and minimize distraction within the computer user interface, certain design elements which can be incorporated to achieve such an objective. Prior research has investigated the role of restoration within computer use, including designing restorative user interfaces that facilitate effective functioning or at least provide a buffer to ongoing demands inherent within not only the computer user interface, but demands within the computer users' environment. Why might this be an important implication for computer users? Because attention is one of several necessary components that collectively facilitate effective functioning and cognition (c.f. Kaplan, 1995).

The following limitations and areas for future research include testing within various physical environments, testing multiple restorative and non-restorative backgrounds, as well as having computer users engage in a range of various tasks which also vary in terms of enjoyment. The current study employed the use of a lab in order to control and provide consistent environmental factors and minimize interruptions. Yet, such limitations are not unique to the current study, and occur throughout laboratory and environmentally-controlled studies. Future research could examine "real-world" usage scenarios within real-world computer use to "examine effect" in non-environmentally controlled laboratory environments, and also to see potential levels of presence and restoration related to users intrinsically motivated use of computers, including social

networking. Additionally, future studies could include testing the restorative potential of the user interface within various physical environments, varying in degree of distraction type, frequency, intensity and duration.

The level of enjoyment associated with the task may be perceived as limitation. That is, the word task may have provided a sense of fascination within, therefore the second limitation within the current study (and lab based studies in general) was that the word descrambling task may (or may not) have been intrinsically enjoyable. Prior research has indicated that, participants reported boredom, having spent time relaxing while viewing a simulated natural environment (Kjellgren & Buhrkall, 2010), yet the task included within the current study was implemented to ensure that users attended to the environment, to ensure users attended to the user interface environment for the same amount of time, to provide an activity to complete for the necessary duration, and finally, to prevent, as much as possible, boredom experienced by participants.

Further research may also test the hypotheses based upon a variety of restorative and non-restorative backgrounds, and may also examine how the location and size of various user elements effect perceptions of presence and restoration.

This study examined only one of many possible ways in which user interface elements could be varied in, specific, purposeful ways to effect the user and user experience. This study, having incorporated user interface elements that, as described within Attention Restoration Theory, hypothesized that user interfaces that incorporated restorative audio-visual elements would facilitate a greater sense of restoration of both presence and restoration than user interfaces that incorporated non-restorative elements. Additional studies are required to further investigate the role of the user interface,

presence, and restoration, but this study highlights the importance of considering environmental effects as presented within the computer user interface.

Concluding considerations of implications include application of restorative user interface to facilitate effective human computer interaction (HCI), but also imply more effective communication between individuals communication through mediated interfaces. Further implications include that the incorporation of restorative media within the user interface are likely to achieve the objective sought by presence-based researchers who seek to create the ideal user interface. Specifically, interfaces incorporating both a centrally located task window with a surrounding restorative animated audio-visual elements may result in users experiencing the display in perceptually non-mediated sense (resulting in user sense of presence) due the incorporated restorative media requiring no effort to perceive. Further, the restorative elements of the display would also facilitate continued attending-to or focusing-on tasks located within the task window. Essentially, the user would perceive an environment that may demand attention within the centrally located window while simultaneously experiencing restored levels of perception with no effort required. Since perception of restorative environments does not require a user's desire to direct attention to a source, the user would be free to allocate additional unburdened resources to task focusing, as restorative environments could restore levels of attention on an on-going basis. Incorporating both elements within one interface, may not only render the total experience as perceptually non-mediated, resulting in user sense of presence, but may also restore depleted levels of attention within the computer user.

APPENDICES

Appendix A
Consent Form

Appendix B: Informed Consent

INFORMED CONSENT

TITLE:RESTORATION, PRESENCE AND COMPUTER USE: HOW COMPUTER DISPLAYS INCORPORATING RESTORATIVE ENVIHONMENTS EFFECT USERS' SENSE OF RESTORATION AND PRESENCE
PRIMARY INVESTIGATOR: JACOB BELL
PHONE: 701 777-2673
DEPARTMENT: COMMUNICATION
RESEARCH ADVISOR: PAMELA KALBFLEISCH
PHONE: 701-777-6389
DEPARTMENT: COMMUNICATION

A person who is to participate in the research must give his or her informed consent to such participation. This consent must be based on an understanding of the nature and risks of the research. This document provides information that is important for this understanding. Research projects include only subjects who choose to take part. Please take your time in making your decision as to whether to participate. If you have questions at any time, please ask.

