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Well-being Technologies: Meditation Using Virtual Worlds

Laura Downey
Nova Southeastern University, ld699@nova.edu

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by

Laura L. Downey

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We hereby certify that this dissertation, submitted by Laura Downey, conforms to acceptable standards and is fully adequate in scope and quality to fulfill the dissertation requirements for the degree of Doctor of Philosophy.

Maxine S. Cohen, Ph.D.
Chairperson of Dissertation Committee

Date

Mary Ayala-Bush, Ph.D.
Dissertation Committee Member

Date

Steven R. Terrell, Ph.D.
Dissertation Committee Member

Date

Approved:

Amon B. Seagull, Ph.D.
Interim Dean, College of Engineering and Computing

Date

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Abstract

In a technologically overloaded world, is it possible to use technology to support well-being activities and enhance human flourishing? Proponents of positive technology and positive computing are striving to answer yes to that question. However, the impact of technology on well-being remains unresolved. Positive technology combines technology and positive psychology. Positive psychology focuses on well-being and the science of human flourishing. Positive computing includes an emphasis on designing with well-being in mind as a way to support human potential. User experience (UX) is critical to positive technology and positive computing. UX researchers and practitioners are advocating for experience-driven design and third wave human-computer interaction (HCI) that focuses on multi-dimensional, interpretive, situated, and phenomenological aspects. Third-wave HCI goes beyond cognition to include emotions, values, culture, and experience. This research investigated technology-supported meditation in a three-dimensional (3D) virtual world from a positive technology perspective to examine how technology can support engagement, self-empowerment, and well-being. Designing and evaluating technology for well-being support is complex and challenging. Further, although virtual worlds have been used in positive technology applications, little research exists that illuminates the experience of user engagement in virtual worlds. In this formative exploratory study, experienced meditators (N = 12) interacted with a virtual meditation world titled Sanctuarium that was developed for this research. Using a third wave HCI approach, both quantitative and qualitative data were collected to understand the nature of engagement with a virtual world and the experiential aspects of technology-supported meditation. Results supported using virtual worlds to produce restorative natural environments. Participants overwhelmingly reacted positively to the islandscape including both visual and sound elements. Findings indicated that Sanctuarium facilitated the meditation experience, similar to guided meditation – although participants remarked on the uniqueness of the experience. Aspects of facilitation centered on the concepts of non-distraction, focus, and simplicity of design and instructions. Participants also identified Sanctuarium as a good tool for helping those new to meditation. Meditators described positive effects of their meditation experience during interviews and also rated their experience as positive using the scale titled Effects of Meditation During Meditation. Phenomenological analysis provided a rich description of the nature of engagement while meditating with Sanctuarium. Meditators also rated engagement as high via an adapted User Engagement Scale. This interdisciplinary work drew from multiple fields and contributes to the HCI domain, virtual worlds' literature, information systems research, and the nascent areas of positive technology and positive computing.

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Chapter 1

Introduction

Background

Meditation is an ancient practice that has become a modern phenomenon (Plaza, Demarzo, Herrera-Mercadal, & García-Campayo, 2013; Suchday, Hagemann, Fruchter, & Frankel, 2014). Meditation may be concisely defined as a concentration-based individual activity involving self-regulation of attention and awareness associated with well-being and self-actualization (MacDonald, Walsh, & Shapiro, 2013). Recent studies indicate the number of Americans meditating is approximately ten million and growing (Suchday et al., 2014). Pickert (2014) reported on the increasing interest and practice of meditation. This included recent scientific support of the benefits of meditation; leadership programs that make use of meditation; meditation research in military resiliency, health, and education; and the combination of technology and meditation. The focus of this research study is about combining technology with the well-being activity of meditation.

For traditional Eastern practitioners, meditation is a lifestyle and a method for achieving and maintaining optimal well-being (Suchday et al., 2014). Embracing meditation as a viable wellness activity, Western neuroscientists, medical personnel, psychologists, practitioners, business leaders, researchers, and yoga teachers have touted the physical and psychological benefits of meditation (Baer, 2013; Carroll, 2013; Dolman

& Bond, 2011; Eberth & Sedlmeier, 2012; Ho, 2011; MacDonald et al., 2013; Mayo Clinic Staff, n.d.; Sedlmeier, Eberth, Schwarz, Zimmermann, Haarig, Jaeger, & Kunze, 2012; Seppala, 2013). Benefits include but are not limited to: increased well-being, stress reduction, anxiety reduction, pain management, increased focus, more effective leadership, and clarity of thinking (Baer, 2013; Carroll, 2013; Dolman & Bond, 2011; MacDonald et al., 2013; Mayo Clinic Staff, n.d.; Sedlmeier et al., 2012; Seppala, 2013; Suchday et al., 2014).

Suchday et al. (2014) advocated for understanding how ancient wellness approaches, including meditation, can be better incorporated into the contemporary world to address physical and psychological well-being. Technology is a significant part of the modern world and people have started using technology to support meditation (Buie & Blythe, 2013a; Buie & Blythe, 2013b; Pickert, 2014). Shaw, Gromala, and Song (2010) noted the potential for technology to support and enhance meditation.

Despite assumptions on the positive impact of technology, increased well-being has not occurred (Calvo & Peters, 2013, 2014). However, a growing recognition and desire exists among individuals, technologists, and researchers to leverage technology in new ways to achieve increased well-being (Calvo & Peters, 2014). Sander (2011) reasoned that technology was uniquely situated to increase well-being and promote flourishing in effective, scalable, and ethical ways. Vidyarthi and Riecke (2014) advanced technology as an enabler of well-being. Researchers and industry have begun to investigate how technology can be combined with meditation and other well-being activities to benefit humans (Botella, Riva, Gaggioli, Wiederhold, Alcaniz, & Baños, 2012; Coyle, Thieme, Linehan, Balaam, Wallace, & Lindley, 2014; Gromala, Song, Yim,

Fox, Barnes, Nazemi, & Squire, 2011; Vidyarthi & Riecke, 2013, 2014; Wiederhold, 2012; Wild Divine, 2014). The theory of positive technology formalizes the scientific approach for technology supporting well-being activities such as meditation as a mechanism to nurture human flourishing (Riva, Baños, Botella, Wiederhold, & Gaggioli, 2012).

Positive technology, and the related concept of positive computing, are new research areas that combine positive psychology and technology (Botella et al., 2012; Calvo & Peters, 2014; Riva et al., 2012). Positive psychology focuses on well-being and happiness and the science of human flourishing (Seligman & Csikszentmihalyi, 2000; Wiederhold & Wiederhold, 2013). More specifically, positive psychology concentrates on positive emotions, attitudes, and behaviors that lead to well-being and happiness and allow individuals to flourish (Seligman & Csikszentmihalyi, 2000). Wiederhold and Wiederhold of the cyberpsychology domain defined positive technology as "the scientific approach to using technology to enhance human functioning" (p. 1). From an HCI perspective, Calvo and Peters (2014) defined positive computing as the "design and development of technology to support psychological well-being and human potential" (p. 2). Calvo and Peters (2012) asserted that positive computing goes beyond user experience (UX) to include an emphasis on designing with wisdom and well-being in mind.

The potential for positive technology and its effect on well-being has been recognized (Botella et al., 2012; Calvo & Peters, 2013, 2014; Coyle et al., 2014); Riva et al., 2012; Wiederhold, 2012). However, the impact of technology on well-being remains unresolved (Riva et al., 2012). Limited evidence exists on the effectiveness of self-

managing well-being with technology (Gaggioli & Riva, 2013). Further, designing and evaluating technology to promote well-being is complex and challenging (Botella et al., 2012; Calvo & Peters, 2014; Coyle et al., 2014).

The combination of technology and meditation, or technology-supported meditation, is the central topic of this research. A blend of factors bounded the problem space for this study. These included: the resurgence of the ancient practice of meditation to address well-being; the call for understanding how to support well-being in contemporary society; the combining of technology and meditation by practitioners and researchers; the rise of new research areas of positive technology and positive computing; the unresolved impact of positive technology; the open question of the effectiveness of self-managing well-being with technology; and the difficulty in designing and evaluating positive technology. In response to these factors, the general research area for this study was the foundations and applications of positive technology and the degree to which they contributed to well-being. The well-being activity was meditation. Because the study examined the experience of technology-supported meditation, it required an experiential approach. Third wave HCI provided that approach with its advance beyond cognition to include emotions, values, culture, and experience (Bødker, 2006). Given that research on combining technology and well-being is at an early stage and little is known about technology-supported meditation, exploratory research was selected.

This formative exploratory study addressed the advanced HCI aspects of user engagement and the experiential perspective of technology-supported meditation, a well-being activity. A positive technology application was designed and evaluated from a third wave HCI perspective. The study investigated a technology-supported meditation

experience in a three dimensional (3D) virtual world through a positive technology lens to examine how technology can support user engagement, self-empowerment, and individual well-being. Researchers have identified virtual worlds as appropriate for use in positive technology applications (Botella et al., 2012; Riva et al., 2012). However, little research exists that illuminates the experience of user engagement in virtual worlds (Jensen, 2012). This further delineated the problem space.

The 3D virtual world titled Sanctuarium provided a tropical island setting where a participant virtually walked a labyrinth (walking meditation) and also performed seated meditation in the center of the labyrinth. The islandscape was based on the restorative effect of nature settings including water (Knight et al., 2012; Valtchanov, 2013). A labyrinth is a timeless meditation mechanism that is an ancient symbol of spirituality, a sacred space, and interactive artistic expression (Compton, 2007). People walk labyrinths as a form of meditation, reflection, problem-solving, to access inner wisdom, and tacit knowledge (Bloos, 2005; Compton, 2007; Curry, 2000; Johnston, 2000; Lonegren, 2007; Shapiro, 2014). See Appendix A for further description of the design of Sanctuarium.

The evaluation utilized a formative approach (early assessment) appropriate to exploratory research and common in HCI (Barnum, 2011; Tullis & Albert, 2013). The evaluation included investigating user engagement, gathering descriptions of the technology-supported meditation experience, and collecting information on the effects of the meditation experience. A better understanding of user engagement in virtual worlds was gained as well as a richer picture of the technology-supported meditation experience. Results of the research also provided foundational input for moving towards an evaluation framework for positive technologies. Botella et al. (2012) advocated that

while HCI researchers focus on high quality user experiences, designing technologies that foster positive emotions and contribute to people's happiness is complex and not easily determined. Coyle et al. (2014) noted that HCI researchers have just begun exploring the challenges and complexities of designing and deploying well-being technologies. One step towards addressing these issues is the development of an evaluation approach for positive technologies that takes into account next-generation HCI like engagement, in combination with a deeper understanding of how the well-being activity is supported via technology.

Problem Description

Concise Problem Statement

Designing and evaluating technology for well-being support is complex and challenging (Botella et al., 2012, Calvo & Peters, 2014; Coyle et al., 2014). Further, although virtual worlds have been used in positive technology applications (Botella et al., 2012; Riva, Mantovani, Capideville, Preziosa, Morganti, Villanni, Gaggioli, Botella, & Alcañiz, 2007; Riva et al., 2012, Wiederhold & Wiederhold, 2013), measuring and understanding the experience of engagement remains an open question (Jensen, 2012; O'Brien & Toms, 2010a; Wasko, Teigland, Leidner, & Jarvenpaa; 2011).

Literature Evidence of Problem

While virtual worlds have been identified as highly applicable for use in positive technology applications (Botella et al., 2012; Riva et al., 2007; Riva et al., 2012, Wiederhold & Wiederhold, 2013), little research exists that illuminates the experience of engagement in virtual worlds (Jensen, 2012). According to Wasko et al. (2011) how the different aspects of virtual worlds work together to create highly engaging experiences is

not well understood. Wasko et al. further noted the lack of existing research that explains the meaning of "deeply engaged" in 3D virtual worlds. On a related note, Haringer and Beckhaus (2012) offered that scant research has been conducted on virtual environments as an affective medium. Understanding the critical element of user engagement (O'Brien & Toms, 2008; O'Brien & Toms, 2010a; Sander, 2011) and what drives positive emotional experiences during technology use, and subsequently how best to design and evaluate technologies for well-being, remains challenging (Botella et al., 2012; Calvo & Peters, 2014; Coyle et al., 2014). Cultural, social, ethical, and psychological factors combine to create research challenges for investigating the intersection of technology and well-being (Calvo & Peters, 2014).

Impact of the Problem

User engagement is a critical element in successful interactive systems and positive computing (O'Brien & Toms, 2008; O'Brien & Toms, 2010a; Sander, 2011). Without a thorough understanding of engagement and users' experiences with positive technology, design and evaluation of positive technologies will continue to be difficult (Botella et al., 2012; Kanis & Brinkman, 2008). The benefits of positive technology may not be fully obtained. Individuals and organizations may not know how best to make use of 3D virtual worlds and other technologies to support well-being activities. HCI innovations that offer optimized experiences may remain unrealized (Zhang Scialdone, & Carey, 2009). A deeper understanding of user engagement and thus UX, will advance HCI and UX and allow designers to offer improved and enhanced digital artifacts (Raptis, Kjeldskov, & Skov, 2013). A focus on experience-driven design of technology will result in more meaningful experiences (Hassenzahl, 2013). Meaningful experiences are

linked with well-being (Hassenzahl, 2013). The experiential computing approach is needed to advance beyond the instrumental value of technology to how technology can add to the inherent value of human activities and experience (Yoo, 2010). Further, experiential computing may help drive information systems success individually, organizationally, and at the community, and society levels (Tate, Sedera, McLean, & Burton-Jones, 2014). Research in positive technologies will further the understanding of the impact of such technologies and has the potential to improve the well-being of humans (Wiederhold, 2012). HCI research in well-being technologies will play a fundamental role in helping healthcare researchers and practitioners address and promote well-being in individuals and society as a whole (Coyle et al., 2014).

Positive Technology Theory

Riva et al. (2012) and Botella et al. (2012) proposed and described a positive technology framework that forms the theoretical grounding for the research. The theory of positive technology provides a basis for the combination of positive psychology and technology to enhance the quality of people's lives both individually and collectively (Botella et al., 2012; Riva et al., 2012). Riva et al. defined the positive technology framework and Botella et al. further described and delimited the boundaries of the positive technology domain. The positive technology framework provides the theoretical backdrop for studying engagement and experience with technology-supported meditation in virtual worlds. Figure 1 provides an adapted view of the framework derived from Riva et al. and Botella et al.

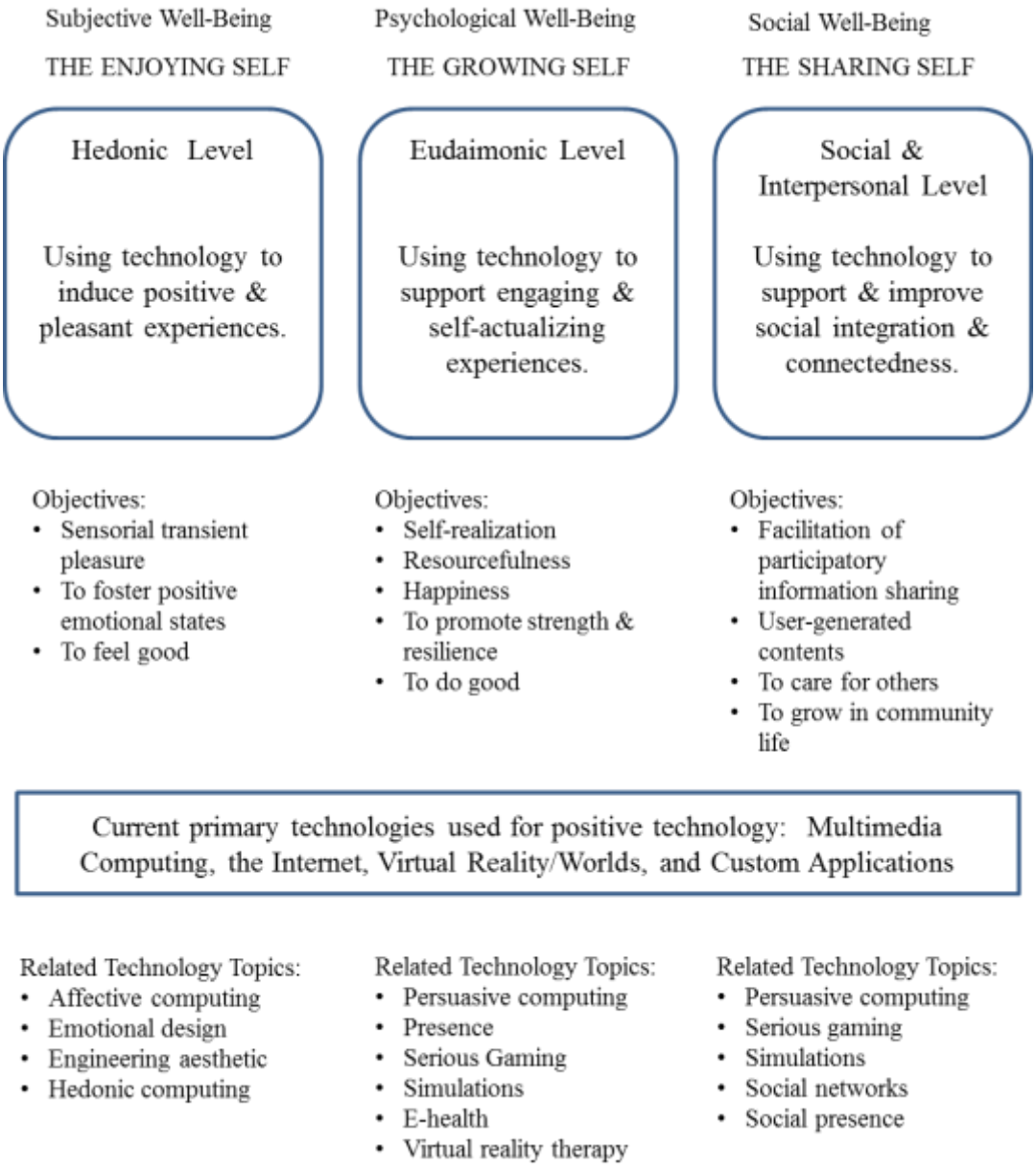

Figure 1. Positive Technology Framework: Levels, Objectives, and Technologies adapted from Riva et al., 2012; Botella et al., 2012)

Riva et al. (2012) developed the positive technology framework based on well-being theory from positive psychology. Positive psychology has evolved in the last decade from a previous focus on happiness to the broader concept of well-being (Foregaard, Jayawickreme, Kern, & Seligman, 2011). According to Foregaard et al.,

while multiple definitions exist for well-being, it is best understood as a multi-dimensional construct with contributions from positive emotions, engagement, relationships, meaning, and accomplishments. Well-being theory includes the concepts of subjective well-being or hedonic well-being, and psychological well-being or eudaimonic well-being (Riva et al., 2012). Subjective well-being refers to an individual's self-assessment of life satisfaction and positive and negative emotions (Riva et al., 2012). Psychological well-being associates happiness with a purposeful life. Social well-being extends psychological well-being to the group level and focuses on connections between individuals, groups, communities, and organizations (Riva et al., 2012).