You are invited to be in a research study about computer-based communication and experiences, because you are taking a Communication course. The purpose of this research study, which will include approximately 25 participants, is to investigate how computer desktop backgrounds influence experiences of restoration and sense of presence. Knowledge gained from this study will help to better understand the experience of computer-based interaction and communication. You will need to meet only one time for approximately 30 minutes.The research will be conducted in the Communication Research Lab, O'Kelly Hall, room 313 at the University of North Dakota.

In this study, participants will spend 10 minutes complete a word-based task which involves guessing the word associated with a collection of letters. The task will be completed using a computer. Next, participants will then complete two questionnaires. You are free to skip any questions you would prefer not to answer. It will take approximately five to ten minutes to answer the questions. Finally, you will submit the completed questionnaires to the researcher. The researcher will provide a receipt to you for your participation. You may show your receipt to your instructor for any extra-credit he or she may have offered. The total time to complete the study is expected to be 30 minutes or less.

There may be some risk from being in this study. You may experience frustration that is often experienced when solving problems and completing surveys. Some questions may be of a sensitive nature, and you may therefore become upset as a result. However, such risks are not viewed as being in excess of "minimal risk". If, however, you become upset by questions, you may stop at any time or choose not to answer a question. If you would like to talk to someone about your feelings about this study, you are encouraged to contact, the Counseling Center at University of North Dakota's Counseling Center at 777-2127. You may not benefit personally from being in this study. In the future, other people might benefit from the results of this study, including an increased understanding of computer use and communication.

Although extra credit is given for your participation in this study, if you choose not to participate in this study, you may earn extra credit in your course in other ways. To inquire about any extra credit offered, please ask your instructor, who may provide you with comparable assignments that you may choose to complete.You may encounter parking related costs if you have parked in metered or short-term parking, or otherwise violate UND's parking policies. You will not be paid for being in this research study. However, you will receive extra credit for participating. The specific amount of extra credit is determined by your instructor. The University of North Dakota and the research team are receiving no payments from other agencies, organizations, or companies to conduct this research study.

Please initial & date that you have read this page. Subject initials: Date:

Approval Date: OCT 2 2013
Expiration Date: OCT 1 2014
University of North Dakota IRB

Revised 05/01/09

Appendix A
Consent Form (cont.)

Appendix C: Informed Consent

The records of this study will be kept private to the extent permitted by law. In any report about this study that might be published, you will not be identified. Your study record may be reviewed by Government agencies, and the University of North Dakota Institutional Review Board. Any information that is obtained in this study, and that can be identified with you, will remain confidential and will be disclosed only with your permission or as required by law.

Your consent form will be collected prior to the beginning of the study, and will be stored separately from data gathered during the study. Data collected in this study will not refer to you by name. Instead, only a generic title (e.g. participant A) will be used for data analysis. Both consent forms and study data will be stored in secure locations at the University of North Dakota. Consent forms will be stored separately from the data collected during the study.

If we write a report or article about this study, any specific reference to transcribed material will be reported using only generic terms (generic terms, such as "a participant") so that you cannot be identified. Additionally, we will describe the study results in a summarized manner so that you cannot be identified. The data for this study will be used for educational purposes, be stored securely and separately from consent forms, and will be destroyed after a minimum of 3 years after the study is completed.

Your participation in this study is voluntary. You may choose not to participate or you may discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. Your decision whether or not to participate will not affect your current or future relations with the University of North Dakota. Although extra credit is given for your participation in this study, if you choose not to participate in this study, you may earn extra credit in your course in other ways. Please ask your instructor, who may provide you with comparable assignments that you may choose to complete (e.g. writing assignments, participation in other research experiments etc.). You may choose to withdraw your consent at any time, and without penalty, during this experiment. Extra credit will still be given if you choose to withdraw your consent at any time during this study.

The student researcher conducting this study is Jacob Bell. You may ask any questions you have now. If you later have questions, concerns, or complaints about the research please contact the student researcher, Jacob Bell at 701-777-2873, or Pamela Kalbfleish, the researcher's advisor, at 701-777-6369. If you have questions regarding your rights as a research subject, or if you have any concerns or complaints about the research, you may contact the University of North Dakota Institutional Review Board at (701) 777-4279. Please call this number if you cannot reach research staff, or you wish to talk with someone else.