Examining eudaimonic well-being reveals the connection to meditation. Eudaimonic well-being is based on theories of personal growth models (including the concept of self-actualization in Maslow's hierarchy of needs), life-span development perspectives, and positive mental health (Foregaard et al., 2011, p. 94; Riva et al., 2012). Maslow's (1943) hierarchy of needs is a foundational theory of human motivation that outlines five progressive levels of needs: physiological, safety, love/belonging, esteem, and self-actualization. Meditation is an activity connected to personal growth and self-actualization.

Putting the three well-being constructs together, Riva et al. (2012) proposed using technology to support and promote well-being by advancing the quality of personal experience via "structuring, augmentation, and/or replacement" (p. 69). The three specific areas of personal experience targeted by Riva et al. are: affective quality, engagement/actualization, and connectedness which map to the three well-being constructs of subjective (hedonic), psychological (eudaimonic), and social and

interpersonal well-being. Riva et al. stated the positive technology framework creates an area of study for the cyberpsychology and HCI domains.

The framework details a specific structure with levels, objectives, and technologies to guide and focus research in multiple areas. The hedonic level refers to the use of technology to promote and foster positive enjoyment and pleasure "The Enjoying Self" (Botella et al., 2012; Riva et al., 2012) Associated theory for the hedonic level is the "broaden and build" theory of positive emotions (Riva et al., 2012). The eudaimonic level denotes use of technology geared towards increasing resilience, engagement, and self-actualization, "The Growing Self" (Botella et al., 2012; Riva et al., 2012). Associated theory for the eudaimonic level includes flow theory and transformation of flow (Riva et al., 2012). The social and interpersonal level uses technologies to promote social integration, community growth, and connectedness, "The Shared Self" (Botella et al., 2012; Riva et al., 2012). Associated theory for the social and interpersonal level includes social capital theory and networked flow (Riva et al., 2012). Riva et al. also mapped technologies to each level: affective computing to the hedonic level; persuasive computing, serious gaming, simulation, e-health, and virtual environments to the eudaimonic level; and, persuasive computing, serious gaming, simulation, and social networks to the social and interpersonal level. Botella et al. generalized these technologies to multimedia computing, virtual environments, and the Internet.

Botella et al. (2012) further elaborated on the objectives per level, how to accomplish those objectives, and provided associated examples. Hedonic objectives include sensorial transient pleasure, to foster positive emotional states, and to feel good.

Objectives can be achieved by providing positive emotional and sensorial experiences. Objectives of the eudaimonic level include self-realization, resourcefulness, happiness, to promote strength and resilience, and to do good. Means for accomplishing the eudaimonic objectives consist of systematic positive mood induction training, well-being training, reminiscence training, life-theme training, and setting significant goals. Technology-supported meditation maps to the eudaimonic level in the positive technology framework as a well-being activity aimed at self-actualization. The objectives for the social and interpersonal level include facilitation of participatory information sharing, user generated content, to care for others, and to grow in community life. Ways of accomplishment involve creating shared positive emotional experiences, well-being training, developing and sharing strengths, and setting shared significant goals. Finally, Riva et al. (2012) proposed a set of critical variables for each level to guide design and evaluation of positive technologies. These included affect regulation variables for the hedonic level, flow and presence variables for the eudaimonic level, and social presence, collective intentions, and networked flow variables for the social and interpersonal level.

Dissertation Goal

The specific goal of the dissertation was to gain a richer understanding of user engagement and the human experience of technology-supported meditation in a 3D virtual world as an integral element of how best to leverage technology to promote and support well-being activities. Research results furthered understanding of 1) engagement in 3D virtual worlds, 2) technology-supported meditation, 3) evaluation of positive

technology, 4) third wave HCI, 5) meditation research, and 6) the impact of technology used for well-being activities.

Research Questions (RQ)

RQ1. Does the 3D virtual world Sanctuarium support the meditation experience (a well-being activity)?

RQ2. Does the 3D virtual world Sanctuarium enhance the meditation experience (a well-being activity)?

RQ3. What is the nature of user engagement during technology-supported meditation utilizing the 3D virtual world Sanctuarium?

For clarity, "support" refers to not interfering or negatively impacting the act of meditating. "Enhance" refers to adding something to the meditation experience, e.g., enabling a perceived quicker attainment of a meditative state, enabling a perceived deeper meditative state, aiding focus, or adding more enjoyment.

Relevance and Significance

In 2009, Seligman, the father of positive psychology, issued a grand challenge to the psychology field: to increase well-being so that by 2051, 51% of the planet's population would be flourishing (Sander, 2011). Sander identified the need to look at technology in a radically different way as a significant enabler for helping achieve Seligman's ambitious goal. Sander stated that technology was uniquely situated to increase well-being and promote flourishing in effective, scalable, and ethical ways. Even though Riva et al. (2012), creators of the positive technology framework, embraced the use of technology to promote positive functioning and increase well-being, they acknowledged that the impact of positive technology remains controversial. Botella et al.

(2012) noted that human progress has been facilitated by technology but not always in positive ways so they defined positive technology as technology that specifically promotes positive functioning. Even so, Botella et al. stated that designing technology to do so is complex and challenging.

Calvo and Peters (2012, 2013, 2014) discussed the standard assumptions that technology makes people's lives better – can increase wealth, health, and happiness. They conversely noted the lack of evidence to support the notion that technology is making humans happier and wiser as individuals or a society. They posed the question "if in the last 30 years computers have come to permeate most of our waking moments, why aren't we experiencing unprecedented levels of psychological wellbeing?" (Calvo & Peters, 2013, p. 19). Sander (2011) cited statistics that only two in ten in the Western world meet the definition of flourishing. Calvo and Peters (2012, 2014) maintained one of the reasons is because the concept of designing with well-being and wisdom in mind to support human flourishing is not presently included in standard technology development.

Positive technology and positive computing are nascent research areas. Work has begun but many open questions remain. In a world full of health problems and technology overload, how can technology support engagement, self-empowerment, and well-being? How can technology enhance people's lives? Advancing the understanding of positive technologies will help promote and support the well-being of humans (Wiederhold, 2012). Research is needed that encompasses the design, evaluation, effect, and impact of technology on well-being because it will benefit users' experience with technology and ultimately further human flourishing (Calvo & Peters, 2013, 2014; Coyle et al., 2014; Wiederhold, 2012).

UX arrived in the early 21st century but brought multiple challenges in defining, designing, and evaluating for engagement, pleasure, emotions, culture, and technology use in everyday life (Bødker, 2006; Downey & Rosales, 2012; MacDonald & Atwood, 2013; O'Brien & Toms, 2010a; Roto & Lund, 2013). UX researchers and practitioners are advocating for experience-driven design and third wave HCI that focuses on multi-dimensional, interpretive, situated, and phenomenological aspects (Harrison, Tatar, & Jengers, 2007; Hassenzahl, 2013). People are combining technology with meditation yet there is little UX research in the area termed techno-spirituality (Buie & Blythe, 2013b). HCI research in well-being technologies is in the early stages and has the potential for helping technology positively affect individual and societal well-being (Coyle et al., 2014).

Barriers and Issues

The major barriers and issues revolved around 1) measuring, describing, and understanding engagement in 3D virtual worlds, and 2) determining and evaluating technology support and enhancement of meditation as an example of a well-being activity. Understanding, describing, and measuring, engagement in virtual worlds is difficult. How to understand the experience of engagement in virtual worlds has not been determined (Jensen, 2012). Current research has revealed the need to understand how interacting in a virtual world creates a richer, more engaging user experience (Wasko et al., 2011). Similarly, does the level of realism in the virtual world affect engagement? How to define and achieve deeply engaging experiences in 3D virtual worlds remains an open question (Wasko et al., 2011). O'Brien and Toms (2008, 2010a) developed a validated engagement scale that has been applied in e-commerce, information retrieval,

Facebook, and video games (Banhawi, Ali, & Judi, 2012; O'Brien & Toms 2010a; O'Brien & Toms, 2010b; O'Brien & Toms, 2013; Wiebe, Lamb, Hardy, & Sharek, 2014) – but not specifically to technology-supported meditation. The UES was adapted to this research context. To address the lack of deep understanding of engagement in virtual worlds, phenomenological analysis was also performed.

Evaluation in UX is varied with multiple philosophical perspectives on qualitative versus quantitative methods as well as debate on which constructs to measure (Bargas-Avila & Hornbæk, 2011; Law, van Schaik, & Roto, 2014; MacDonald & Atwood, 2013). From a third wave HCI perspective, experiential ways of designing and evaluating technology are still being developed and discussed (MacDonald & Atwood, 2013; Roto & Lund, 2013). This created challenges in selecting and justifying evaluation of Sanctuarium. The researcher chose a complex evaluation method that combined quantitative and qualitative approaches. Third wave HCI requires multi-dimensional, interpretive, situated, and phenomenological aspects aimed at the total user experience. However, as Harrison et al. (2007) noted, evaluation in these situations will have trade-offs and can be messy.

Meditation support and enhancement is hard to quantify (Shaw et al., 2010) so qualitative assessment was used as a way of gaining a deeper understanding of meditation as a phenomenon, and the experience of how technology-supported meditation compared to meditation without using Sanctuarium. The evaluation approach included both quantitative and qualitative methods and involved multiple data collection points and different types of data. This created a complex assessment methodology which added challenge and time integrating results and drawing conclusions. The approach included

demographics, background information on participant meditation practice, a semi-structured interview on the phenomenon of meditation, the perceived engagement rating, a semi-structured interview investigating the experience of technology-supported meditation, and data on perceived effects of meditation. While complex, the overall approach was designed to provide a richer picture than could be gained by utilizing only one kind of data.

Using technology to promote positive emotions is a new pursuit and its impact is not yet known or fully understood (Riva et al., 2012). Technology-supported meditation is an example of positive technology. Designing and evaluating technology for well-being is complex and challenging (Botella et al., 2012, Calvo & Peters, 2014; Coyle et al., 2014). Relatively few studies exist designing and evaluating positive technology, positive computing, or well-being technology.

Assumptions, Limitations, and Delimitations

Assumptions, limitations, and delimitations of the proposed study involved four main themes: 1) generalizability, 2) the nature of engagement, 3) validity and reliability, and 4) the scope of the study. Because of the discovery nature of exploratory studies and the small number of participants, results were not generalizable. Additionally formative evaluation is not targeted for generalization. However, results of the formative evaluation provided valuable insight into the nature of user engagement in technology-supported meditation using a 3D virtual world and the overall experience of technology-supported meditation.

Engagement was assumed to be a measure of a positive nature and does not extend to addiction. O'Brien and Toms (2008) characterized a line between intense engagement

and addiction as a future area of research. In a review of engagement in digital entertainment games, Boyle, Connolly, Hainey, and Boyle (2012) also noted a fine line between enjoyment and addiction in games. Their analysis viewed engagement as a positive aspect while noting that some research exists, and further is needed, especially in the on-line gaming community, of negative aspects related to engagement. Wiebe, Lamb, Hardy, and Sharek (2014) adopted O'Brien and Tom's engagement perspective, essentially assuming engagement from the positive perspective. This study also assumed engagement as a positive aspect.

Wiebe et al. (2014) revised the User Engagement Scale UES (O'Brien & Toms, 2010a) to produce the UESz and validated it for use in measuring engagement in video games. Video games and virtual worlds are related with video games as part of the history of virtual worlds (Comas & Tschang, 2013). Reavley and Pallant (2009) developed the scale titled Experience of Meditation-During Meditation (EOM-DM) specifically to measure perceived effects of meditation. As best can be determined, this research was the first use of the EOM-DM as reported in the literature. For both instruments (UESz and EOM-DM), factor analysis in this specific context was not achievable because of the small number of participants. Both the UESz and the EOM-DM use Likert scales. Likert scales are not technically interval data but it is common to treat them as such in UX; assumptions include that there is a degree of intervalness between items in a Likert scale and that numbers between the items on a Likert scale have meaning (Tullis & Albert, 2013). Finally, as dissertations are individually done, intercoder agreement was not applicable. The researcher has many years practical experience in qualitative analysis but to increase validity, she followed Creswell's (2013)

guidance and the specific procedures of Moerer-Urdahl and Creswell (2004) in conducting the phenomenological portion of the research.

Positive technology is an emerging field dealing with positive emotions and well-being (Riva et al., 2012). Other related areas exist that deal with, and respond to emotion, or that can be utilized within the goal of positive technology, i.e., affective computing, persuasive computing, serious gaming, simulation, virtual environments, and electronic health applications (see related technology topics listed in Figure 1). The scope of this research dealt with how 3D virtual worlds could support the specific well-being activity of meditation and the overall experience of technology-supported meditation. The specific evaluation perspective was bounded via third wave HCI.

Definitions of Terms

Affective computing **–** **"**computing that relates to, arises from, and deliberately influences emotion" (Picard, 2010, p. 11).

Blue Ocean research – exploring or creating new areas of research rather than further refining or competing in existing areas (AMCIS, n.d., Tate et al., 2014).

Broaden and build theory – model that states that positive emotions can drive well-being with joy or fun leading to exploration or creativity (Riva et al., 2012).

Cognitive absorption – in information systems and software, a deep state of involvement; also associated with presence in virtual worlds and flow theory (Agarwal & Karahanna, 2000; Cahalane, Feller, & Finnegan, 2012).

Cyberpsychology – recent subfield of applied psychology concerned with technology and how humans interact with each other via technology, how human

behavior is shaped by technology, and how technology affects human psychological states (Kirwan & Power, 2014)

Dose response – relationship between being exposed to a phenomenon and the associated response (e.g., exposure to phenomenon that helps build resilience) (Wiederhold, 2012).

Engagement - component of user experience that includes the elements of challenge, positive affect, endurability, aesthetic and sensory appeal, attention, feedback, variety/novelty, interactivity, and perceived user control (O'Brien & Toms, 2008).

Eudaimonic – referring to sense of purpose, meaning in life, and self-actualization (Botella et al., 2012; Riva et al., 2012).

Experiential computing - humans' experience with technology and how experiences are being transformed (Yoo, 2010).

Flow Theory – flow conceptualized as an optimal experience characterized by intrinsic motivation, deep absorption and focus, loss of awareness of time, enjoyment, and being completely immersed in an activity (Csikszentmihalyi, 1990, 2008).

Flow State Scale (FSS) – validated psychometric instrument (Jackson & Marsh, 1996; Marsh & Jackson, 1999) for measuring flow experience during physical activity but subsequently applied to measure the flow experience in technology-supported activities (Wiebe et al., 2014)

Hedonic – referring to positive enjoyment and pleasure (Botella et al., 2012; Riva et al., 2012)

Horizontalization – in phenomenological research, this is the process of identifying significant statements (sentences or quotes) from participant transcripts that

represent aspects of how the participants understand and experienced the phenomenon (Creswell, 2013).

Human-computer interaction (HCI) – an interdisciplinary field with contributions from psychology, computer science, graphic design, anthropology, sociology, human factors, ergonomics, and information architecture; field aims to design, evaluate, and implement technology for optimal human use and accomplishment. (Hewett, Baecker, Card, Carey, Gasen, Mantei, Perlman, Strong, & Verplank, 2009; Shneiderman, Plaisant, Cohen, & Jacobs, 2009)

Immersive 3D environment – three-dimensional environment that includes special equipment to provide system or physical and sensory immersion, e.g., head-mounted displays or special gloves (Cahalane et al., 2012).

Labyrinth – a unicursal ancient symbol of spirituality, a sacred space, and interactive artistic expression (Compton, 2007). Labyrinths can be small or large, drawn on paper or rock, or formed or built using stones, pavers, rope, tape or other materials, or built or carved through nature as pathways (Curry, 2000; Lonegren, 2007). People walk labyrinths as a form of meditation, reflection, problem-solving, to access inner wisdom, and tacit knowledge (Bloos, 2005; Compton, 2007; Curry, 2000; Johnston, 2000; Lonegren, 2007; Shapiro, 2014)

Meditation - concentration-based individual activity involving self-regulation of attention and awareness associated with well-being and self-actualization (MacDonald, et al., 2013)

Meditation bubbles – fantasy environments that were part of the Literary Project in Second Life where users could be inside a bubble and meditate; included different

element such as meditation pillows or fish swimming. Designed to be an innovative and interactive engaging experience (Jensen, 2012).

Mindfulness – being present and observing the current moment without judgment (Sauer, Walach, Schmidt, Hinterberger, Lynch, Büssing, & Kohls, 2013).

Mood induction procedures (MIP) – "experimental procedures designed to provoke transitional mood states in non-natural situations in a controlled manner" (Botella et al., 2012, p. 80).

Non-immersive 3D environment – three-dimensional environment (without special physical equipment or configuration) with an aim to generating psychological or emotional immersion (Cahalane et al., 2012).

Persuasive computing – using computers to try and change people's attitudes and/or behavior voluntarily (excluding coercion and deception) (Fogg, 2003).

Positive computing – the "design and development of technology to support psychological well-being and human potential" (Calvo & Peters, 2014, p. 2).

Positive psychology – field that concentrates on positive emotions, attitudes, and behaviors that lead to well-being and happiness and allow individuals to flourish (Seligman & Csikszentmihalyi, 2000)

Positive technology – the combination of positive psychology and technology to promote positive emotions (Riva et al., 2012).

Presence – perceived sense of "being there" in a virtual environment (Riva et al., 2012).

Restorative environment – a real or virtual environment that positively affects humans by enhancing well-being, e.g., stress reduction, calming, clarity of thought (Knight, Stone, & Qian, 2012)

Self-actualization – the top level need in Maslow's hierarchy of needs; the notion that humans seek happiness via fulfilment of their potential, to be all they can be, and to experience the world fully (Maslow, 1943).

Serious gaming – using gaming beyond entertainment goals to help solve real-world problems, promote learning, or motivate participants; may also help increase well-being and promote positive emotions (Argenton, Triberti, Serino, Muzio, & Riva, 2014)

Techno-spirituality – the combination of spirituality and religious practices with technology (Buie & Blythe, 2013b).

Thangka – "A thangka is a complicated, composite three-dimensional object consisting of: a picture panel which is painted or embroidered, a textile mounting; and one or more of the following: a silk cover, leather corners, wooden dowels at the top and bottom and metal or wooden decorative knobs on the bottom dowel" (Shaftel, 2015, p1).

Unicursal – a single path, e.g., one way in and one way out of a labyrinth (Bloos, 2005; Curry, 2000).

User experience – field rooted in HCI (thus also interdisciplinary) that encompasses human experiences and encounters with technology (Downey & Rosales, 2012; Law et al., 2014).