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Subjects Name:

Signature of Subject **Date**

Please initial & date that you have read this page. Subject Initials:
Date:

page 2 of 2

Approval Date: OCT 2 2013
Expiration Date: OCT 2 2014
University of North Dakota IRB

Revised 05/01/09

Appendix B

WORD LIST TABLE

correct answer 1	correct answer 2	Randomized word presented
pouts	spout	supot
gape	page	aepg
idles	slide	lsdei
carp	parc	aprc
nuts	stun	nstu
form	from	mfro
alvin	anvil	nlaiv
lin	nil	inl
ivan	vain	navi
hacks	shack	kshca
flog	golf	ogfl
mien	mine	einm
alva	lava	vala
pills	spill	sllpi
darn	rand	dnra
frey	frye	fery
roost	roots	oosrt
exist	exits	teisx
sweep	weeps	pwsee
brien	brine	nberi
strut	trust	ttusr
coops	scoop	opocs
horus	hours	hruso

eric	rice	eicr
minks	minsk	nimsk
ample	maple	ealpm
tower	wrote	roewt
gris	rigs	rgsi
moist	omits	otmsi
lore	role	lroe
snaps	spans	nasps
ovid	void	oidv
gapes	pages	peasg
cyril	lyric	irycl
clays	scaly	yalsc
clod	cold	locd
lyre	rely	leyr
frees	reefs	sfeer
eire	erie	eeir
over	rove	orev
epics	spice	spiec
doria	radio	adoir
chain	china	hainc
lump	plum	umlp
warps	wraps	wrspa
dolly	lloyd	oydll
dooms	moods	mdoos
armed	dream	amerd
canoe	ocean	aneco
bakes	beaks	kbsae
oats	taos	oast
eden	need	deen

arson	sonar	nsaro
blake	bleak	bekal
stalk	talks	lskta
aches	chase	cshea
sales	seals	lsaes
corps	crops	srpoc
peels	sleep	eselp
riot	trio	tori
aloft	float	olaft
atom	moat	taom
opus	soup	puso
chou	ouch	ouhc
avid	vida	davi
blow	bowl	bolw
chars	crash	crhas
ail	ali	lia
adorn	radon	rdona
best	bets	sebt
amy	may	mya
buds	dubs	bdsu
dogs	gods	odgs
swipe	wipes	epsiw
dine	enid	nide
pawns	spawn	pnasw
carla	clara	ralca
flair	frail	rfila
del	led	eld
quiet	quite	tiuqe
lyman	manly	manyl

decal	laced	adlec
state	taste	tstae
gusty	gutsy	sytug
moors	rooms	omsor
lungs	slung	lngus
knead	naked	dknea
issue	susie	usesi
holst	sloth	sothl
pore	rope	eorp
night	thing	ntihg
brags	grabs	agrsb
par	rap	arp
amino	naomi	monai
dons	nods	nsod
mires	miser	esrmi
sure	user	uesr
mares	smear	srmea
aid	ida	adi
hans	nash	nsha
anise	siena	isean
corns	scorn	ncsro
cabs	scab	sabc
cobol	cobol	obclo
cone	once	cnoe
moore	romeo	mreoo
adds	dads	dsad
neon	none	eonn
how	who	owh
emory	moyer	yoerm

pends	spend	psnde
gem	meg	gme
depot	opted	topde
dares	reads	redsa
aids	said	isad
pests	steps	ssetp
liman	milan	malin
hooks	shook	oksho
lyle	yell	elly
mater	tamer	rmeta
alarm	lamar	armal
furs	surf	sufr
dingo	doing	idgno
piers	spire	esipr
evans	vanes	naevs
rout	tour	urto
sinks	skins	kssin
joes	jose	soej
balms	lambs	sblam
whit	with	twhi
rare	rear	rrea
dawn	wand	anwd
crud	curd	urdc
surge	urges	srueg
wires	wiser	ewsir
overt	voter	torev
outer	route	rouet
awed	wade	aewd
alsop	opals	aslop