Virtual world – persistent, shared, three-dimensional environment often easily accessible via browser-based viewers, where users may communicate and cooperate,

generate content, and interact with each other and/or artifacts in the virtual world (Cahalane et al., 2012).

Virtual reality – computer-generated three –dimensional environment that simulates the real world or introduces an imaginary world; often enhanced with special equipment like large screens, stereoscopic displays, and head-mounted gear to provide system immersion (Cudworth, 2014).

Well-being – a happy and healthy state which involves multiple dimensions of positive emotions, engagement, relationships, meaning, and accomplishment (Foregaard et al., 2011).

List of Acronyms

- 3D – Three dimensional
- EOM-DM – Experience of Meditation During Meditation
- FSS – Flow State Scale
- GSR – Galvanic skin response
- PMR – Progressive muscle relaxation
- UES – User Engagement Scale
- UESz – User Engagement Scale refined by Wiebe et al., 2014 to measure engagement in video games
- UX – User Experience
- VW – Virtual World(s)

Summary

The potential for using technology to support well-being has been recognized (Botella et al., 2012; Calvo & Peters, 2013, 2014; Coyle et al., 2014; Riva et al., 2012;

Sander, 2011; Shaw et al., 2010; Vidyarthi & Riecke, 2014; Wiederhold, 2012). Well-being is a happy and healthy state which involves multiple dimensions of positive emotions, engagement, relationships, meaning, and accomplishment (Foregaard et al., 2011). Positive technology and positive computing are two emerging research areas that focus on using technology to support, enhance, and promote well-being (Botella et al., 2012; Calvo & Peters, 2013, 2014; Riva et al., 2012). Both emerging areas are grounded in positive psychology which introduced the science of human flourishing (Seligman & Csikszentmihalyi, 2000; Wiederhold & Wiederhold, 2013). Positive technology theory provides a framework to study the effect of technology on well-being (Botella et al., 2012; Riva et al., 2012).

Meditation is an activity associated with well-being and self-actualization (MacDonald et al., 2013). This centuries-old practice is being embraced by the contemporary world as a wellness approach (Plaza et al., 2013; Suchday et al., 2014). Multiple benefits exist including increased well-being (MacDonald et al., 2013; Seppala, 2013; Suchday et al., 2014). People have begun to use technology to support meditation (Buie & Blythe, 2013a; Buie & Blythe, 2013b; Pickert, 2014). Researchers and industry have also begun examining the combination of technology and well-being activities to benefit humans (Botella et al., 2012; Coyle et al., 2014; Gromala et al., 2011, Vidyarthi & Riecke, 2014; Wild Divine, 2014). To date, the full impact of technology on well-being remains an open question (Riva et al., 2012). Further, limited findings address self-managing well-being with technology (Gaggioli & Riva, 2013).

This research investigated technology-supported meditation using a 3D virtual world. Virtual environments are one of the suitable technologies identified in the positive

technology framework (Botella et al., 2012; Riva et al., 2012). An islandscape named Sanctuarium was constructed based on restorative concepts (e.g., naturescapes and water) and the meditation concepts of walking meditation via a labyrinth, and seated meditation. Designing and evaluating technologies for well-being is challenging and complex (Botella, et al., 2012, Calvo & Peters, 2014; Coyle et al., 2014). Further, while virtual worlds have been used in positive technology applications (Botella et al., 2012; Riva et al., 2012; Wiederhold & Wiederhold, 2013), the nature of engagement in virtual worlds is not well-understood (Jensen, 2012; Wasko et al., 2011).

This formative exploratory study utilized a blended approach gathering quantitative data (demographics and surveys) and qualitative data (semi-structured interviews). Study participants interacted with Sanctuarium to virtually experience walking meditation and seated meditation. Third-wave HCI provided the evaluation perspective and the research focused on 1) the nature of engagement in technology-supported meditation using a 3D virtual world and, 2) the overall experiential aspect of technology-supported meditation.

The goal of the research was to gain a deeper understanding of user engagement and the holistic experience of technology-supported meditation using a 3D virtual world as a way of advancing knowledge on how best to leverage technology to support, enhance, and promote well-being. Results can help individuals and organizations better understand how virtual world technology may be of benefit combined with well-being activities. It is hoped that this research will ultimately contribute to increasing well-being in the world.

The remaining chapters of this dissertation include a review of the literature, a description of the methodology, presentation of results, and a final chapter with conclusions, implications, and recommendations. The research spans multiple domains including HCI as the umbrella domain, with major contributions from information systems (IS), virtual worlds, positive technology and positive computing, and technology-supported meditation. Chapter 2 reviews and summarizes the relevant literature and highlights the intersections and connections between the domains. The methodology chapter (Chapter 3) explains the blended approach, presents a description on the current state of evaluation in UX and HCI, and describes the particulars of participants, data collection, the protocol, data analysis, and presentation of results. Chapter 4 includes comprehensive data analyses and integrated results that answer the three research questions. Chapter 5 presents conclusions, implications, recommendations for future research, and concludes with a full summary of the dissertation. Lastly, a set of appendices provides details on the design of Sanctuarium, chakra descriptions, and messages in Sanctuarium (Appendix A, B, C); the IRB approval letter and the informed consent form, the demographic questionnaire, pre-activity survey, explanatory information about Sanctuarium, and the post-activity survey(Appendix D, E, F, G, H); the instruments (Appendix I, J); the pilot script and avatar choices (Appendix K, L); detailed demographic data and instrument data (Appendix M, N, O); and the results of the phenomenological analysis of the pre-activity and post activity interviews (Appendix P, Q).

Chapter 2

Review of the Literature

Context

The research drew insight and information from multiple domains and intersections of those domains including: Positive technology/computing, technology – supported meditation, virtual worlds, IS, and HCI. Figure 2 illustrates the connections and Table 1 shows the intersections. The nascent research area of positive technology provided the theoretical foundation as well as applications of positive technologies. Positive technologies are reviewed (Botella et al., 2012; Wiederhold, 2012) and specific technology-supported meditation examples are presented (Buczynski, 2012; Coleman, 2013; Gromala et al., 2011; Jensen, 2012; Radde-Antweiler, 2008; Tlalka, n.d.; Wild Divine**,** 2014). Virtual Worlds literature included here focuses on virtual world experiences, uses, and remaining challenges, including understanding engagement in virtual worlds and the gap in understanding the experience of engagement (Jensen, 2012). IS literature provides a system view of virtual worlds and highlights the need to better understand how humans engage with virtual worlds, information systems, and technology (Wasko et al., 2011; Yoo, 2010; Zhang et al., 2009). HCI literature addresses the move from second wave HCI dealing with user-centered design to third wave HCI with a focus on user experience, emotions, and engagement creating the tie to positive technology (Bødker, 2006; Roto & Lund, 2013). This includes early HCI research on promoting and

supporting well-being with technology. The need to define, understand, and measure user engagement is also a part of the HCI domain review (O'Brien & Toms, 2008; O'Brien & Toms, 2010a). Advancement in evaluation of HCI and UX is discussed with a focus on attributes like emotion, engagement, and aesthetics (Harrison et al., 2007; Hassenzahl & Tractinsky, 2006; MacDonald & Atwood, 2013).

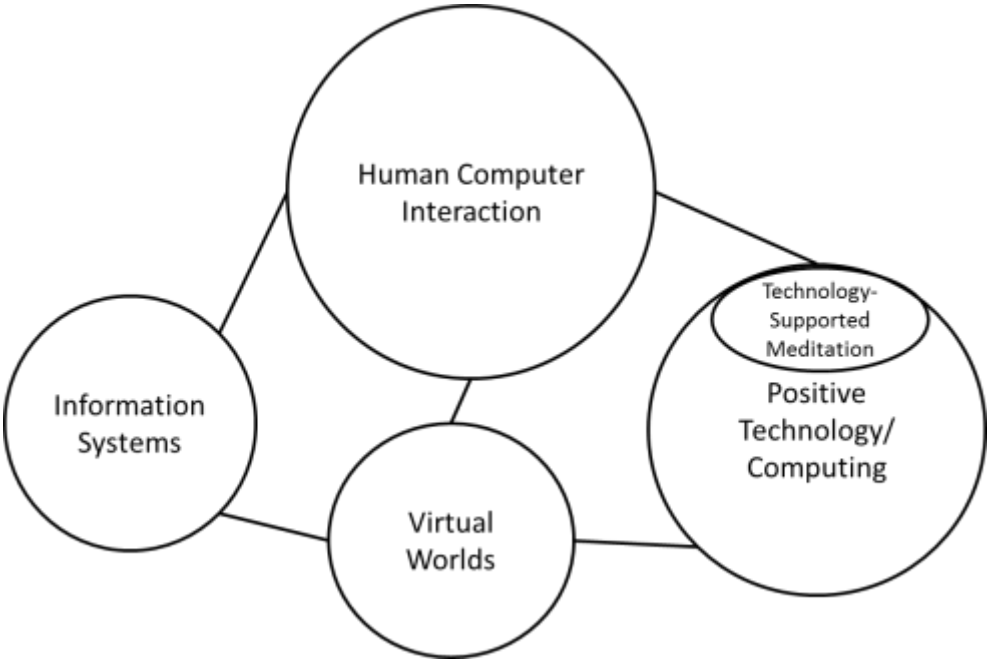

Figure 2. Domain Connections

Table 1

Domain Intersections

	Human Computer Interaction	Information Systems	Virtual Worlds	Technology-Supported Meditation	Positive Technology/ Computing
Human Computer Interaction		**X**	**X**	**X**	**X**
Information Systems	**X**		**X**	**X**	
Virtual Worlds	**X**	**X**		**X**	**X**
Technology-Supported Meditation	**X**		**X**		**X**
Positive Technology/ Computing	**X**		**X**	**X**	

The literature review begins with a look at virtual world applications and technology-supported meditation. Next it moves to positive technology and positive computing followed by virtual world literature and the IS domain. Lastly, HCI literature is examined with a specific perspective on the third wave and emerging research in well-being technologies. The common thread that runs through all of these domains is engagement and experience with the technology, which is directly linked with the research questions. The chapter concludes with a summary.

Virtual World Applications

While Haringer and Beckhaus (2012) offered that little research has been conducted on virtual environments as an affective medium, some applications and research examples do exist. Researchers and industry have used virtual worlds to address

well-being, stress reduction, pain management, and anxiety reduction (ATN-P Lab, n.d.; Gromala et al., 2011; Knight et al., 2012; Morie, Haynes, Chance, & Purohit, 2012; Riva et al., 2007; Shaw et al., 2010; Stetz, Kaloi-Chen, Turner, Bouchard, Riva, & Wiederhold, 2012; Wiederhold & Wiederhold, 2013; Wild Divine, 2014). Knight et al. summarized research that supports reduced stress and improved well-being when individuals are exposed to natural settings. This set the stage for their work on experimenting with 3D virtual world natural settings and resulting effects on anxiety and relaxation. Participants (N = 14) provided pre and post-test anxiety and relaxation ratings based on researcher-created questions. Knight et al. found that overall virtual environments are good candidates for restorative environments. Multiple studies have validated that viewing nature, including within virtual environments, has restorative effects (Valtchanov, 2013). Moire et al. (2012) summarized reasons why virtual worlds (VW) are poised to become a major factor in telehealth including opportunities for encouraging and improving well-being. The reasons included: 1) highly social nature of VWs, 2) ability to recreate restorative environments that promote psychological health and well-being, and 3) embodiment in avatars can translate to psychological and physical effects. Morie et al.'s work is part of the Institute for Creative Technologies where virtual reality and virtual worlds research is aimed at creating solutions in training, military instruction, healthcare, well-being, coaching, education, and other areas (University of Southern California, 2014). One example that may be viewed as positive technology is a preliminary study using a virtual world for resiliency training (Morie, Chance, & Buckwalter, 2011). Researchers designed an activity in Second Life where participants (N = 27) virtually jogged around an island controlling their avatar via their

breath with a microphone (jogging occurred with steady rhythmic breathing). The choice of controlled breathing was selected based on mindfulness and yoga concepts. Morie, Chance, and Buckwalter used three different standardized instruments to measure arousal, positive affect, and negative affect before and after the jogging scenario. Results indicated significant drops in all scales (mean score) after the virtual jogging activity translating to the overall effect of a more relaxed and calm state. This application required no special equipment making use of biofeedback via a standard microphone.

Stetz et al. (2011) used a virtual island landscape with audio narrative to investigate the effectiveness of technology-enhanced relaxation methods (progressive muscle relaxation [PMR] and controlled breathing) with military medical warriors (N = 60). Military medical warriors are those military medical personnel in a combat zone. Results indicated overall anxiety reduction after the relaxation treatment as measured by a standardized pre and post-test anxiety instrument. Researchers also tried to induce a stressful situation then measure post-treatment anxiety but were unsuccessful in inducing stress. Riva et al. (2007) created virtual parks and measured effects on anxiety and relaxation and concluded that virtual environments are effective and useful as an affective medium. Both standardized validated instruments (multiple) and researcher-based rating questions were utilized with participants (N = 61 undergraduate students).

Riva et al. (2012) presented a theoretical argument for using interactive technologies to support well-being and positive functioning in three specific areas: affective quality, engagement/actualization, and connectedness. Virtual reality technologies were identified as one of the suitable interactive technologies. Researchers have utilized both immersive and non-immersive 3D environments (Botella et al., 2012;

INTERSTRESS, n.d; Gromala et al., 2011; Morie et al., 2011). One of the early examples of technology based on the positive technology framework is the positive technology application (PTA), which utilizes a non-immersive virtual world (ATN-P Lab, n.d.; Gaggioli, Cipresso, Serino,, Campanaro, Pallavicini, Wiederhold, & Riva, 2014). The PTA is an iPad application designed to combat stress that combines a 3D virtual world and biosensors. In 2012, the PTA earned an award for best mobile health application at the U.N.-based World Summit (ATN-P Lab, n.d.). This recognition reinforces the perspective that VWs are prime candidates for telehealth applications including the support and promotion of well-being.

Technology-supported Meditation

Researchers and industry have also used technology, including 3D VWs, to specifically support meditation thus establishing a precedent for combining VWs and meditation (Gromala et al., 2011; Jensen, 2012, Shaw et al., 2010; Vidyarthi & Riecke, 2013, Wild Divine, 2014). The Transforming Pain Research Group (TPRG) developed The Virtual Meditative Walk, The Meditation Chamber, and the Sonic Cradle – all of which use immersive virtual environments combined with other mechanisms such as a treadmill, sensors, or headgear (Gromala et al., 2011; Shaw et al., 2010; Vidyarthi & Riecke, 2013, 2014). Shaw et al. utilized (and plan future use of) a phenomenological approach combining subjective and physiological aspects for assessing The Meditation Chamber and The Virtual Meditative Walk. Shaw et al. asserted that meditation (and pain) are subjective experiences with multiple aspects that "are difficult to communicate and measure" (p. 121). The Meditation Chamber experience includes sitting in a semi-reclined chair, wearing a head mounted display, and three biosensors that measure skin

conductance, respiration, and heart rate. Users progress through three phases 1) guided relaxation, 2) guided PMR (also used by Stetz et al., 2011), and 3) guided meditation and breathing. In Phase 1 participants controlled a sunset or a moonrise via relaxation detection based on galvanic skin response (GSR). During PMR in Phase 2, users listened to instruction and tensed and relaxed their muscles accordingly. For Phase 3, participants listened (narrator and ambient sounds) and viewed relaxing imagery. When the system detected an approximated meditative state via the biosensors, sound decreased and the imagery faded to black. Shaw et al. tested The Meditation Chamber with a large number of participants (N = 411) as part of an emerging technology exhibition at a professional conference. Participants filled out pre and post-test relaxation ratings (researcher-based 10 –point scale) and also provided written comments (30% of respondents) post activity. Shaw et al. also reported post-activity informal discussions with researchers citing significant interest and enthusiasm. Relaxation ratings indicated a positive significant difference (from a mean of 5.65 to a mean of 8.00). Notably, novice meditators had a different GSR profile than expert meditators – meaning novices started high and then learned to reduce GSR as relaxation progressed, while experienced meditators were able to much more quickly lower their GSR and enter a relaxed meditative state. Shaw et al. concluded that The Meditation Chamber helped users learn to meditate and self-modulate, especially novices. The Virtual Meditative Walk builds on the work of The Meditation Chamber (Shaw et al., 2010; Gromala et al., 2011). It includes the use of a unidirectional treadmill, HMD, and biosensors. Further research results are pending.

TPRG's Sonic Cradle combines sound and meditation (Vidyarthi, Riecke, & Gromala, 2012; Vidyarthi & Riecke, 2013, 2014). Users lay in a suspended hammock in

a darkened room outfitted with sound equipment. They use attached biosensors to control the soundscape with their respiration. In this way the Sonic Cradle trains self-regulation and helps users learn to meditate by focusing inward on their breathing to affect the sound. Vidyarthi and Riecke (2014) described The Sonic Cradle as a "human-computer interaction paradigm designed to foster meditative attentional patterns" (p. 674). The inventors take a persuasive technology perspective (Fogg, 2003) and view their approach as a motivational and experiential method for teaching the beneficial practice of mindfulness meditation to non-practitioners. Vidyarthi and Riecke (2014) deemed persuasive technologies as enablers of well-being. This view aligns with the positive technology framework in which Riva et al. (2012) identified persuasive technologies as supporting both the eudaimonic and social and interpersonal levels. To lay a foundation for further investigation, Vidyarthi and Riecke (2013, 2014) leveraged a technology conference and conducted an exploratory phenomenological study with participants that experienced The Sonic Cradle. The researchers argued that this early investigation required a rich qualitative approach rather than using instruments, adding that not many appropriate and well-developed instruments exist for measuring meditation. Using purposive sampling, Vidyarthi and Riecke (2014) conducted immediate post-activity interviews with participants (N = 34, 20 with some meditation experience, and 14 with no meditation experience). Multiple coders converged on several primary themes common to both participant groups – top themes included 1) initial tendency to explore the control method 2) a relaxing, refreshing experience, 3) positive and emotional responses, 4) transition to less intentional control, and 5) clarity of thinking (Vidyarthi & Reicke, 2014, p. 681). The Sonic Cradle demonstrates user

experience as the primary task, not a secondary dimension which exemplifies third wave HCI. Per Vidyarthi and Riecke (2013, 2014), the main contribution of their study revealed that using technology to help create experiences comparable to mindfulness meditation is possible. This in turn lends support for technology as an enabler of self-regulation and well-being rather than technology having a negative impact (Vidyarthi & Riecke, 2014).