daley	delay	lyead
diana	nadia	niaad
cope	opec	peoc
payer	repay	yaper
crews	screw	erswc
0	fleas	EFALS
elroy	leroy	leory
bonus	bosun	bouns
dusty	study	tyusd
gels	legs	eslg
cows	scow	wcos
clot	colt	tolc
grips	sprig	psigr
unix	unix	uxin
dune	nude	ednu
henri	rhine	inreh
unite	untie	einut
warp	wrap	arpw
inert	inter	rtein
body	boyd	bydo
braun	urban	rnbua
piss	sips	sisp
dusts	studs	tsdsu
andre	arden	rneda
sails	silas	lssia
algol	algol	ollga
draws	wards	sdrwa
swell	wells	wslel
run	urn	nru

cans	scan	asnc
fired	fried	redfi
rate	tear	arte
brief	fiber	irfbe
casks	sacks	cassk
ever	veer	eerv
argus	sugar	gasru
argot	gator	argto
orb	rob	bro
boost	boots	obost
rowe	wore	rwoe
atoms	moats	aotms
peru	pure	urpe
kiel	like	leki
balsa	basal	slaba
parks	spark	pkars
rears	serra	srare
bin	ibn	bni
code	coed	deoc
runt	turn	tnur
aims	siam	smia
betsy	bytes	ebtsy
cask	sack	kasc
ports	sport	ptosr
for	fro	rfo
hems	mesh	mshe
cigar	craig	raigc
stony	tyson	syton
hurt	ruth	trhu

hom	ohm	hmo
limbo	mobil	oilmb
nobel	noble	eonlb
tory	troy	oyrt
shout	south	otuhs
toys	yost	styo
curbs	scrub	urbcs
grist	grits	sgitr
corks	rocks	osrck
fast	fats	astf
keep	peek	pkee
horns	shorn	noshr
ours	sour	orus
goals	lagos	sloga
door	odor	rdoo
alden	laden	nldea
crams	scram	sacmr
nap	pan	npa
trout	tutor	trotu
swing	wings	nwigs
hoard	rhoda	rdaoh
bush	hubs	hsbu
lake	leak	aelk
gnu	gun	nug
stag	tags	tsga
epsom	poems	smeop
flue	fuel	eulf
otto	toto	otot
glove	vogel	veogl

lids	slid	dsil
newer	renew	erenw
civet	evict	tievc
tow	two	otw
ape	pea	pae
swore	worse	esowr
mist	tims	stmi
vein	vine	envi
bluer	ruble	lrbeu
stove	votes	vesot
exalt	latex	lxtea
tilde	tiled	tdlei
dust	stud	utds
aces	case	ecsa
keel	leek	ekle
babul	bulba	blaub
lenin	linen	inlne
noted	toned	dtnoe
pinto	point	ntipo
gates	stage	eagst
nip	pin	pni
draw	ward	awrd
kits	skit	stki
its	sit	sti
angry	rangy	nryag
cable	caleb	ecbla
blows	bowls	lbows
irma	mira	rmia
gulps	plugs	supgl

drain	nadir	adnir
cohen	enoch	heocn
keeps	peeks	ekeps
dopes	posed	osdpe
roth	thor	tohr
anger	range	eragn
gain	gina	anig
essex	sexes	sxsee
burne	ruben	runeb
tex	tex	etx
map	pam	amp
airs	sari	rsia
hardy	hydra	arydh
melts	smelt	tlsem
los	sol	lso
bat	tab	tba
argue	auger	raegu
cafe	face	efac
moor	room	omro
clean	lance	ecnal
strew	wrest	rewts
abode	adobe	bdaoe
gazer	graze	zgrea
eel	lee	ele
piles	plies	ipsel
costs	scots	ctsso
adler	alder	arled
cheap	peach	apceh
fate	feat	aetf

tunis	units	utisn
based	beads	debas
doom	mood	oomd
abby	baby	byba
canny	nancy	naync
reub	rube	erub
bugle	bulge	glebu
saw	was	asw
acne	cane	cena
arc	car	acr
setup	upset	teups
alloy	loyal	yallo
delia	ideal	leadi
drape	raped	darep
hides	shied	hsied
palsy	plays	yalps
emery	meyer	merye
cider	cried	idrce
rests	tress	retss
pepsi	pipes	ispep
erne	rene	enre
agree	eager	eerga
sleet	steel	ltsee
loser	roles	selor
irks	risk	srki
creep	crepe	preec
adept	taped	dtepa
dies	side	ieds
shawl	walsh	hslwa

situ	suit	iust
grin	ring	nirg
sheet	these	htees
prey	pyre	pery
kyoto	tokyo	ktoyo
straw	warts	rswat
elmer	merle	lreme
wrist	writs	itwrs
keels	sleek	leesk
cause	sauce	asceu
feels	flees	sfele
leer	reel	eerl
hums	mush	hmus
felt	left	tfle
peers	spree	eerps
low	owl	wol
stow	twos	swot
oslo	solo	osol
spilt	split	tlspi
lyon	only	oyln
erwin	winer	neirw
imps	mips	spmi
hunts	shunt	nsuth
suez	zeus	uezs
bake	beak	ekba
coder	cored	decor
crass	scars	ascrs
pier	ripe	riep
arm	ram	mra

lap	pal	pla
herds	shred	edhrs
hips	ship	phsi
swat	twas	tswa
crete	erect	ectre
dealt	delta	ladet
knits	stink	ksitn
lest	lets	lste
nodes	nosed	esnod
raven	verna	anrve
cups	cusp	ucps
pelts	slept	lteps
vast	vats	vtas
mated	tamed	atedm
deaf	fade	aefd
astor	roast	aosrt
bagel	gable	aeblg
gas	sag	sga
angst	gnats	tnags
grape	pager	raepg
also	laos	osal
edges	sedge	gdese
coin	icon	ncio
oust	outs	utso
aye	yea	eya
gnat	tang	ntag
poses	posse	soeps
ash	has	ahs
loves	solve	vseol

host	shot	tohs
essen	sense	senes
morn	norm	mron
busy	buys	yusb
loire	oiler	orlie
priam	prima	imrpa
sues	uses	uess
alice	celia	iecal
askew	wakes	skaew
balm	lamb	malb
sweat	waste	atews
kurt	truk	ktur
ore	roe	oer
crays	scary	arscy
hosts	shots	tohss
stilt	tilts	ttisl
late	tale	leta
gulp	plug	upgl
strip	trips	rispt
gary	gray	rayg
swaps	wasps	pwssa
hells	shell	llhes
alec	lace	aecl
licks	slick	clksi
minos	simon	nmsio
cain	inca	cian
thaw	what	awht
flit	lift	tilf
karl	lark	aklr

alms	slam	lams
louse	seoul	oleus
must	smut	ustm
gaped	paged	dpage
pains	spain	sanpi
chin	inch	hicn
gird	grid	grdi
arid	raid	rdai
free	reef	eerf
haves	shave	ehsav
sizes	zeiss	zsise
lamed	medal	ldmae
opal	palo	alop
ink	kin	kni
gut	tug	ugt
bar	bra	rab
cod	doc	odc
goal	olga	lago
charm	march	rahmc
abo	boa	aob
raw	war	wra
pecks	speck	pckes
barn	bran	abrn
bart	brat	arbt
haply	phyla	yphal
act	cat	cta
harms	marsh	hrmas
aide	idea	aedi
brush	shrub	bshru

santa	satan	atasn
lures	rules	uerls
puns	spun	sunp
canis	incas	sicna
aft	fat	fta
loot	tool	olto
lays	slay	ysla
awl	law	alw
lever	revel	vrele
bored	robed	erobd
lure	rule	uelr
gayer	geary	aeygr
death	hated	thade
pikes	spike	eiksp
rises	sires	issre
signs	sings	isgsn
russo	sours	srosu
files	flies	siefl
sale	seal	esla
haley	healy	yaehl
nero	reno	eorn
and	dan	adn
snake	sneak	ekasn
halls	shall	hlsal
genre	green	eerng
save	vase	vaes
taint	titan	natit
hunk	kuhn	hkun
marts	smart	tsmra

bane	bean	enba
iron	orin	rnoi
saves	vases	vsaes
mawr	warm	rwam
maori	mario	orami
lamp	palm	plma
barer	berra	rbrae
laces	scale	aelcs
awls	laws	wsal
still	tills	lstil
jest	jets	setj
dave	veda	dvea
vigor	virgo	givor
arch	char	hacr
deny	dyne	eynd
lions	loins	sionl
buns	snub	sbun
sir	sri	isr
mason	moans	manos
lura	raul	uarl
dikes	skied	dsiek
hikes	sheik	khies
snoop	spoon	opnos
meson	omens	enosm
been	eben	ebne
lisps	slips	lipss
amid	maid	diam
hines	shine	neihs
engel	engle	geenl