Chitarro and Vianello (2014) evaluated computer-supported mindfulness using mobile phones. Mindfulness is a form of meditation (Butera, 2012). According to Chitarro and Vianello, while mobile applications are being used for well-being, evaluation for efficacy has not occurred. In their study with smart phones, Chitarro and Vianello compared a technology-supported technique for mindfulness to two non-technology techniques (N = 22 college students that had little or no meditation experience). Results indicated that the technology-supported technique performed better in the areas of achieving mindfulness (based on a subscale of the validated Toronto Mindfulness Scale), perceived level of difficulty (based on three questions produced by the researchers), and the perceived level of pleasantness (based on the pleasure dimension of the validated Self-Assessment Mannikin). Participants preferred the technology-supported mindfulness technique over the traditional non-technology methods (results based on asking the participants for their preference).

Commercial ventures involving meditation and technology have also appeared in recent years. The popular VW Second Life hosts religious communities where people can meditate as well as a Literary project that includes meditation bubbles with the goal being a fun way of fostering creativity (Jensen, 2012; Radde-Antweiler, 2008). Wild

Divine (2014) produced a biosensor mechanism that fits on the fingers and plugs into a Mac or personal computer along with various software games and programs for guided meditation (Wild Divine, 2014). YouTube contains a variety of meditation videos (Buie & Blythe, 2013a). Mobile applications and web sites that support meditation have emerged – providing timers, cues (bell tones), calming music, chanting, and/or displays of geospatial feedback of others simultaneously meditating around the world to provide a feeling of connectedness (Buczynski, 2012; Coleman, 2013; Tlalka, n.d.). While several examples provided here demonstrate VWs (and other technology) used in a variety of manners including support for well-being and meditation, using 3D VWs for mind-body activities (e.g., meditation) has not been systematically investigated (Hoch, Watson, Linton, Bello, Senelly, Milik, Baim, Jethwani, Fricchione, Benson, & Kvedar, 2012).

Positive Technology and Positive Computing

Several of the previous examples pre-date the formalization of positive technology theory but demonstrate the move towards using technology to improve humans' lives in multiple forms. However, according to Botella et al. (2012), very few examples exist that can be categorized as positive technology per the positive technology framework. Botella et al. established that to be considered positive technology it must promote positive emotion, and "be designed to improve the quality of the personal experience, which in turn serves to promote wellness and generate resources and strengths in individuals" (p. 78). Botella et al. (2012) and Wiederhold (2012) summarized specific examples of positive technology. One hedonic illustration is Emotional Parks which uses mood induction procedures (MIPs) coupled with virtual reality to promote feelings of happiness and relaxation (Botella et al., 2012). Botella et

al. confirmed via testing and analysis that Emotional Parks promote positive emotions. The Emotional Activities Related to Health (EARTH) system uses virtual reality and MIPs and was part of a project designed to aid astronauts on a future trip to Mars (Botella et al., 2012). The EARTH system included life experiences and future significant plans to promote psychological strengths. Researchers adapted the EARTH system to the general population and a pilot study demonstrated results in increasing positive mood (*N=36*) (Baños, Etchemendy, Farrfallini, García-Palacios, Quero, & Botella, 2014). Wiederhold reported on eudaimonic work using virtual reality aimed at building resiliency in elite athletes and military personnel. At the social and interpersonal level, Botella et al. presented Wikipedia as a seminal example of positive technology because of its goal to empower, engage, and educate people around the world. No evaluation of Wikipedia as a positive technology was shared. Lastly, Wiederhold reported on the use of virtual reality as an anti-bullying tool called FEAR NOT. Researchers found that in clinical trials with 1000 plus children in Germany and the United Kingdom (UK), a dose-response existed based on time spent in the virtual environment and the ability to avoid bullying, with a significant effect for UK children.

Wiederhold (2012, p. 48) also noted that positive computing (Calvo & Peters, 2013, 2014; Sander, 2011) arose in the context of the social and interpersonal level as the "study and development of technologies designed to support well-being, wisdom, and human development." Calvo and Peters (2013) differ in their approach versus the positive technology framework even though both approaches are founded on positive psychology concepts of well-being. Positive computing takes a broader perspective with specific aspects of wisdom including interpersonal skills, intrapersonal skills, change and

uncertainty, balance, relativism, mindfulness, reflective insight, and social consciousness. Calvo and Peters (2013) identified three factors with fundamental links to well-being: autonomy, relatedness, and competence. Positive Computing is made up of three kinds of applications: preventative, active, and dedicated (Calvo & Peters, 2013; 2014). Preventative technologies are those that make changes because evaluation revealed a hurdle to well-being, e.g., redesign occurs because research revealed a feature encourages cyber bullying. Active systems are those built for general purposes (e.g., email) that add a new feature to promote well-being, i.e., a thank you button to express gratitude. Dedicated positive computing applications are those developed from the beginning to promote and encourage positive emotions and well-being, e.g., mindfulness applications. The commonality between positive technology and positive computing is a theoretical grounding in positive psychology and well-being concepts; the intersection is the category of dedicated technologies of positive computing, which is the focus of positive technologies.

While a small number of positive technology applications exist, Botella et al. (2012) maintained that how best to use technology to affect positive change in humans' everyday lives is a complex challenge. Botella et al. urged further research at the intersection of positive psychology and technology specifically focusing on emotional quality, engagement/actualization, and connectedness. Wiederhold (2012) stated that it is important to advance the understanding of positive technologies in order to promote and support the well-being of humans. According to Riva et al. (2012), the effect of technologies on well-being remains controversial. Limited confirmation has occurred on the effectiveness of self-managing well-being with technology (Gaggioli & Riva, 2013).

Botella et al. also cautioned that the ethics of using technology to promote positive emotions is a research area that needs significant exploration. From an HCI perspective Hassenzahl and Tractinsky (2006) noted a new focus on positive emotional outcomes in UX but wondered if technology should be used for affect regulation and maintenance? Echoing Botella et al., Hassenzahl and Tractinsky asked what are the effects of designing for affect on responses and judgments? While emerging areas consistently raise questions and concerns, Calvo and Peters (2013, 2014) advocated a current need to research, evaluate, and design for the effect of technology on well-being because it will benefit users' experience with technology and ultimately further human flourishing. Because of the inherent complexity of this research space, they also promoted a multidisciplinary approach as crucial.

Virtual Worlds and Information Systems

Engagement is a centerpiece element in the positive technology framework and grounded in well-being concepts of positive psychology (Botella et al., 2012; Riva et al., 2012). But in the positive psychology context, engagement refers to a human actively participating and pursuing satisfying activities and capitalizing on strengths and capabilities (Riva et al., 2012). So the connection becomes how can technology be engaging to better support living an engaged life? Examining the VWs' literature and the IS literature revealed the need to understand engagement with technology. Jensen (2012) conducted an in-depth and comprehensive investigation (almost 10 years in the making) into virtual world making and sense-making both from an actor (human) and an avatar (mediated representation of human in the virtual world) perspective. Virtual environments included EverQuest (multi-user online role-playing game), and Second

Life. Research was driven by the diversity of actors and their motivations, coupled with emotional experiences of engagement from earlier experimental workshops in virtual world-building (Active Worlds). Jensen's overall dissertation goal focused on understanding how actors make sense of engaging in VWs. She utilized participant observation and video interviews as the primary research methods. She devoted an entire chapter to actors and engagement, with engagement in this context being motivations for constructing VW, and choices for interacting in specific ways in VWs. Jensen viewed avatars as mediators between the human actor and the technology, not merely virtual representations of the human self. She utilized actor-network theory, semiotics, and communication theory in her interpretation of engagement to explain motivations, behavior, and virtual world-making. Even with this deep qualitative examination and theoretical analysis of engagement, Jensen proffered that how to understand the experience of engagement has not been determined.

Viewing engagement in VWs from the information systems perspective, Wasko et al. (2011) described and summarized work and associated open research questions. They noted multiple rich research areas: (1) how the rules system set down by VW creators drives both virtual world and real world interactions, (2) how information systems design needs to adapt and adjust to handle the flexibility and diversity in VW environments, (3) how people make sense of their experiences in virtual environments (sense-making), (4) how the human–avatar relationship is formed and developed, (5) how interacting in a virtual environment creates a richer, more engaging user experience, and (6) how VW experiences affect co-construction, originality, advancements, buying/selling, and other human–avatar activities. Wasko et al. highlighted the criticality of avatar interpretation

both by the human and others interacting with an avatar as a key element in understanding engagement in VWs since the avatar is an embodiment. Based on media richness theories, 3D VWs are assumed or claimed as more engaging than other less rich environments, but how various elements of 3D environments work together to create engaging experiences is not yet determined (Wasko et al., 2011). Engagement constructs identified in IS research include telepresence, social presence, flow, intrinsic motivations, playfulness, and cognitive absorption but these were based on research conducted on 2D information systems utilized for work productivity (Wasko et al., 2011). How to define and achieve deeply engaging experiences in 3D VWs remains an open question (Wasko, et al., 2011).

Cahalane et al. (2012) specifically targeted what they termed "social virtual worlds" in their information systems review of VWs research from 2007-2011. However, the analysis did not preclude the subset of an individual interacting in a VW with the environment and/or the co-creation of the VW (e.g., between an individual actor and the world-maker). Cahalane et al. advocated for a socio-material perspective and the need to address the immersion and emergence aspects of VWs, seeing VWs as a process much in the same way as Jensen (2012). Immersion was especially highlighted as an entangled definition in the IS literature; sometimes used to refer to system immersion (e.g., head mounted displays), other times used to refer to cognitive absorption, flow, level of engagement, telepresence, and presence (Cahalane et al., 2012). Using the latter perspective, Cahalane et al. argued that researchers rethink the notion of immersion from an augmentation perspective to understanding "immersion" from the perspective of world builders and creators. While Cahalane et al. assessed the IS literature as focusing too

much on novice users, avatars, and notions of presence, flow, and cognitive absorption, they indicated a need to include the human, the avatar, the world-maker, and the digital artifacts in an integrated theoretical model based on aspects of immersion and emergence.

Examining the IS literature also uncovered a lack of research, and subsequent call for, the IS domain to better understand how humans engage with and experience technology both individually and collectively (Tate et al., 2014; Yoo, 2010; Zhang et al., 2009). Zhang et al. conducted an extensive review of the IS literature looking at the advancement of HCI as a research stream of IS. The review included 758 papers published between1990-2008. One of the five research questions (R3) looked at the evolution of HCI in IS. R3 results indicated an increase in studies looking at non-work contexts (moderate increase for the marketplace, small increases for home, social, and cultural contexts). A small increase in studies examining emotion/affect also occurred. Overall, Zhang highlighted the need to better understand the human experience with technology to make the experience more enjoyable, rewarding, and fulfilling.

A year after the assessment by Zhang et al. (2009), Yoo (2010) proposed that the IS field establish a research line termed experiential computing (humans' experience with technology and how experiences are being transformed). Yoo offered an organizing framework that included four dimensions around experience with technology: time, space, actors, and artifacts. Finally, Yoo outlined an experiential computing research framework adapted from design science research and offered six IS research themes. Tate et al. (2014) highlighted Yoo's approach as part of "blue ocean" research in IS stating that experiential computing offered new opportunities for IS success in work and

non-work contexts across individuals, groups, organizations, and society. HCI in IS is moving towards a more comprehensive view of experience with technology.

Human-Computer Interaction

User engagement is a critical element in successful interactive systems and positive computing (O'Brien & Toms, 2008; O'Brien & Toms, 2010a; Sander, 2011). Calvo and Peters (2014) grouped motivation and engagement together as a determinant factor of well-being in their list of well-being factors for positive computing. (Other factors included: positive emotions, self-awareness, mindfulness, resilience, gratitude, empathy, compassion, and altruism.) Calvo and Peters asserted motivation occurs first in initializing an activity, wanting to sustain an activity represents engagement, and high engagement may transition to flow (optimal engagement). In discussing engagement, Calvo and Peters acknowledged no universal definition for engagement exists and mentioned two multi-dimensional engagement models. The first was by Christenson, Reschly, and Wylie (2012) which divided engagement into four kinds: emotional, cognitive, behavioral, and agentic. The second model referenced was by Sharafi, Hedman, and Montgomery (2006) and it included five dimensions: enjoying/acceptance, ambition/curiosity, avoidance/hesitation, frustration/anxiety, and efficiency/productivity.

O'Brien and Toms (2008) identified the need for an operational definition of engagement and subsequently established engagement as a component of user experience that includes the elements of challenge, positive affect, endurability, aesthetic and sensory appeal, attention, feedback, variety/novelty, interactivity, and perceived user control. O'Brien and Toms performed an extensive multidisciplinary literature review of engagement including examining theories of aesthetics, flow, and play. They asserted

that flow and engagement are related but differences exist, e.g., intrinsic motivation significantly drives flow whereas engagement may occur even during suggested, mandatory, or necessary use of a system or application. Further, engagement can occur in a short-term period while flow involves long-term focus.

O'Brien and Toms (2008) also conducted semi-structured interviews in four domains to inform the engagement definition. Domains included: video games, online shopping, web searching, and educational software. Results also revealed four states of engagement: start of engagement, period of engagement, disengagement, and re-engagement (O'Brien & Toms, 2008). As a final result of the work on establishing a definition for engagement, O'Brien and Toms identified the lack of empirical evidence in how engagement with technology should be measured. To meet this need, they developed the user engagement scale (UES), a multi-dimensional scale with 31 questions covering six dimensions: perceived usability (PU), aesthetics (AE), focused attention (FA), felt involvement (FI), novelty (NO), and endurability (EN) (O'Brien & Toms, 2010a). PU and FI predicted EN (see Figure 3). Development of the UES included factor analysis, validity, and reliability assessment. The UES was first applied in the e-commerce domain. O'Brien and Toms (2010a) encouraged research into the use of the scale in different domains for generalizability and further validation. O'Brien and Toms (2010b, 2013) subsequently applied the UES in the information retrieval domain and other researchers have applied it to Facebook and in the video game arena (Banhawi et al., 2012; Wiebe et al.; 2014). In three studies following the original UES, the three factors of FA, PU, and AE remained stable and distinct while the remaining three factors of NO, FI, and EN combined into one factor resulting in a four scale instrument (O'Brien

& Toms, 2013; Wiebe et al., 2014). O'Brien and Toms (2013) offered multiple possibilities for differences which included scale problems, context, tasks, longitudinal assessment versus immediate assessment, study design, and understandability of concepts in questions.

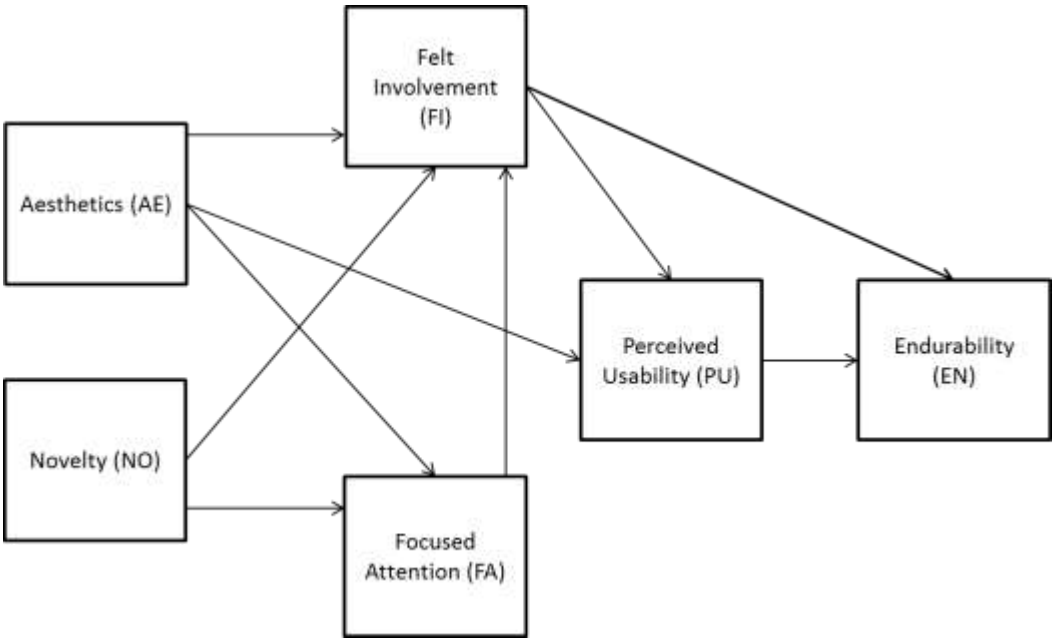

Figure 3. Original UES Construct Relationships (O'Brien & Toms, 2010a)

Engagement is critical for success because it drives decisions for use and investment. This translates to providing an "experience" and the experience movement (third wave HCI) is being motivated by those eager to understand how to design systems that create positive user experiences, and by those desiring to use experience as a competitive differentiator for their products and services (O'Brien & Toms, 2010a). HCI research is moving beyond interaction to user experience (Bødker, 2006; O'Brien & Toms, 2010a).

This move is an example of the evolution of HCI as described by Bødker (2006). First wave HCI dealt with human factors, users, and the desktop. Formal and quantitative

methods were primarily employed. Second wave HCI targeted the workspace and its context. Users became humans and participatory design emerged. Formative methods, contextual inquiry, and qualitative methods became popular. Third wave HCI views humans as actors and expands computer and technology use beyond the desktop and the work place into everyday life. It goes beyond cognition and involves emotions, values, culture, and experience. Third wave HCI also incorporates multiple mediators in the experience of humans with technology. Bødker examined HCI challenges left from the second wave of HCI and expanded into the third wave and characterized these challenges into the areas of multiplicity, boundaries, context, participation, and experience. She asserted that in the move from second to third wave, second wave theory and concepts can and should be addressed to help contribute to the maturity of the third wave. Because of its affective quality and focus, positive technology belongs to third wave HCI as does the investigation of engagement and experiences with technology beyond human factors and usability. Bødker challenged the HCI community to find ways to involve the user beyond work and tasks. She suggested starting with "felt life" which is looking at lived life, including senses, experiences, and emotions (McCarthy & Wright, 2005). McCarthy and Wright characterized the notion of technology as experience and highlighted the need to examine humans' relationships with technology and what that reveals about technology and humanity. This perspective was driven by computers and technology becoming part of humans' everyday lives. Humans interact with technology in many and varied ways.

Following in the "felt life" vein and third wave HCI context, Buie and Blythe (2013b) reported on the lack of, and need for, techno-spiritual research in HCI – research

that studies how people combine spirituality and religious practices with technology. (Some meditation may be classed as part of the spirituality context.). Buie and Blythe noted that despite the calls for research in this area for over 10 years, very little exists. They compared the number of mobile applications addressing spirituality and religion in the iTunes App Store (over 6000) to the number of items on techno-spirituality in the ACM Digital Library. Out of almost 400,000 items in the library, Buie and Blythe found 98 items related to techno-spirituality. Within the 98 items, only 19 research papers existed on techno-spirituality and roughly half of them were by one author. The 98 items were categorized into three buckets: institutional, practical, and experiential. Technology-supported meditation fell into the experiential category and two examples involving meditation were provided. The experiential category had the least number of items, and only one paper addressed characteristics of the experience and technology. This is a clear gap directly supporting the subject research. Buie and Blythe also identified several candidate barriers for the lack of techno-spiritual research. These included: spirituality is a sensitive topic, it could be professionally risky, spirituality is not scientific, and techno-spiritual research is not funded. Because spirituality is such a big part of humans' lives and practically speaking people are combining it with technology, the HCI field needs to conduct techno-spiritual research (Buie & Blythe, 2013b).