cowls	scowl	wlcos
boast	boats	oastb
valid	vidal	iadlv
acrid	dirac	dairc
lewd	weld	ldew
bus	sub	usb
swink	winks	skniw
enemy	yemen	nmeey
runs	urns	unrs
akron	koran	akorn
oaks	soak	aoks
ann	nan	nna
tired	tried	tedri
clare	clear	caerl
devil	lived	dvile
freer	refer	rreef
easel	lease	asele
kiss	skis	isks
defer	freed	reefd
olson	solon	onlos
cruel	ulcer	crule
cam	mac	cma
budge	debug	dgeub
cape	pace	cepa
artie	irate	ritea
elm	mel	lme
rater	terra	earrt
evens	seven	eevsn
jaunt	junta	ntauj

halts	stahl	salth
air	ira	rai
huns	shun	suhn
domes	modes	sodme
dade	dead	ddea
clay	lacy	layc
miss	sims	sism
dyed	eddy	yedd
lobe	loeb	lboe
roses	sores	soers
gnaw	wang	wgna
gosh	hogs	osgh
mast	mats	mtas
neva	vane	aenv
brunt	burnt	nbrut
poles	slope	eopls
attic	tacit	atitc
paler	pearl	earpl
kills	skill	sikll
hoses	shoes	ohses
board	broad	rodab
hills	shill	hilsl
nasa	sana	saan
add	dad	dda
fief	fife	effi
prate	taper	atepr
veto	vote	tevo
dolan	nodal	aldno
chit	itch	ihtc

bella	label	alebl
piled	plied	dliep
bleat	table	taelb
niger	reign	ngeri
carty	tracy	rytac
horse	shore	orhes
abuse	beaus	uabse
gnash	hangs	nasgh
scrap	sparc	csapr
boner	borne	obren
fare	fear	faer
dairy	diary	ydair
bars	bras	bsar
feuds	fused	deufs
caper	pacer	rceap
itel	tile	leti
rots	sort	tsor
ekes	seek	eesk
owe	woe	weo
heron	honer	ernoh
cores	score	oescr
pit	tip	ipt
cents	scent	stnce
torus	tours	ustor
porto	troop	rootp
rust	ruts	ustr
feel	flee	eelf
roves	servo	evsor
illy	lily	liyl

hinge	neigh	nighe
annie	inane	aenin
flea	leaf	efla
note	tone	ento
ansi	sian	iasn
deer	reed	rede
eldon	olden	olned
daly	lady	ylad
hint	thin	nhti
ills	sill	lisl
doe	ode	oed
storm	strom	ormts
bag	gab	abg
alum	maul	umal
eli	lie	lei
ewe	wee	eew
beets	beset	sbete
cager	grace	ergac
sets	tess	sset
ernie	irene	ineer
brute	tuber	utber
ergo	gore	groe
ethel	lethe	ehetl
lakes	leaks	kesla
goto	togo	goot
lome	mole	elmo
equip	pique	uipqe
fiend	fined	fiedn
kant	tank	nkat

claus	lucas	sualc
amend	named	emdna
hurst	hurts	ustrh
idle	lied	iedl
mare	ream	rema
hip	phi	ihp
pokes	spoke	eposk
grown	wrong	onrwg
sue	use	eus
awry	wary	aryw
cheat	teach	aceht
aspen	panes	nasep
blots	bolts	obslt
remus	serum	rsume
tenex	tenex	xeetn
drier	rider	ridre
drag	grad	adgr
vail	vial	iavl
calms	clams	lcsam
wier	wire	iewr
girth	right	ritgh
pass	saps	spsa
cram	marc	mrac
loner	loren	olrne
dent	tend	tnde
gave	vega	aveg
sway	ways	ywsa
haney	hyena	anyhe
bail	bali	ibla

suing	using	gisun
waist	waits	astwi
net	ten	nte
busts	stubs	utbss
broth	throb	tbhro
buss	subs	sbus
jane	jean	jnae
dingy	dying	giynd
purse	super	upser
heres	sheer	erhse
kate	take	eakt
taxes	texas	asetx
lingo	login	ilgno
amain	mania	inmaa
faker	freak	rkefa
labs	slab	lasb
optic	topic	potci
crude	cured	edcur
not	ton	ont
dora	road	adro
dim	mid	imd
stint	tints	ntsit
gown	wong	ngwo
ads	sad	das
hug	ugh	uhg
booms	bosom	oosmb
ages	sage	gaes
bayed	beady	yebda
swarm	warms	wmsar