Similar to techno-spiritual research, HCI research in well-being technologies is in the early stages (Coyle et al., 2014). Researchers investigated technology-mediated reflection to increase well-being with positive results (Isaacs, Konrad, Walendowski, Lennig, Hollis, & Whittaker, 2013). Isaacs et al. (2013) built and tested a smartphone

application called Echo that allowed participants to record and reflect on events. They conducted a complex evaluation which involved 44 participants across three rounds of testing (10 in a month-long time frame, 33 in a month-long time frame, and one for a four-year time frame). Methods used included self-ratings, semi-structured interviews, linguistic analysis, and four validated well-being scales (Subjective Happiness Scale, Satisfaction with Life Scale, Psychological General Well-being Index, and the Mindfulness Attention Awareness Scale). Results showed well-being as measured by the scales increased after one month ($N = 33$). Self-ratings on emotions were positive. Linguistic analysis revealed differences in recorders and reflectors but each group benefitted with recorders improving well-being by discussing relationships, and reflectors improving via analysis and gaining insight for future behavior. The long-term study with one participant also showed improved well-being in positive behavior changes and increased appreciation of the present and the good times of the past.

Coyle et al. recently served as editors for a special issue on the topic of designing technology to support emotional well-being (International Journal on Human-Computer Studies, August/September 2014). They noted this is an under-explored research area that is vital to helping healthcare researchers and practitioners address and promote emotional well-being in both individuals and society. The special issue included five papers. Two papers addressed technology used for supporting relationships and social connectedness. Piper, Weibel, and Holland (2014) conducted two case studies on audio-enhanced paper photos used between elderly patients and caregivers. The technology demonstrated the potential for positive impact on the well-being of elderly patients suffering from aphasia (language impairment) or to aid reminiscence. Wadley, Vetere,

Hopkins, Green, and Kulik (2014) designed and tested activity visualization software with photo sharing capability between hospitalized youth and parents and peers at school. Wadley et al. essentially utilized design science: conducting co-design workshops, developing the technology, then conducting field trials (N = 9 cases of hospitalized children interacting with family and peers). Results indicated overall positive reception by children and teachers to stay connected technologically, less so by parents. Parents generally were with their sick children thus not needing the ambient presence application or when not, they wanted more information than the application provided. Challenges included privacy issues and disruption in school and hospital environments. This study highlighted issues of competing priorities and needs.

The third paper looked at the stress relieving capability (post-work recovery or recharging for the next day of work) of playing recreational digital games as a way of combatting technology overload (Collins & Cox, 2014). Collins and Cox surveyed gamers (N = 491) using a combination of validated instruments and estimates on gamer play times, weekly frequency, and types of games. Time spent on digital gaming correlated positively with overall recovery while correlations varied depending on game genre, with active, first-person games producing the highest correlation with recovery. The fourth paper investigated the use of biofeedback and affective computing in a 3D computer game to teach relaxation based on physiological response of the participant that was reflected by an avatar in the game (Chitarro & Sioni, 2014). The avatar reflected the level of relaxation of the participant and affected how the avatar behaved in expression, gesture, and completion of tasks. Participants (N = 35 university students and others known by the researchers) played three versions of the game: one utilizing a single

physiological measure (of the participant) that directly affected the avatar, one utilizing multiple physiological measures, and one using a placebo that randomly generated expressions and behavior in the avatar (unbeknownst to participants). Physiological data was collected via sensors and perceptual data was collected via researcher-based surveys on perceived quality of feedback and difficulty of the relaxation training. Results indicated the single-sensor game as the most effective. The authors noted that without the placebo condition, the single-sensor and multi-sensor conditions would have appeared mostly comparable and that this highlights the need for more comprehensive methodologies in affective computing studies. The final paper (discussed in an earlier section) was on technology-supported meditation using the Sonic Cradle (Vidyarthi & Riecke, 2014**).**

These early papers on evaluating well-being technologies demonstrate the complexity and diversity of evaluation needs and choices. Evaluation in HCI and UX is varied and fluid (Bargas-Avila & Hornbæk, 2011; Barkhuus & Rode, 2007; Law et al., 2014; Vermeeren, Law, Roto, Obrist, Hoonhout, & Väänänen-Vainio-Mattila, 2010). Second wave HCI included usability and current third wave includes UX. This expansion has implications for evaluation. Traditional HCI empirical evaluation involved primarily quantitative approaches (mostly summative) (Barkhuus & Rode, 2007). Usability introduced formative methods (early and diagnostic, often iterative) which were considered more informal and often involved a combination of qualitative and quantitative data (Downey, 2007; Shneiderman et al., 2009; Tullis & Albert, 2013). While UX is grounded in HCI (including usability), UX researchers and practitioners heavily utilize qualitative approaches (Bargas-Avila & Hornbæk, 2011; Law et al., 2014).

Even though qualitative methods are favored, the current state of evaluation in UX contains multiple approaches and multiple perspectives (Bargas-Avila & Hornbæk, 2011; Law et al., 2014; Vermeeren, et al., 2010). Vermeeren, et al. identified 96 evaluation methods used in UX evenly divided into quantitative, qualitative, and mixed approaches. Further, since the rise of UX in 2000, two basic evaluation philosophies have emerged: the reductionists advocating for objective measurement and primarily quantitative approaches, and the holistic proponents favoring qualitative and subjective assessment (Law et al., 2014).

The debate on evaluation includes a growing recognition in HCI and UX that new ways are needed for designing and evaluating for this third wave called user experience (Harrison, et al, 2007; Law et al., 2014; MacDonald & Atwood, 2013; Roto & Lund, 2013). Roto and Lund conducted a special interest group (SIG) at a major HCI conference to examine the evolution of HCI methods and approaches, challenges encountered, and to gather a vision for new ways of designing and evaluating user experience. To date, no results of the SIG have been published. Hassenzahl (2013) advocated for the experience-driven design of technology with a focus on the resulting experience as the key not the "thing" of technology.

MacDonald and Atwood (2013) summarized HCI evaluation and charted its evolution. They discussed the effect of technology and culture and how it has driven evaluation. Five phases of evaluation were presented: system reliability (1940-50s), system performance (1950-60s), user performance (1960-70s), usability (1970-2000s), and user experience (2000s to present). The shift to user experience is characterized by non-utilitarian computer use, and a move from task-based to affect and value-based

evaluation. As mentioned earlier, computers have moved into humans' everyday lives (e.g., social media, smart phones). How do we evaluate this new shift? According to MacDonald and Atwood, the major challenge is the lack of a shared conceptual framework for UX, even though different proposals have been made. Hassenzahl and Tractinsky (2006) highlighted the existence of multiple definitions of UX, as well as the HCI field's seeming acceptance of inconsistent, sometimes vague definitions. Controversy exists over which attributes to measure and how they are categorized and defined (Hassenzahl & Tractinsky, 2006; MacDonald & Atwood, 2013). Reviews of UX constructs studied from 2005 – 2012 revealed a wide variety (Bargas-Avila & Hornbæk, 2011; Law et al., 2014). Per MacDonald and Atwood, two categories of UX measures appear prevalent: hedonic and pragmatic. Both types are necessary for UX evaluation. However, often hedonic measures are associated with user experience and pragmatic measures are associated with usability (MacDonald & Atwood, 2013). Changing technology, cultural evolution, and evolving contexts require new evaluation methods (Harrison et al., 2007; MacDonald & Atwood. 2013). MacDonald and Atwood concluded with five suggested research directions for advancing HCI evaluation: 1) create a more comprehensive/holistic vision for user experience, 2) develop inspection methods for hedonic variables, 3) examine the key skills needed for evaluation, 4) investigate informal methods for evaluation, and 5) learn from practitioner evaluation. Law et al. suggested the need for more integrated approaches rather than a strident stance for either quantitative or qualitative evaluation while also highlighting the necessity of more theoretically-based UX measures.

Harrison et al. (2007) argued that differing epistemological foundations have driven and should drive evaluation. They defined third wave HCI from a situated phenomenological perspective and advocated for a collection of different design and evaluation strategies including values, and also noted that evaluation in situations will have trade-offs and can be messy. Calvo and Peters (2014) also included value-sensitive design as complementary to positive computing. The third wave HCI evaluation approaches map to a more holistic perspective of evaluation – multi-dimensional, interpretive, situated, and phenomenological – aimed at the total user experience. Emerging HCI research on well-being technologies demonstrates the complexity and diversity of evaluation approaches which are trending towards a third wave HCI perspective.

Summary

Looking across the research domains revealed the threads of needing to understand 1) engagement and 2) (user) experience with technology in non-work related activities. These two elements are fundamental to third wave HCI (Bødker, 2006) thus pointing to HCI as the umbrella domain. User engagement is a critical element in successful interactive systems and positive computing (O'Brien & Toms, 2008; O'Brien & Toms, 2010a; Sander, 2011). No universal definition of engagement exists (Calvo & Peters, 2014). After an extensive multi-disciplinary review, O'Brien and Toms (2008, 2010a) established an operational definition of engagement and subsequently developed a multi-dimensional user engagement scale (31 questions) to assess engagement during technology use. To date, researchers have applied the UES in e-commerce, information retrieval, to Facebook, and in video games (Banhawi et al., 2012; O'Brien & Toms,

2010b; O'Brien & Toms, 2013; Wiebe et al., 2014). Three studies revealed some agreement in refinement of the scale from six dimensions to four with variations on some individual questions (Banhawi et al, 2012; O'Brien & Toms 2013; Wiebe et al., 2014) More research on the UES and engagement is needed (O'Brien & Toms, 2013; Wiebe et al., 2014).

According to Riva et al. (2012), the positive technology framework creates an area of study for the cyberpsychology and HCI fields. This aligns with the positive computing approach which takes an HCI perspective (Calvo & Peters, 2013, 2014). Riva et al. proposed using technology to support and promote well-being by advancing the quality of personal experience via structuring, augmentation, and/or replacement. The three specific areas of personal experience targeted were: affective quality (hedonic level), engagement/actualization (eudaimonic level), and connectedness (social and interpersonal level). Sander (2011) emphasized technology must be used in ethical ways to support flourishing and also that success would be dependent on UX. Specifically positive computing should be fun, exciting, and engaging (Sander, 2011). Positive computing was posited as going beyond usability to become a future HCI paradigm (Calvo & Peters, 2012). Calvo and Peters suggested positive computing as a new research area that would add to HCI, help researchers better understand the mind, and better understand how to support human potential via technology. Calvo and Peters (2014) further formalized positive computing and highlighted the growing recognition by researchers in multiple disciplines to leverage technology in new ways to achieve increased well-being. They also asserted that multidisciplinary research is crucial.

Wiederhold (2012) stated that it is important to advance the understanding of positive technologies in order to promote and support the well-being of humans.

Positive technology is an emerging area and the effect of technologies on well-being remains controversial (Riva et al., 2012). Botella et al. (2012) maintained that how best to use technology to affect positive change in humans' everyday lives is a complex challenge. Multiple researchers noted the need to address the ethics of using technology to promote positive emotions (Botella et al., 2012; Calvo & Peters, 2014; Hassenzahl & Tractinsky, 2006; Sander, 2011). While emerging areas consistently raise questions and concerns, Calvo and Peters (2013, 2014) advocated a current need to research, evaluate, and design for the effect of technology on well-being because it will benefit users' experience with technology and ultimately further human flourishing.

Viewing the connections and intersections presented here, clearly a strong link exists between HCI and positive technology/computing and it is embodied in third wave HCI. Two schools of evaluation thought have emerged in the third wave: the reductionists advocating objective measures and quantitative approaches, and the holistic proponents favoring subjective and mainly qualitative methods (Law et al., 2014). Current methods include quantitative, qualitative, and blended approaches with UX researchers and practitioners generally leaning more towards qualitative methods (Bargas-Avila & Hornbæk, 2011; Law et al., 2014; Vermeeren et al., 2010). Despite the debate, multiple researchers recognize that design and assessment in the third wave demands new approaches and new ways of thinking to include situated, cultural, emotional, and phenomenological aspects (Bødker, 2006; Harrison et al., 2007;

MacDonald & Atwood, 2013; Roto & Lund, 2013). Early HCI research in well-being technologies has revealed complex and diverse approaches.

HCI is also studied as a sub-discipline in IS. Recent evolutions in IS literature included an increase in studies on affect/emotion in HCI but overall third wave HCI is minimally addressed (Zhang et al., 2009). Zhang et al.'s assessment of the IS literature reflected the need for making humans' experiences with technology more enjoyable, rewarding, and fulfilling both at the individual level and the community level. Zhang (2013) offered an affective response model and Yoo (2010) called for a new research stream in IS termed experiential computing. Tate et al. (2014) echoed support for the experiential computing approach in IS, highlighting implications for IS success at multiple levels – individual, group, organization, and society. This evolution in the IS field demonstrates the strong connection between HCI and IS, and a possible future connection with positive technology/computing.

Studying VWs, as does studying any technology, includes HCI aspects. A specific and targeted example identified here is the need to better understand engagement in VWs. Even after deep qualitative examination of sense-making and a theoretical analysis of engagement in VWs, Jensen (2012) proffered that how to understand the experience of engagement has not been determined. VWs have also been studied in the IS domain. This research revealed the need to understand how interacting in a VW creates a richer, more engaging user experience (Wasko et al., 2011). How to define and achieve deeply engaging experiences in 3D VWss remains an open question (Wasko et al., 2011). VWs also have a very strong link with positive technology/computing. Several researchers have identified and utilized VWs or virtual environments as ideal

technology to support well-being, mind/body activities, and human flourishing (Botella et al., 2012; Gromala et al., 2011; Hoch et al., 2012; Knight et al., 2012; Morie et al., 2012; Riva et al., 2012; Shaw et al., 2010; Vidyarthi & Riecke, 2013, 2014; Wiederhold, 2012). But according to Hoch et al., using 3D VWs for mind-body activities (e.g., meditation) has not been systematically investigated.

Surveying instances of technology-supported meditation (Gromala et al., 2011; Shaw et al., 2010; Vidyarthi & Riecke, 2013, 2014), verifies the connection between virtual environments, HCI, and positive technology/computing. For example, Vidyarthi and Riecke (2014) characterized the Sonic Cradle as an HCI model for enabling and encouraging meditation. This aligns with the eudaimonic level in the positive technology framework and the opportunity for HCI contributions. Reflecting current HCI and UX practice, researchers have employed multiple methods in the assessment of virtual environments and technology-supported meditation. These include but are not limited to ad-hoc rating scales, standardized instruments, physiological measurements via sensors, and interviews.

Lastly, some technology-supported meditation can be classed as a form of techno-spiritual practice. Buie and Blythe (2013b) reported on the lack of, and need for, techno-spiritual research in HCI. Their assessment of the HCI literature revealed extremely low coverage on the topic and they offered multiple barriers to techno-spiritual research (previously elaborated). Because spirituality is such a big part of humans' lives and practically speaking people are combining it with technology, the HCI field needs to conduct techno-spiritual research (Buie & Blythe, 2013b). Similarly, Coyle et al. (2014) asserted that HCI research in well-being technologies is under-explored and in the early

stages. More importantly HCI research in this area has an opportunity and potential for helping promote and support well-being (Coyle et al., 2014).

Chapter 3

Methodology

Overview

This exploratory study investigated technology-supported meditation including user engagement and overall user experience from a third wave HCI perspective. Study participants performed virtual walking meditation and seated meditation while interacting with Sanctuarium, a 3D virtual world (VW). (See Appendix A for a detailed description of Sanctuarium). A formative blended approach was utilized which included collecting both quantitative and qualitative data. Drawing from current research and practice in HCI and UX evaluation, the methodology targeted 1) perceptual measures of engagement and interview data to answer RQ3 and, 2) interview data and perceptual data on technology-supported meditation to answer RQ1 and RQ2. For reference, the research questions are repeated here:

RQ1. Does Sanctuarium support the meditation experience?

RQ2. Does Sanctuarium enhance the meditation experience?

RQ3. What is the nature of user engagement during technology-supported meditation?

Demographics and interview data on current meditation practice were collected from participants prior to interaction with Sanctuarium. After the participant interacted with Sanctuarium, perceptual measures on engagement were gathered via an engagement

scale as well as qualitative information related to technology-supported meditation. Additionally, the researcher administered a scale on perceived effects of meditation (as related to the technology-supported meditation experience).

Multiple methods for collecting data enabled data variety which helped form a holistic perspective of the user experience (Vermeeren et al., 2010). Wiebe et al. (2014) noted multiple measurement approaches are necessary and appropriate to understand engagement. The variety of data collected provided for triangulation of the results (Barnum, 2011; Resnick, Elkerton, Maher, Pastel, Rodriguez, & Kelley, 2013). Table 2 provides an overview of the data, methods, and collection points.

Table 2

Data Collection Overview

Data	**Type**	**Method**	**Research Target**	**Collection Point**
Demographics	Descriptive, Quantitative	Questionnaire	Context	Pre-activity
Non-technology meditation experience	Subjective, qualitative	Semi-structured interview	Baseline	Pre-activity
Engagement ratings	Subjective, quantitative	Validated scale	Primarily RQ3	Post activity
Technology-supported meditation ratings	Subjective, quantitative	Validated scale	RQ1, RQ2	Post activity
Technology-supported meditation experience	Subjective, qualitative	Semi-structured interview	RQ1, RQ2	Post-activity

The remainder of the methodology chapter first presents the rationale for the research approach, and the state of HCI and UX evaluation to provide context. Next, descriptions of the following are included: participants, the protocol, data collection and analysis methods, and how validity and reliability were addressed. Lastly the chapter is summarized.

Research Approach and Methods

Exploratory Research

Exploratory research aims to investigate and understand phenomenon about which nothing or little is known (Hair, Celsi, Money, Samouel, & Page, 2011; Sekaran & Bougie, 2009). Exploratory studies are also useful when investigating innovative approaches such as matching needs and technology (Hair et al., 2011). Positive technology is a new research area and technology-supported meditation is a specific example of positive technology by applying technology to a well-being activity. While potential and interest is high, the impact of technology on well-being remains unclear (Riva et al., 2012). Limited evidence exists on the effectiveness of self-managing well-being with technology (Gaggioli & Riva, 2013). Further, according to Hoch et al. (2012) using 3D VWs for mind-body activities (e.g., meditation) has not been systematically investigated. Coyle et al. (2014) noted that HCI research in well-being technologies is in the initial phase and will play a vital role in helping healthcare professionals increase well-being in humans. Given that research on combining technology and well-being is at an early stage, exploratory research was appropriate.