acton	canto	anoct
peaks	speak	epkas
ought	tough	ohutg
daily	lydia	yldai
don	nod	ond
flows	fowls	swlfo
cairn	rican	anrci
girt	grit	itgr
ants	stan	snta
dog	god	dgo
dive	vied	ediv
finer	infer	rifne
site	ties	tise
fader	fared	dfrae
mocks	smock	ocmsk
allot	atoll	latol
sane	sean	ensa
paso	soap	apos
bud	dub	bdu
forts	frost	ftosr
jeers	jeres	eerjs
falk	flak	klaf
ware	wear	rewa
sawed	wades	edwsa
endow	owned	wdeno
olav	oval	avlo
mets	stem	mset
bury	ruby	ubry
maids	midas	isamd

north	thorn	trnho
emacs	maces	ecams
lured	ruled	derlu
grins	rings	ngrsi
forth	froth	torhf
gases	sages	gaess
erich	reich	cehri
lacks	slack	sckal
keen	knee	eekn
anti	tina	inat
hale	heal	ehla
cures	curse	ucrse
nor	ron	onr
drake	raked	dkrea
lose	sole	leso
shams	smash	hmsas
idols	solid	idsol
stuck	tucks	cskut
lisa	sail	slia
deeps	speed	epdse
boss	sobs	osbs
file	life	efli
ban	nab	anb
bier	brie	rieb
doors	odors	sdoro
sault	tulsa	sltau
gel	leg	egl
molar	moral	rolma
ache	each	hcae

horde	rhode	roedh
dents	tends	ntdes
heir	hire	rieh
moen	omen	onem
blur	burl	lurb
abbe	babe	ebab
cited	edict	ectid
egos	goes	soeg
dirge	ridge	igdre
ago	goa	oag
abort	bator	raobt
gaps	gasp	spga
karp	park	rpka
gum	mug	mgu
amass	assam	ssmaa
flesh	shelf	hesfl
calm	clam	lcma
caner	crane	rnaec
hairs	shari	sraih
axons	saxon	axsno
throw	worth	wrhto
cloud	could	ucldo
any	nay	yan
newt	went	tenw
into	toni	tion
della	ladle	leadl
drop	prod	orpd
but	tub	ubt
pyle	yelp	peyl

trail	trial	itral
views	wives	vwesi
dam	mad	adm
opel	pole	eopl
dice	iced	icde
cafes	faces	eafcs
liens	lines	lisne
ramo	roam	oamr
chum	much	humc
veins	vines	nsvei
sword	words	drswo
rogue	rouge	oguer
lain	nail	inal
loses	soles	ssleo
alone	leona	lanoe
dozen	zoned	edozn
mire	rime	riem
wake	weak	ekaw
carve	crave	vcaer
inlet	intel	elint
braze	zebra	brzae
porte	toper	orept
corey	royce	yocer
town	wont	onwt
handy	haydn	dhnay
wiley	wylie	lywie
hewer	where	weehr
lanes	leans	alsne
ezra	raze	reaz

hones	shone	noshe
more	rome	meor
stick	ticks	ktsci
cork	rock	rkco
bard	drab	brda
ranks	snark	sankr
blot	bolt	blto
done	node	oend
keys	skye	kyse

Appendix C
Computer Interface / Media Questionnaire 1

Temple Presence Inventory, slightly modified from Lombard, M., Ditton, T. B., & Weinstein, L. (2007). Measuring presence: The temple presence inventory (TPI). Retrieved from http://astro.temple.edu/~lombard/research/p2_ab.html.

Thank you very much for agreeing to complete this questionnaire.

The questions on these pages ask about the computer interface/media experience you just had.

There are no right or wrong answers; please simply give your first impressions and answer all of the questions as accurately as possible, even questions that may seem unusual or to not apply to the particular media experience you just had. For example, in answering a question about how much it feels like you are "inside the environment you see/hear," base your answer on your feeling rather than your knowledge that
you are not actually inside that environment.

Throughout the questions, the phrases "the environment you see/hear" and "objects, events, or people you see/hear" refer to the things or people that are presented in the media experience, not your immediate physical surroundings (i.e., the actual room you are in during the media experience).

Please circle the responses that best represent your answers. All of your responses will be kept strictly confidential.