Exploratory research is also currently used in HCI and UX across varying topics, e.g., system usefulness (MacDonald & Atwood, 2014), interaction techniques for large

displays (Knudsen, Jakobsen, & Hornbæk. 2012), accessibility of a virtual world by those with aphasia (Galliers & Wilson, 2013), and online health information and older adults (Choi, 2013). While qualitative techniques are common in exploratory research, both qualitative and quantitative approaches can be used (Hair et al., 2011). A specific recent example from HCI is MacDonald and Atwood who combined numerical ratings and results of open ended questions while exploring system usefulness.

Formative Multi-Method Approach

To support the exploratory study and the research questions, the evaluation approach was viewed as formative (first or early assessment) and included quantitative and qualitative methods, a variety of data collection points, and different types of data. Formative approaches are common in HCI and are used to gather participant likes and dislikes, initial impressions, perceptions, and to diagnose major issues (Barnum, 2011; Tullis & Albert, 2013). This can include measures such as time on task, perceptual ratings, and survey data, all aimed at detecting major trends, issues, and overall suitability; but not results with statistical significance or generalizability which is the aim of summative studies (Barnum, 2011; Tullis & Albert, 2013). In the formative context, metrics are employed for diagnostic purposes (Law et al., 2014; Tullis & Albert, 2013). Formative studies are also generally done with a small number of participants and provide insight into what works best for users (Barnum, 2011). A small number of participants enables deeper investigation via qualitative methods such as interviews. A review of UX evaluation methods (96 total) revealed about one-third of the methods combined quantitative and qualitative approaches (Vermeeren et al., 2010). Similar to a formal mixed methods approach (Venkatesh, Brown, & Bala, 2013), using both

quantitative measures and qualitative inquiry yields a deeper understanding of the user experience (Barnum, 2011; Resnick et al., 2013).

Traditionally, formative methods arose during second wave HCI and the usability era (Barnum, 2011; Bødker, 2006; Downey, 2007). It is generally accepted that UX includes usability and thus researchers and practitioners currently use these methods applied to UX or third wave HCI even while there is recognition that new evaluation techniques are needed (Bargas-Avila & Hornbæk, 2012; MacDonald & Atwood, 2013, Roto & Lund, 2013; Tullis & Albert, 2013; Vermeeren et al., 2010). In third wave HCI, the aspects investigated have expanded beyond objective measures such as time on task or number of errors, to include subjective measures of emotions, values, motivations, culture, and a full range of other experiential items (Bargas-Avila & Hornbæk, 2012; Vermeeren, et al., 2010). Third wave HCI also values the holistic user experience (Bargas-Avila & Hornbæk, 2011; Hassenzahl, 2013; Law et al., 2014; Vermeeren, et al., 2010).

State of HCI and UX Evaluation

HCI and UX evaluation is varied and evolving (Bargas-Avila & Hornbæk, 2011; Barkhuus & Rode, 2007; Law et al., 2014; Vermeeren, et al., 2010). Barkuus and Rode conducted an analysis of CHI papers from years 1983 (59), 1988 (39), 1994 (70), 2000 (72), and 2006 (118). They reported a clear majority focused on quantitative approaches although in later years an increase occurred of "blended" approaches -- quantitative methods supplemented by some qualitative data. Qualitative approaches doubled from 2000 to 2006 but in 2006 only made up 14% with quantitative studies comprising almost 70% of the papers. While UX is part of HCI, the trend is opposite in UX. Bargas-Avila

and Hornbæk examined the UX literature (51 papers from 2005-2009) and found 50% utilized qualitative methods, 33% used quantitative methods, and 17% some mixture.

The current state of evaluation in UX contains multiple approaches and multiple perspectives (Bargas-Avila & Hornbæk, 2011; Law et al., 2014; Vermeeren et al., 2010). Vermeeren et al. identified 96 evaluation methods used in UX evenly divided into quantitative, qualitative, and mixed or blended approaches. Multiple constructs are also studied in UX. Bargas-Avila and Hornbæk's review of 51 papers from 2005-2009 produced ten UX dimensions (Table 3). The review also identified questionnaires (53%) and semi-structured interviews (20%) as the two most prevalent data collection methods.

Table 3

UX Dimensions Studied 2005-2009 (Bargas-Avila & Hornbæk, 2011)

Number	Dimension	Count/Percentage
1	Generic UX	27/41%
2	Affect, emotion	16/24%
3	Enjoyment, fun	11/17%
4	Aesthetics, appeal	10/15%
5	Hedonic quality	9/14%
6	Engagement, flow	8/12%
7	Motivation	5/8%
8	Enchantment	4/6%
9	Frustration	3/5%
10	Other	15/23%

Law et al. (2014) conducted a two-part assessment on UX measurement which consisted of 1) a review of empirical studies (similar to Bargas-Avila & Hornbæk, 2011)

to identify which UX dimensions were being measured, and 2) interviews and surveys on UX researchers' attitudes towards UX measurement. First, Law et al. reviewed 58 papers between years 2010-2012 and identified measured UX constructs. While 42 different UX dimensions were studied, 12 dimensions appeared with a frequency of two or more (see Table 4). All 58 studies utilized questionnaires or scales, validated or informal, to measure the UX dimensions.

Secondly, Law et al. (2014) investigated attitudes towards UX measurement of experiential qualities (EQs) using a combination of interviews and surveys, then categorized the EQs based on an adapted Components of User Experience (CUE) model from Thüring and Mahkle (2007). EQs were defined as feelings or emotional responses. Respondents were asked to identify EQs that were of professional and personal relevance and to assess the measurability of the specified EQ. Law et al. grouped the EQs into four categories:

- Instrumental Quality (IQ) - usability-inspired or system based, e.g., effectiveness, efficiency.
- Non-instrumental Quality (NIQ) - look and feel types, i.e., aesthetics, motivation.
- Short-term affective response (STAR) - relatively immediate subjective or physiological response.
- Long-term evaluative response (LTER) - extended time effects on system appraisal based on a user's behavior, attitude, and cognition.

Table 4

UX Dimensions Measured 2010-2012 (Law et al., 2014)

Number	Dimension	Frequency > 2	Notes
1	Flow	12	8 general, 4 multi-dimensional
2	Aesthetic/beauty	9	
3	Emotion	7	4 general, 3 multi-dimensional
4	Enjoyment	5	
5	Affect	5	3 general, 2 multi-dimensional
6	Arousal/valence	4	
7	Hedonic quality	4	
8	Intrinsic motivation	4	
9	Presence	4	
10	Engagement	4	2 general, 2 multi-dimensional
11	Attractiveness	3	
12	Satisfaction	3	

Table 5 displays the EQ results (includes engagement) from a small set of interviews (N = 11), and Table 6 displays the EQ results for the STAR category (includes engagement) from two sets of surveys (N = 135 total). Several EQs were assessed as both measurable and non-measurable providing further evidence of non-agreement in the HCI and UX communities regarding measuring UX dimensions.

Table 5

UX-EQ Dimensions – Categories and Measurability Results (N = 11 Interviews) (Law et al., 2014)

Category/Dimension	Measurable	Non-Measurable
Instrumental Quality		
Reliability	X	
Non-instrumental Quality		
Challenge	X	
Curiosity	X	X
Short-term Affective Response		
Engagement	X	
Flow	X	
Surprise	X	
Interested	X	
Disgust	X	
Fun	X	X
Long-term Evaluation Response		
Expectation	X	
Satisfaction	X	
Trust	X	
Connectedness	X	
Love		X
Happiness		X
Enlightenment		X

Table 6

UX-EQ Dimensions – STAR Category Measurability Results (N = 135 Surveys) (Law et al., 2014)

STAR Category Dimension	N Assessed as Measurable	N Assessed as Non-Measurable
Affect	2	
Arousal	2	
Delight	4	
Disgust	2	
Excitement	3	
Frustration	7	
Physical pain	2	
Stress	2	
Annoyance	2	1
Anxiety	1	1
Attachment	1	1
Emotion	6	5
Engagement	9	1
Enjoyment	12	1
Fear	3	1
Flow	5	3
Fun	9	10
Immersion	4	1
Joy	6	2
Pleasure	5	4
Surprise	7	4

Engagement appeared as an EQ in both the interview and the survey results and was categorized as a short-term affective response. It was assessed as measurable in the interviews (Table 5), and measurable in the surveys (nine respondents) and non-measurable by one survey respondent (Table 6). Bargas-Avila and Hornbæk (2011) categorized engagement and flow together whereas Law et al. (2014) separated these dimensions. From a positive computing aspect, Calvo and Peters (2014) tied motivation and engagement together. O'Brien and Toms (2008) based their work on engagement on theories from aesthetics, flow, and play. They asserted that flow and engagement overlap but that differences exist, e.g., intrinsic motivation significantly drives flow whereas engagement may occur even during suggested, mandatory, or necessary use of a system or application. According to O'Brien and Toms "flow requires sustained long-term focus" (p. 939) whereas engagement can occur in a more short-term period. Riva et al. (2014) suggested flow and presence as critical variables to drive design and development of positive technology at the eudaimonic level. Wiebe et al. (2014) compared engagement (UESz) to flow using the Flow State Scale (FSS) and found that the UESz and FSS were complementary in the video-game context but did note possible overlaps and lack of the UESz to adequately assess flow. The UESz appeared to better measure usability and hedonic qualities. Additionally, the UESz better predicted game performance (reaching a higher level) than the FSS.

Critique and debate on UX evaluation is prevalent. Since the rise of UX in 2000, two basic evaluation perspectives have emerged: the reductionists advocating for objective measurement and primarily quantitative approaches, and the holistic proponents favoring qualitative and subjective assessment (Law et al., 2014). Multiple definitions of

UX exist and multiple dimensions are studied, with some being defined and categorized in different ways (Hassenzahl & Tractinsky, 2006; Law et al., 2014; MacDonald & Atwood, 2013). Contemporary examination of UX constructs has identified a wide variety along with varied measurement (Bargas-Avila & Hornbæk, 2011; Law et al., 2014). UX and HCI researchers also utilize both ad-hoc and validated instruments with the latter occurring much less frequently even though many validated instruments exist from other fields that could be utilized (Bargas-Avila & Hornbæk, 2011). Lastly, third-wave HCI demands new approaches and new ways of thinking to include situated, cultural, emotional, and phenomenological aspects (Bødker, 2006; Harrison et al., 2007; MacDonald & Atwood, 2013; Roto & Lund, 2013). The methodology used in this study combined both quantitative and qualitative data collection to explore engagement with technology and the overall experience of technology-supported meditation. The research utilized validated instruments as well as semi-structured interviews. Phenomenological analysis was applied to interview transcripts. This diverse multi-part approach reflects a similar trend in early HCI research of well-being technologies, including technology-supported meditation.

Participants

Purposeful sampling from a local yoga studio was used to gather participants with a high probability of being interested in meditation that were able to offer informed perspectives on meditation as a phenomenon, and were able to provide information on the central questions of engagement and experience in technology-supported meditation. This approach aligns with phenomenology research as described in Creswell (2013). According to Vidyarthi and Riecke (2014), purposive sampling is most useful for

qualitative research; and especially appropriate in an HCI context when investigating progressive technology designs because informed and interested participants can provide important insights and highlight future possibilities for research.

The number of participants was originally estimated at 10-15 and the final count was 12. This number falls in the recommended range of 5-25 participants that have experienced the phenomenon being studied (Creswell, 2013). All participants had meditation experience and were adults drawn from one organization (local yoga studio) for convenience in obtaining owner permission and conducting the research in one location. Appendix E contains the demographic questions asked of each participant.

Protecting Participants' Rights and the Pilot Study

Because human participants were involved in this study, precautions were taken to protect their rights including identities. Names were not collected or recorded with the exception of the signature on the informed consent form. Participants were assigned an identification number (i.e., P1) which was listed on all materials associated with that participant. Each participant had an electronic and/or a paper file maintained and stored by the researcher. This included any observations and notes, demographic information, scale information, interview recordings, and interview transcripts. The research materials will be kept secure by the principal investigator and only available to Institutional Review Board (IRB) personnel, the dissertation advisor, or regulatory agency staff. The electronic recordings will be deleted after 36 months. Per university requirements, the planned interaction with participants, including the protocol, was submitted and received IRB approval (See Appendix D). This ensured the research was conducted in an ethically sound manner and human subjects' rights were protected. As is common in UX research,

no harm was anticipated to users from participating in research using software. A pilot study of the full protocol was conducted with one participant. This type of pilot is standard practice in HCI and was designed to identify any protocol issues including problems with instruments and process (Barnum, 2011; Downey & Rauch, 2008; Tullis & Albert, 2013).

Protocol Description

To begin, each participant was informed about the research, given the opportunity to ask questions and obtain answers, and then completed the informed consent form. Next, the participant answered the demographic questions and then the investigator conducted the pre-activity semi-structured interview. Following the pre-activity interview, the participant selected an avatar and also reviewed some explanatory information about Sanctuarium. Next the participant virtually walked the labyrinth and meditated in the virtual world Sanctuarium. The investigator was not in the room but watched the participant's screen via computer screen in another room. Once the meditation task was complete, the participant filled out the engagement rating to help understand the nature of engagement during technology-supported meditation utilizing 3D VWs. Next, the participant filled out the EOM-DM scale to assess the technology-supported meditation experience. Lastly, a semi-structured interview was conducted to obtain information about the participant's meditation experience in Sanctuarium.

See Appendix K for a detailed description of the research script which describes the protocol and the interaction with the participant. Overall, the time per participant was estimated at approximately two hours. The breakdown was:

1. Explanation of activity and informed consent (10 minutes)
2. Demographic questionnaire (5 minutes)
3. Pre-activity interview (30 minutes)
4. Selection of avatar by participant (2 minutes)
5. Review of explanatory information about Sanctuarium (5 minutes)
6. Meditation activity in Sanctuarium (20 minutes)
7. Post-activity engagement scale (10 minutes)
8. Post-activity meditation scale (10 minutes)
9. Post-activity interview (30 minutes)

The actual cumulative time per participant ranged from a minimum of 57 minutes to a maximum of 96 minutes. Average time per participant was 72.5 minutes.

Data Collection and Analysis Methods

Demographic Data

Participants filled out a one-page questionnaire (Appendix E). The investigator reviewed the data and where applicable noted frequency measures and calculated descriptive statistics. Participant demographics, along with meditation experience and preferences are described and summarized in Chapter 4.

Engagement Scale

To measure engagement, the UESz (Wiebe et al., 2014) was adapted and administered (see Appendix I). The UESz refined the UES which is a multi-dimensional

scale based on extensive research on engagement from multiple domains (O'Brien & Toms, 2010a). Due to the small number of study participants (N = 12), the UESz-m was not specifically validated in the meditation context but it was piloted to reveal any issues with its use. No issues emerged with the UESz-m. The research did not aim to validate and confirm, but to explore and formatively assess engagement. The UES is primarily aimed at engagement and was developed after a thorough investigation of engagement across the literature in multiple contexts, and with input from several domains: video games, shopping, web searching, and educational software (O'Brien & Toms, 2008; O'Brien & Toms, 2010a). UES evaluation included factor analysis (N = 440 adults during exploratory factor analysis and N = 802 participants ranging in age from 14 to 83 during confirmatory factor analysis), validity and reliability analysis (O'Brien & Toms, 2010a).

Originally applied in the e-commerce arena, further research utilized the UES to examine engagement with Facebook, in exploratory search, and in video games (Banhawi et al., 2012; O'Brien & Toms, 2013; Wiebe et al., 2014). These subsequent studies adjusted and refined the UES for their contexts and tasks but also generally agreed on reducing the number of dimensions from six to four by combining FI, EN, and NO into one dimension called Satisfaction. Wiebe et al. termed their revised UES the UESz, and concluded it better reflected the video-game domain including enhanced reliability (N = 413 adults). Video-games played a significant role in the history and in the current incarnation of VWs (Comas & Tschang, 2013) suggesting UESz as suitable to VWs. Video games and VWs share the characteristics of media richness and 3D interactivity. Appendix I provides a comparison of the UES and the UESz showing the collapse of

three dimensions to one resulting in a shift from six factors to four factors as well as removal of three questions, and assignment of two questions to different dimensions. The UESz demonstrated good validity and enhanced reliability (Wiebe et al., 2014).

It is common practice in HCI and UX to adapt scales and surveys (Tullis & Albert, 2013). This includes adapting instruments to a domain or task (Tullis & Albert, 2013). For example, the System Usability Scale (SUS) while developed to measure perceived usability (often equated with satisfaction) of software systems, has been simply adapted and applied to desktop applications, websites, voice-response systems, operating systems, consumer products, and even paper ballots in both formative and summative evaluations (Tullis & Albert, 2013). Wiebe et al. (2014) also adapted the original UES by substituting "game" references for the "shopping" references.

The UESz contains 28 questions covering four dimensions of engagement: Focused Attention (FAz), Perceived Usability (PUz), Aesthetics (AEz), and Satisfaction (SAz) (Wiebe et al., 2014). The original UES scale is publicly available and the researchers advocated further investigation and use in other domains. Following the example of Wiebe et al. in adapting the UES to video games, the UESz was adapted to the meditation task producing the UESz-m (via simple word substitution of "meditation" for "gaming"). Measuring engagement in VWs as an example of positive technology is a new application of the UES/UESz both in a formative manner and in the virtual world domain. Participants filled out the UESz-m after completing the meditation activity in Sanctuarium.

Meditation Scale

To measure perceived effects of the technology-supported meditation experience, the researcher administered the scale titled Experiences of Meditation During Meditation (EOM-DM) developed by Reavley and Pallant (2009). As with the UESz-m, the EOM-DM scale was included in the pilot test and no issues emerged. The scale contains five sub-scales: cognitive effects (CE), emotional effects (EE), mystical experiences (ME), relaxation (RE), and physical discomfort (PD) (See Appendix J). Reavley and Pallant developed two scales to measure the perceived effects of meditation – one during meditation (EOM-DM) and another focused on measuring the perceived effects of meditation in everyday life (EOM-EL). Only the EOM-DM was utilized as it can target the experience of technology-supported meditation directly following the meditation activity with Sanctuarium. The EOM-EL targets a longitudinal measure.

To develop the scales, Reavley and Pallant (2009) gathered input from meditation experts and teachers, conducted a literature review of different meditation perspectives, leveraged existing validated meditation-related instruments, and examined practitioner-based questionnaires (one non-validated and one open-ended). Evaluation for both scales included factor analysis, validity, and reliability assessment with a sample of adults all with some meditation experience ($N = 236$).

Both scales are aimed at assessing the quality of the meditation experience – regardless of the type of meditation so provide a way of comparing different kinds of meditation experiences and combinations of meditation methods. The EOM-DM was administered after the participant interacted with Sanctuarium. As best can be

determined, the EOM-DM has not been formally administered and reported on in the literature. As a result, this will be the first research application of the instrument.

Scoring Scale Data

Both the UESz-m and the EOM-DM use Likert scales. For UESz-m, the scale is a one to five point Likert scale with endpoints of "strongly disagree" and "strongly agree" respectively. The EOM-DM uses a one to six point Likert scale with endpoints of "almost never" and "almost always" respectively. Likert scales are commonly used in HCI and UX for both singular ratings and on questionnaires and instruments (Barnum, 2011; Tullis & Albert, 2013).

The creators of the UES, other researchers that used the UES, and the creators of the EOM-DM all approached scoring in the same manner (Banhawi et al., 2011; O'Brien & Toms, 2010a; O'Brien & Toms, 2013; Reavley & Pallant; 2009; Wiebe et al., 2014). Likert scale ratings for questions in each sub-scale were added and divided by the number of questions in the sub-scale to produce a mean score for the sub-scale. The researcher applied this same scoring method to produce sub-scale scores per participant and sub-scale scores across all participants for both the UESz-m and the EOM-DM. The UES and EOM-DM were designed as multi-dimensional and the sub-scales are distinct and cannot be merged to produce a composite score (O'Brien & Toms, 2010a; Reavley & Pallant, 2009). While Likert scale results are not strictly interval data, it is essentially standard practice in UX to treat them as such (Tullis & Albert, 2013).

Semi-structured Interviews on Meditation Experience

Semi-structured interviews are a technique used in qualitative research to help understand the how and why of a phenomenon or experience (Creswell, 2013).

Phenomenological research looks at the essence of an experience (Creswell, 2013) and RQ1 focuses on understanding the holistic experience of technology-supported mediation. Third wave HCI includes phenomenological aspects (Harrison et al., 2007). Qualitative inquiry is also highly used and valued in UX research (Bargas-Avila & Hornbæk, 2011, Law et al., 2014).

Zhang et al. (2009) argued that more qualitative methods are needed to understand how people interact with technology. Yoo (2010) identified the need for experiential computing approaches in IS which directly aligns with third wave HCI. Qualitative research is prevalent in UX and some researchers advocate that qualitative inquiry better supports design and evaluation for UX (Bargas-Avila & Hornbæk, 2011; Law et al., 2014). Recent HCI research on well-being technologies utilized qualitative approaches such as interviews and phenomenology (Piper et al., 2014; Vidyarthi & Riecke, 2014; Wadley et al., 2014). This study also applied the phenomenological methodology to analyze the pre and post-activity interviews to investigate the meditation experience as a phenomenon and from the experiential aspect of third wave HCI.

All interviews were digitally recorded then transcribed to facilitate data analysis (Creswell, 2013). The pre-activity interview was designed to lay a baseline for understanding participants' regular meditation experience. This aligns with looking at lived experience as a way to understand and support UX in third wave HCI (Bødker, 2006). See Appendix F for the pre-activity interview questions. The interview questions were semi-structured to capture broad concepts on reasons for pursuit of meditation. ways of learning meditation, feelings and perceptions after meditation, reasons to continue meditating, and any desired changes in meditation practice. This is more

structured than the general phenomenological approach of Creswell (2013) and Moustakas (1994) who suggested asking two broad questions on what the participant experienced regarding the phenomenon and what situations generally affected the participant's experience of the phenomenon (paraphrased from Creswell, 2013, p. 81).

The post-activity interview targeted the research questions on how technology supports and enhances meditation and the overall experience with technology-supported meditation using Sanctuarium. Appendix H lists the post-activity interview questions. As with the pre-activity interview, post-activity questions were semi-structured and did not adhere to the general suggestion of two broad questions on experience and context of the phenomenon (Creswell, 2013; Moustakas, 1994). The post-activity questions were designed to capture concepts related to understanding the differences or similarities between current meditation practice and the experience of technology-supported meditation using Sanctuarium, other technology uses in meditation practice, participant suggestions for designing a VW for meditation, and participant perception and understanding of Sanctuarium. However, the general categories of experience and context of the phenomenon were used to guide analysis of both the pre-activity and post-activity data.

Following analysis guidelines in Creswell (2013), interview transcripts were reviewed to identify significant statements – a process termed horizontalization. Next, these statements were grouped into themes. Once the themes were constructed and described (with quoted examples from the significant statements), the investigator created a composite textural description of participants' experiences ("the what"). Next, the researcher composed a structural description of the context in which the experience

occurred ("the how"). The final step involved combining the textural and structural descriptions to create a narrative that represented the essence of the experienced phenomenon. Moerer-Urdahl and Creswell (2004) provide an example of applying the Creswell (2013) guidelines. The investigator modeled the phenomenological analysis and results format after Moerer-Urdahl and Creswell.

The pre-activity and post-activity transcripts were analyzed separately producing results for the phenomenon of current meditation practice as background and context for the phenomenon of technology-supported meditation with Sanctuarium. Interview results were then compared to identify differences and similarities.

Integration of Results

The quantitative and qualitative results were integrated to provide a holistic view of the overall technology-supported meditation experience. The investigator analyzed all data outcomes (demographics, scale data, and interview data) and related the outcomes and identified supporting indicators to answer the three research questions. Detailed results and findings are presented in Chapter 4.

Validity and Reliability

Creswell (2013) outlined multiple strategies for validation in qualitative studies and recommended use of at least two per study. Strategies included: prolonged engagement and persistent observation; triangulation; peer review or debriefing; negative case analysis; clarifying researcher bias; member checking; rich, thick descriptions; and external audits. Sekaran and Bougie (2009) also identified triangulation and in-depth descriptions as appropriate validation mechanisms in qualitative research. For the given study three validation strategies were employed: triangulation (multiple types of data and

data collection); clarifying researcher bias; and rich, thick description (phenomenological approach). Two validated instruments were administered for measuring 1) the concept of engagement with Sanctuarium, and 2) the effects of the technology-supported meditation experience.

To address reliability, consistent and repeatable data collection methods were used, e.g., the same demographic questionnaire, validated instruments, and semi-structured interviews. One researcher conducted all the interviews and performed the subsequent analysis. Additionally, interviews were recorded using a quality digital recorder, and then transcribed by an independent professional transcriptionist to ensure accuracy and completeness of participant comments.

Summary

The study utilized an exploratory approach to investigate technology-supported meditation. The research examined participant engagement and the overall experiential aspect of technology-supported meditation. A formative blended methodology was applied, combining both perceptual measures and phenomenological research. Formative approaches are common in HCI and UX and used to conduct early assessments (Barnum, 2011; Downey, 2007; Shneiderman et al., 2009; Tullis & Albert, 2013).

The protocol was designed to reflect the strengths of current practice in HCI and UX and to address shortcomings. The research focused on third wave HCI that deals with experiential qualities such as emotions, values, and cultural aspects (Bødker, 2006). The methodology included the most common data collection methods in UX: surveys and semi-structured interviews (Bargas-Avila & Hornbæk, 2011). HCI and UX researchers have been criticized for not using available validated instruments, instead creating ad-hoc

surveys (Bargas-Avila & Hornbæk, 2011). Two validated instruments were administered: the UESz and the EOM-DM. The researcher conducted a pre-study with one participant to pilot the surveys, test the protocol, and test the VW Sanctuarium. No issues emerged.

Specifically, the research explored how technology supported meditation, enhanced meditation, and the level of engagement during technology-supported meditation using the 3D VW Sanctuarium. Using purposive sampling, participants (N = 12) were recruited from a local yoga studio. They interacted with Sanctuarium to perform virtual walking meditation and seated meditation. Data collection occurred at both pre and post-activity and included a demographic questionnaire, an interview on current meditation experience, engagement survey data, a survey on the perceived effects of the technology-supported meditation experience, and a final interview about the technology-supported meditation experience. The collection of different kinds of data (both quantitative and qualitative) gathered at different points and in different ways enabled a comprehensive picture not obtainable by any singular means.

Chapter 4

Results

Overview

This chapter describes the results of the research and includes sections on data analysis, findings, and a summary. The data analysis section describes the different types of data and the method of analysis. Quantitative analysis includes frequencies and descriptive statistics (Terrell, 2012) of the demographic data, the engagement scale, and the scale used to assess perceived effects of technology-supported meditation with Sanctuarium. Qualitative analysis was performed using a phenomenological approach to gain a deep understanding of technology-supported meditation. The analysis process is described and rich descriptions of the experience are presented including significant participant statements and emerging themes.

Findings triangulate the quantitative and qualitative results to answer the three research questions. The quantitative and qualitative results together provide a foundational picture of the nature of engagement using Sanctuarium and the overall experience of technology-supported mediation with Sanctuarium. The results of this formative multi-method exploratory study indicate a positive outcome for participants' engagement with Sanctuarium, as well as support and enhancement of their meditation experience while using Sanctuarium.

Data Analysis

Demographic Data

Participant data (N = 12 adults) was collected via a one-page paper demographic questionnaire (See Appendix E) and then transferred to a spreadsheet for comparison and calculations. This included the pilot participant data as no significant issues emerged with the process or instruments during the pilot test. One minor addition to the demographic questionnaire was the addition of a question asking the participant's profession. The only other changes to the research protocol were adding page numbers and a reminder to record start and stop times per participant.

Basic demographics included age, profession, gender, relationship status, and race/ethnicity. Median age of participants was 49 years with a minimum of 32 and a maximum of 75. Professions varied and included technology professionals (three) and also yoga-related professions (three). More women than men participated in the research (nine females, three males). Relationship status included four married, five single, two in a relationship, and one widow. Participant results for race/ethnicity were 11 Caucasian and one Black. Even though purposive sampling was used, participant demographics aligned with recent U.S. statistics on complementary and alternative medicine (CAM) which includes yoga and meditation. As reported in Suchday et al. (2014), women are twice as likely to practice yoga, meditation, and guided imagery. Statistics also indicate that in yoga and meditation practice, Caucasians significantly outnumber Americans of Black, Chinese, and Mexican race/ethnicity (Suchday et al., 2014).

All study participants had experience and interest in meditation. Participants reported a wide range of meditation experience with a minimum of eight months and a

maximum of 44 years. Median experience was 12.75 years. Eight of 12 participants had been meditating seven or more years. Half of the participants meditated daily. The median meditation time for all participants was 32.5 minutes with a minimum of 10 and a maximum of 40. Most participants practiced meditation alone (nine of 12). Participants also indicated varying preferences for self-directed or guided meditation (four self-directed, five guided, and three both styles). Appendix M provides detailed participant data in tabular form.

UESz-m Scale Data

Scale data was collected via paper surveys that were filled out directly following participant interaction with Sanctuarium. Participants completed both surveys within three to five minutes. The researcher followed instructions for scoring each sub-scale independently by calculating means for each individual sub-scale per participant, and also means across each sub-scale for all participants.

Appendix N provides detailed results of the UESz-m used to measure engagement while interacting with Sanctuarium. UESz-m sub-scales include Aesthetics (AE), Focused Attention (FA), Perceived Usability (PU), and Satisfaction (SA). Table 7 presents the individual sub-scale scores per participant and the sub-scale scores across all participants. Many high ratings occurred on different sub-scales across the individual scores. Even the lowest question average was relatively high at 3.92/5.0 (FA/Q7 – during the meditation experience I let myself go). The highest average question score across all participants was 4.83/5.0 (PU/Q28). Q28 was "I could not do some of the things I needed to do with Sanctuarium." Participants felt they were able to do what they needed to do during technology-supported meditation with Sanctuarium.

Each of the engagement sub-scale scores averaged across all participants was greater than 4.0 on a one to five Likert scale. The PU scale ranked highest with a score of 4.61/5.0. The AE, SA, and FA respectively scored 4.42/5.0, 4.29/5.0, and 4.15/5.0. Clearly this indicates a very positive rating for engagement among the 12 participants. Also of particular note is the FA sub-scale score since focused attention is an important aspect of meditation.

Table 7

UESz-m Sub-scale Scores (Likert scale of one to five)

Participant	**AE Score**	**FA Score**	**PU Score**	**SA Score**
Pilot	4.80	3.75	3.88	3.71
P1	4.00	4.50	4.75	4.71
P2	5.00	3.75	4.88	4.14
P3	4.00	3.88	4.88	3.71
P4	3.80	4.00	4.63	3.71
P5	5.00	4.13	4.38	4.29
P6	5.00	4.56	5.00	4.86
P7	5.00	4.88	4.50	5.00
P8	4.00	4.38	4.88	4.71
P9	4.00	4.00	5.00	4.00
P10	4.40	4.25	4.75	4.71
P11	4.00	3.75	3.88	3.86
All	4.42	4.15	4.61	4.29

Aesthetics (AE), Focused Attention (FA), Perceived Usability (PU), Satisfaction (SA)

EOM-DM Scale Data

Appendix O provides detailed results of the EOM-DM used to assess the meditation experience of technology-supported meditation with Sanctuarium. EOM-DM sub-scales include Cognitive Effects (CE), Emotional Effects (EE), Mystical Experiences (ME), Relaxation (RE), and Physical Discomfort (PD). Table 8 presents the individual sub-scale scores per participant and the sub-scale scores across all participants.

Table 8

EOM-DM Sub-scale Scores (Likert scale of one to six)

Participant	**CE Score**	**EE Score**	**ME Score**	**PD Score**	**RE Score**
Pilot	4.75	2.67	1.80	1.80	1.40
P1	5.25	2.83	3.00	1.60	3.40
P2	4.75	2.17	2.60	3.80	4.40
P3	5.00	2.33	3.60	2.80	4.20
P4	4.50	1.67	3.40	2.00	5.20
P5	4.88	2.17	4.80	2.00	3.40
P6	5.38	2.33	4.20	1.80	3.40
P7	5.38	2.17	1.60	4.40	4.80
P8	5.00	1.67	3.80	1.40	4.40
P9	4.50	2.17	4.00	2.60	4.00
P10	4.50	3.50	3.60	2.00	4.60
P11	4.38	1.67	2.80	1.20	5.40
All	4.85	2.28	3.27	2.28	4.05

Cognitive Effects (CE), Emotional Effects (EE), Mystical Experiences (ME), Relaxation (RE), Physical Discomfort (PD)

Scores varied across individual sub-scales, and across the averaged sub-scale scores for all participants. The CE sub-scale score averaged across all participants was the maximum with a relatively high rating of 4.85/6.0 on a Likert scale of one to six. The highest average question across all participants fell in the CE sub-scale (Q21 – my mind was alert but still). According to discussion in Reavley and Pallant (2009), the CE factor is most likely representative of the mindfulness dimension of meditation – being aware and in the present without judgment. The EE and PD sub-scales appear to be measuring the negative effects of emotional interruptions and physical discomfort which would generally not be desirable during meditation. So a lower score on the EE and PD sub-scales is more indicative of a positive outcome, especially for experienced meditators. The EE and PD sub-scale scores across all participants were both 2.28/6.0. The RE subscale across all participants measured relatively high with a 4.05/6.0. The remaining sub-scale, ME, was quantified slightly above the midpoint with a 3.27/6.0. Overall, relatively high ratings on CE and RE, combined with relatively low ratings on the negative sub-scales of EE and PD, plus a medium rating on ME, indicates a positive trend on perceived effects of meditation using Sanctuarium.

Of note are some possible issues with the EE and the PD sub-scales. Participants were fairly consistent with low scores across 5/6 questions in the EE scale. One question was consistently rated with a high score (Q3 – had thoughts or memories which produced an emotional response) which suggests it may need to be examined as a candidate for reverse coding. The same situation appeared for the PD scale where participants were generally consistent across 4/5 questions with low scores, with one question receiving generally consistent high ratings (Q20 – desire to smile or laugh). Again Q20 may need

to be examined as a candidate for reverse coding. Q20 is related to a physical reaction and did positively load on the PD factor during factor analysis by Reavley and Pallant (2009). However, it is different than the other questions in the PD sub-scale which pertains to physical discomfort. Q20 is also a compound question. Smiling may generally be perceived as less disruptive during meditation than laughing. Perhaps Q20 received a high scored based on the word "smile." However that is not discernible due to the compound nature of Q20. That said, Q6 (desire to cough, sneeze, scratch, or swallow) in the PD sub-scale while scoring low, is also a compound question. These issues did not emerge during the pilot test because the researcher did not formally score the results until all participants were complete. She generally reviewed the demographic questionnaire and surveys for participant completeness.

Pre-Activity Interview Data

Pre-activity interviews ranged from 6.27 minutes to 17.05 minutes with an average of 11.59 minutes. After three rounds of reviewing the interview transcripts resulting from five questions, the investigator identified 140 significant statements and seven themes. The themes included: definition of meditation, motivations for meditation, learning meditation, teaching meditation/serving others, effects of meditation, realizations of meditation, and challenges and changes to meditation practice. Table 9 provides the themes with example significant statements. Appendix P contains a listing of the 140 significant statements grouped by theme. In the remainder of this section, the phenomenological analysis is described. Next, the thematic descriptions are presented followed by a composite textural narrative and a composite structural narrative. The

section ends with a holistic description of the essence of the current meditation practice of the participants.

Table 9

Pre-Activity Themes and Sample Significant Statements

Theme	**Sample Significant Statements**
Definition of Meditation	Achieving an inner calm and sense of focus, and ability to shut out the distractions of the outside world; to elevate one's consciousness beyond the mundane day-to-day concerns of life and to sort of free flow and do some creative sort of subconscious thinking. And that's what meditation is – it's an inward journey…you really don't need to be looking outside of yourself to, you know, tap into your creative and intuitive power. I mean, it's there. The idea is by taking that journey inward you can watch the boundaries disappear.
Motivations for Meditation	Basically to reduce anxiety and stress level and later it blossomed into more of a spiritual exploration. So clearly in both cases it was really to come to an inner sense of calm or peace. For peace of mind and ability to focus in the moment and to become more centered and less being caught in the past or in the future; trying to stay in the moment.
Learning Meditation	Well, it was a recommendation on the part of a mentor, and I actually joined the group in New York City that met on a monthly basis and it was guided meditation. And in between monthly events I did individual meditation. Guided meditation involved visualizing, learning the chakra colors in sequence through the body. But I would say that those things all influence it – you know, reading about it, doing the series through the Institute that they do (e.g., Oprah Winfrey series), and then through yoga, just seeing like, well, I can take a mantra and just focus on that or just, you know, that type of stuff.