To what extent do you feel mentally immersed in the experience?
Not at all 1 2 3 4 5 6 7 Very much

How involving is the media experience?
Not at all 1 2 3 4 5 6 7 Very much

How completely are your senses engaged?
Not at all 1 2 3 4 5 6 7 Very much

To what extent do you experience a sensation of reality?
Not at all 1 2 3 4 5 6 7 Very much

How relaxing or exciting is the experience?
Very relaxing 1 2 3 4 5 6 7 Very exciting

How engaging is the interaction?
Not at all 1 2 3 4 5 6 7 Very much

For each of the pairs of words below, please circle the number that best describes your evaluation of the computer experience

Impersonal	1 2 3 4 5 6 7	Personal
Unsociable	1 2 3 4 5 6 7	Sociable
Insensitive	1 2 3 4 5 6 7	Sensitive
Dead	1 2 3 4 5 6 7	Lively
Unresponsive	1 2 3 4 5 6 7	Responsive
Unemotional	1 2 3 4 5 6 7	Emotional
Remote	1 2 3 4 5 6 7	Immediate

Appendix D

Computer Interface / Media Questionnaire 2

Perceived Restoration Scale, slightly modified from Appendix 1, p. 18, Hartig, T., Kaiser, F. G., & Bowler, P. A. (1997). Further development of a measure of perceived environmental restorativeness. *Uppsala University, Uppsala,Working Paper*.

1. Being here is an escape experience.

Not at all 1 2 3 4 5 6 7 Completely

2. Spending time here gives me a break from my day-to-day routine.

Not at all 1 2 3 4 5 6 7 Completely

3. It is a place to get away from it all.

Not at all 1 2 3 4 5 6 7 Completely

4. Being here helps me to relax my focus on getting things done.

Not at all 1 2 3 4 5 6 7 Completely

5. Coming here helps me to get relief from unwanted demands on my attention.

Not at all 1 2 3 4 5 6 7 Completely

6. This place has fascinating qualities.

Not at all 1 2 3 4 5 6 7 Completely

7. My attention is drawn to many interesting things,

Not at all 1 2 3 4 5 6 7 Completely

8. I want to get to know this place better.

Not at all 1 2 3 4 5 6 7 Completely

9. There is much to explore and discover here.

Not at all 1 2 3 4 5 6 7 Completely

10. I want to spend more time looking at the surroundings.

Not at all 1 2 3 4 5 6 7 Completely

11. This place is boring.

Not at all 1 2 3 4 5 6 7 Completely

12. The setting is fascinating.

Not at all 1 2 3 4 5 6 7 Completely

13. There is nothing worth looking at here.

Not at all 1 2 3 4 5 6 7 Completely

14. There is too much going on.

Not at all 0 1 2 3 4 5 6 Completely

15. It is a confusing place.

Not at all 1 2 3 4 5 6 7 Completely

16. There is a great deal of distraction.

Not at all 1 2 3 4 5 6 7 Completely

17. It is chaotic here.

Not at all 1 2 3 4 5 6 7 Completely

18. Being here suits my personality.

Not at all 1 2 3 4 5 6 7 Completely

19. I can do things I like here.

Not at all 1 2 3 4 5 6 7 Completely

20. I have a sense that I belong here.

Not at all 1 2 3 4 5 6 7 Completely

21. I can find ways to enjoy myself here.

Not at all 1 2 3 4 5 6 7 Completely

22. I have a sense of oneness with this setting.

Not at all 1 2 3 4 5 6 7 Completely

23.There are landmarks to help me get around.

Not at all	1	2	3	4	5	6	7	Completely

24. I could easily form a mental map of this place

Not at all	1	2	3	4	5	6	7	Completely

25. It would be easy to find my way around here.

Not at all	1	2	3	4	5	6	7	Completely

26. It is easy to see how things are organized.

Not at all	1	2	3	4	5	6	7	Completely

You're almost done! These last questions are about you. Again, all of your responses will be kept strictly confidential, so please answer as accurately and honestly as possible.

How old are you (in years)? _____

Please indicate your gender: _____ Male _____ Female

What is your race?

_____ Asian
_____ African American
_____ Hispanic
_____ Native American
_____ Pacific Islander
_____ White
_____ Other: _____

Thank you very much for completing this questionnaire. We Truly value and appreciate your time and effort!

Please return this questionnaire to the study coordinator.

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