Theme	Sample Significant Statements
Teaching Meditation/ Serving Others	And I also teach some other groups. I teach seniors. I teach rehab groups. I teach some substance abuse groups. So it's important for me to learn… But I feel called through teaching to serve and so then I keep saying yes to that rather than protecting multiple hours in the day.
Effects of Meditation	I feel much myself. I don't know how to explain it. It's like grounded and present and just there's a lot of clarity. There's a lot of clarity. I can just like see things a lot more clearly. And, yeah, I would say and peaceful, tranquil. Sometimes I experience a lot of joy afterwards. Sometimes it's just a very quiet like steadiness. I get a sense of like deep contentment. I feel as though I've come into balance not only within myself but with what's around me. I feel a sense of harmony. I feel peace. It's funny; sometimes I feel like I'm floating, you know, when I do that and it's going to this blissful state. It kind of makes me feel good about being me at the time. You know, I feel like I'm a better person now that I've meditated, because it takes away so much of the nonsense that we usually have on our minds during the day, and the chatter and, in my opinion, insignificant thoughts, you know. So it suddenly shifts everything into another perspective. So I feel more at one, if you will, more at one with nature and myself and everything around me.
Realizations of Meditation	You know, this isn't about me. And I credit the meditation for enabling me to get to that spot. But when I was able to center with my breathing and say, Hey, I have compassion for you. You know, it was just being able to breathe and contain my center made what could have been a really ugly situation something that could be resolved. So I would say that because of the meditation – and I didn't start out that way – I could directly see benefits to what I was doing on the side in my practice to how I changed as an individual, especially in the work environment. What I learned was that in meditation there's an alignment that takes place. When I'm in alignment with my soul and not like out of balance or something then I'm open. But I have learned now to put myself into alignment without having to spend a lot of time to get there.

Theme	Sample Significant Statements
Challenges and Changes to Meditation	And I feel that if I focus a bit more on it and put a little bit more structure into it I think I might get more out of it, as opposed to the unstructured second nature thing which has sustained me for quite a while now. Now, getting back into it as a regular practice is something that's been on my mind a bit and… that getting into a little bit more structured meditative work would be beneficial to me getting to the next level. I think the only thing that I would like to do is have a more designated place in my home, you know, than I do. It would be a place where I would have, you know, my cushion and candles and incense and where I could just let nothing else happen there except sitting and meditating; totally dedicated space.

As described in Chapter 3, the investigator followed the Moerer-Urdahl and Creswell (2004) procedure for phenomenological analysis that was adapted from Moustakas (1994). Because the researcher has an interest in and currently regularly practices meditation, she included reminders in the research protocol to "bracket" or set aside her own experiences as much as possible in order to conduct the interviews (Creswell, 2013; Moustakas, 1994). Bracketing or epoche is a way of consciously acknowledging specific experience, perceptions, and judgments of the phenomenon being investigated, in order to mitigate personal assumptions and biases (Creswell, 2013; Moustakas, 1994).

To bracket the researcher's meditation experience during analysis, she delayed reading the transcripts for a few weeks following completion of the research. This allowed her to view the participant responses anew. She began by reading the pre-activity interview transcripts on current meditation practice all the way through without performing formal analysis – although she did mentally note some repetition of concepts such as participants desiring more consistency in their meditation practice, a dedicated

space for meditation, and the use of some technology across different participants (e.g., CD's, mobile phones, podcasts). During the next two rounds of review, significant statements were identified and duplicates were culled. Lastly, the researcher grouped the statements into themes. After determining the themes, the investigator formulated a textural description, a structural description, and a final composite description of the essence of participants' meditation experience. For easy reference in the subsequent themes and narrative descriptions, the participants are referred to using "P" plus either P for pilot participant (e.g., PP) or "P" plus the participant number (e.g., P1).

Definition of Meditation: The semi-structured interview questions did not specifically ask about the definition of meditation but early participants' definitions emerged. In later interviews the researcher queried deeper into participants' definitions and views on meditation when a participant began to offer that type of information. Participants offered descriptors like focused, non-distraction, centered, connected, intentional, peace, and calm. P7 (least experience meditating) summed up meditation as "Achieving an inner calm and sense of focus, and ability to shut out the distractions of the outside world; to elevate one's consciousness beyond the mundane day-to-day concerns of life and to sort of free flow and do some creative sort of subconscious thinking." The notion of centeredness was especially highlighted among interviewees. P2 (most experience meditating) shared that she felt centered and calm after meditating then defined centered as "Knowing that whatever's going to happen will be okay. Knowing that yes I can control some things but there's a lot of things that I can't, and recognizing what I can and can't. And sometimes it's hard, especially if you're Type A, not to try to…I liken it to instead of being in the situation you're kind of watching the

situation unfold. And in a way it gives you a better control because you're not reacting. And that's because you're here in yourself saying, 'Okay, let's let this unfold and see what's going to happen." Being with yourself, inside yourself, connecting with yourself, or to some higher power or the divine emerged as an important dimension in meditation. After sharing his view that anyone has the power to tap into their higher power or higher self, P4 defined meditation as: "it's an inward journey…you really don't need to be looking outside of yourself to, you know, tap into your creative and intuitive power. I mean, it's there. The idea is by taking that journey inward you can watch the boundaries disappear. Alright? So it's a path to oneness." Participants also offered views on spiritual versus secular meditation as well as kinds of meditation. Secularization of meditation has made it more accessible to those not seeking the spiritual path allowing motivations such as stress-relief (motivations are discussed as a separate theme). The relationship between meditation and prayer surfaced but took varying perspectives. Some participants felt strongly that prayer and meditation are different. P2 offered this reflection: I used to go to Notre Dame and I'd just sit and reflect at the rose window. I mean, that was my meditation. So, you know, some people might think it's prayer but I don't think I was praying; I think it was more meditative." P10 described his view: "I believe meditation's very different from prayer but I think that just the general overall mindfulness and attitude about spirituality has enabled me to learn more about myself through prayer and meditation, which are very different things now." While P11 blended the connection between prayer and meditation this way: "Well, my meditation was part of a spiritual practice. … I mean, the meditation I'm doing now is very different than the meditation I came from before. It was very much a form of prayer for me – which it is

now but it's very different . . ." Finally, participants mentioned several types and styles of meditation such as breath-focused, object-focused, guided, candlelight meditation, reflection, visualization, chakra-based, Kundalini-yoga based, and slipping into meditative states throughout the day. While some differences arose across these different styles, overall participants were open to different perspectives and focused on the positive outcomes of meditation. P2 offered this experience to demonstrate that view: "But I have found that if you are working with the general population and they haven't been exposed to meditation, having something to ease them into total quiet is a good way to go. And part of that was for myself, I found when I was the most stressed at work if you asked me to sit, my mind was goofy. If I could visualize something or a take a little voyage in a calm place I was able to get to a place of peace quicker. So I know that, you know, real true yogis would say that's cheating, but, you know, as far as I'm concerned whatever works for you."

Motivations for Meditation: Motivations included pursuit of a spiritual path, living in and appreciating the present, harnessing the power of the mind, seeking inner calm and peace, self-reflection, seeking answers, connecting with a higher power, and dealing with and reducing stress or other physical aspects. For most participants, it was a combination of multiple motivations. PP combined spirituality and harnessing the power of the mind with this commentary: "So the reason that you meditate is to get in touch with the nature of mind, you know. And eventually you can drop, you can let go of all your thoughts, your emotions, your habits, your… all these things that are in the way of being in touch with the nature of mind….. [meditation is a tool you use] in order to make progress on the path." P11's motivation combined spirituality, balance, and health issues

with the following description: "I started pursuing it much more intentionally from a Buddhist perspective for both devotional purposes but then also like to really kind of rebalance things out, because I was under extreme stress and experiencing a lot of severe health conditions at the time, including a potential diagnosis with lupus…" The concept of self-care was strong across multiple participants including managing thoughts, health, and choices. P2 described her motivation in this way: "Basically to reduce anxiety and stress level and later it blossomed into more of a spiritual exploration. So clearly in both cases it was really to come to an inner sense of calm or peace." P3 combined grounding, connecting, and being present with this description: "Just as a way of giving me a grounding… foundation. Just a connection. Just a connecting…To a higher power, to the divine. So meditation is a good way for me to stay present and in my body, that type of thing." P4 was more singular in focus and offered this perspective: "And in terms of tapping into your higher power, higher self, meditation is highly recommended for that purpose." P5's description covered several of the motivations while also relating it to everyday life: "You know, there's always the need to quiet your mind and to really see things, and so it helps me to be more open to the spirit world, I guess, and to spiritual awakening overall… Just a sense of calm. And like one of the other reasons I think I kind of really started to pursue it is because when I would start to feel a sense of anxiety - …. okay, I'm stressed, I'm whatever – the mindfulness thing really came to be something I learned about and I started to say, okay, that's something I can do at any given time and just start to take a breath and figure out why do I feel what I feel now." P7 also described a combination of motivations but without the "divine" or spiritual aspect – "For peace of mind and ability to focus in the moment and to become more centered and less being

caught in the past or in the future; trying to stay in the moment." All participants described some type of "seeking" or inward or reflective journey motivated by a variety of factors. That included even an accidental motivation to begin a journey as described by P9: "I actually sort of fell into it. I, if you will, had a sort of an awakening, I think, years ago and I realized… I took a yoga class and I realized that all of these years that I had been running away from myself. What I really needed was to go within."

Learning Meditation: Participants reported varying methods for learning about meditation and learning to do meditation. These included self-study with books and articles, listening to CD's and podcasts, studying with a mentor, taking specific classes for meditation (and mindfulness based stress reduction - MBSR), participating in group meditation, and completing yoga teacher training. P10 shared a learning-through-doing approach which was tried after he really found he enjoyed guided meditation: "So that led to me experimenting more with just trying to find a place at home to be still and quiet and personal meditation, which wasn't necessarily guided or anything really more than just trying to be still and quiet." P5 shared an example that included multiple learning approaches and mentioned technology: "But I would say that those things all influence it – you know, reading about it, doing the series through the Institute that they do, and then through yoga, just seeing like, well, I can take a mantra and just focus on that or just, you know, that type of stuff. And then also when Oprah Winfrey and Deepak Chopra started doing those meditation series… Each series follows a theme and each day you have a mantra or you have a centering thought. And so what I try to do… With those two I do it in the morning usually, so kind of get the day started, even if it meant waking up a little earlier. And then I would usually write down in my planner for the day whatever the

centering thought is or try to go back to it later in the day and…" While all participants had meditation experience, some considered themselves to be "still" learning as well as one participant still not sure he had learned yet even after multiple years meditating. Those with specific meditation training, yoga training, and yoga teacher training were confident and eager to share their experiences. P6 shared this recollection: "I tried a lot of different yoga. But Kundalini yoga really resonated with me and I was actually able to do it, you know. It's not like vinyasa where the body… I mean, my body just doesn't work like that. But Kundalini yoga I could do almost everything. And breathing. A lot of the postures or the kriyas are seated, and…" P8 described her yoga teacher training and other specialized meditation training which aptly demonstrates instructional approaches and learning-by-doing: "And so then when I took the yoga teacher training I did learn more about it. I had two very good teachers and a lot of other outside influences during that training and I began to get comfortable with it and learn that I could do it. So during those nine months of the teacher training I learned a lot and tried to begin on a regular basis and I have managed to continue fairly well since then….. P8 went on to describe use of technology and a description of a very specialized training: "And I've also sort of gotten into the online versions; mainly like through podcasts…I [also] took a course at Duke Integrated Medicine and it was for therapeutic yoga for seniors. And so part of that was devoted to some meditation and it was nice because it was in a different location. They use some different venues. It was more of a group setting. And I love the way they use different sort of goals and objectives through that meditation. So that was a whole different sort of exposure from another side." Overall participants sought out multiple methods and discovered what worked best for them – reinforcing the

overarching concept of an individual meditation journey. Through the various narratives, participants also displayed an openness and appreciation for trying different approaches and an eagerness to gain more meditation knowledge.

Teaching Meditation/Serving Others: The other side of learning meditation is teaching meditation. Five of the 12 participants had progressed to the point of not only being expert meditation practitioners but also teaching meditation, teaching meditation with yoga, or teaching meditation as part of spiritual healing. Tightly coupled with the desire to teach was also a desire to serve others. PP put it this way: "…I've been stamped on the head as an instructor, so now I'm holding classes in meditation. But all of it's motivated by this wish to benefit beings and to… You know, Buddha Chitta is to become enlightened for the benefit of beings and that's what my motivation is." P4 expressed the following view that demonstrates the connection between teaching meditation and making a better world: "Over the years, though, I've been actively involved in a course in miracle study and other studies and what it's really come down to for me is that what I teach – what I call trinity healing – is a practice that's focused on personal empowerment. It's non-dogmatic. It's for everyone. And if you really do want to help the planet you really have to shift the vibration of everybody on the planet, which means you want to make these types of practices accessible." The notion of sharing knowledge and helping others was consistent among the meditation teachers. P8 talked of learning and teaching yoga and meditation in order to share with various groups such as seniors, rehab groups, and substance abuse groups and to give her daughters some tools to help deal with the vulnerable teenage years. Finally, two participants were surprised to have become teachers but even then the desire to share and help was apparent. P2 decided she had so

much training for herself, that she could share it with others and pursued yoga teacher training including meditation. She described herself as a "defense contractor by day and a yogini by night." P11 said she never expected to become a teacher but after intense study for multiple years and even considering becoming a monk, she felt "called through teaching to serve."

Effects of Meditation: Participants richly described how they felt after meditating. A shared vocabulary easily emerged and included terms such as peace, calm, clarity, relaxed, connected, awakened, focused, present, and content. Participants experienced these effects in various combinations. P3 offered this simple but descriptive statement: "I feel very relaxed, connecting to what's around me, connected to people around me. I feel very present." P7 shared her experience this way: "I usually feel very good, just like I usually feel very good after yoga or after a workout. There seems to be a sort of a residual cleansing effect, like a lightness almost." When pressed for other adjectives she added: "light, unencumbered, supple, strong, and alive." Participants described being calm and peaceful while also awake and alive. Experiences such as a blissful state, joy, happiness, and feeling complete were also communicated. P9 shared a very detailed account of her feelings after meditation that touched on several of the shared concepts but also highlighted the path to becoming a better person: "I feel as though I've come into balance not only within myself but with what's around me. I feel a sense of harmony. I feel peace. It's funny; sometimes I feel like I'm floating, you know, when I do that and it's going to this blissful state. It kind of makes me feel good about being me at the time. You know, I feel like I'm a better person now that I've meditated, because it takes away so much of the nonsense that we usually have on our minds during the day, and the

chatter and, in my opinion, insignificant thoughts, you know. So it suddenly shifts everything into another perspective. So I feel more at one, if you will, more at one with nature and myself and everything around me." A feeling of clarity, sense of purpose, and deeper insight were also reflected in the responses. P9 offered this experiential description: "Well, I usually feel more peaceful. I feel more serene. Oftentimes, I feel as if I know what my purpose is, at least for that day, just in terms of specific activities. So often when I begin meditation there's not much clarity in my mind, I would say. My mind is moving and, you know, active, but it's not focused. So I'd say I feel more focused and I feel more directed." Finally, P11's description captured the variety of effects but also different ones at different times: "I feel much myself. I don't know how to explain it. It's like grounded and present and just there's a lot of clarity. There's a lot of clarity. I can just like see things a lot more clearly. And, yeah, I would say and peaceful, tranquil. Sometimes I experience a lot of joy afterwards. Sometimes it's just a very quiet like steadiness. I get a sense of like deep contentment."

Realizations of Meditation: Closely related to effects of meditation and motivations for meditation, are participants' realizations as a result of meditating. These include realizations during and after meditation, crediting meditation for behavioral changes such as coping with difficult situations, and important self-discovery aspects. Realizations also included recognizing positive outcomes of meditation driving continued meditation practice. Beginning a day with meditation makes for a better day. According to the PP: "When I start my day with my 45 minutes of meditation I end up with more focus. I have insight, things go smoother. You know, it's not really anything you can put your finger on but it's a better day." While P10 considered meditation part of his

recovery program, he also viewed it as a necessary daily reset. Meditation is self-care and healthcare. As shared by P5, meditation is "something that I want to have as part of my life, like exercise or anything else, like, you know, healthy eating, exercise… So it's a self-care type of thing… Just like I want to go to the spa regularly." P6 believes meditation is essential and "is like food." P4 professed that "meditation is now like breathing….It's like second nature." Meditation realizations also included the concept of knowing yourself better, and becoming a better self or person. P4 stated that "meditation helps her be a better person, one that does no harm; that strives to make the world a better place for everybody; is kind." P3 viewed meditation as "a way that I can get clear as to who I am and whose I am." Knowing yourself better also encompassed the notion of exploration and not judging yourself too harshly. P2 shared a vignette of a time when she was feeling insecure and having self-esteem issues and that during a meditation session she "felt like I met my inner self, who said, 'It's okay. Give yourself a break.' But when I'm doing a lot of meditation, that intuition, that person, that being – whatever it is – that energy… I don't know what to call it but that's what speaks to me and says it's okay." Several participants also credited meditation for behavioral changes in daily life and work situations. P2 credited her meditation practice with helping resolve a specific ugly work situation in which a co-worker was blaming and attacking her. She was able to "step outside herself" and have compassion for the co-worker. P4 stated that meditation has played a transformative role over several years: "And I will tell you that over the last three decades I went from being a fairly stressed out individual to being much more Zen. I've been described as being very Zen. And I just am less at the effect of the stresses of the world, mainly because I don't give a crap! But I think the spiritual discipline of

meditation, yoga… Like I've let go of a number of vices – alcohol, cigarettes – you know, I've had challenges with over the years, but it's all part of a multifaceted lifestyle shift, and meditative and healing arts have certainly been important in that." Lastly, realizations included the need for continued balance, alignment, and harmony and how these properties positively manifested in their daily lives. P6 addressed it this way: "What I learned was that in meditation there's an alignment that takes place. When I'm in alignment with my soul and not like out of balance or something then I'm open… And if I keep a meditation practice then I'm able to more stay with the mindset of just observe and not judge…" Lastly, P11 provided a perspective that brought several of the realizations together beginning with balance: (1) [meditation] "keeps me in balance. I'm a pretty intense person. My partner describes me as like driving the motorcycle 100 miles an hour all the time. Yeah, so I needed to keep myself in balance because my mind is naturally very intense and very extreme. And so it's to keep myself in check. (2) It's also connecting me to something deeper for me. It's a very spiritual practice. So it's connecting me with source. And it's taking time for that. And then (3) by connecting with source and balance like I also get a lot of deep insight into like just the nature of life and most importantly the nature of what's happening with me, like how are things happening and just like a lot of clarity of seeing how things are, how I'm showing up in the world, how I may be getting triggered by certain things, how I can start to shift patterns. Yeah."

Challenges and Changes to Meditation: The final theme combines challenges and changes to meditation as there was a distinct overlap among responses. The major challenges centered on the problem of distraction and quicker focus, and finding more time to meditate. For changes, participants expressed a desire to meditate more often and

consistently, and to create a designated or dedicated space for meditation. On the topic of distraction and quicker focus, P5 framed the issue thusly: "The hardest thing for me is to really relax and quieten my mind. It really is difficult. It's so hard for me to just be still because I am sort of that Type A. So that would definitely help me be better at meditation if I could just really start to let go. And I think that's a vulnerability thing, you know." P6 acknowledged that focusing can be very difficult and sometimes thoughts just will not stop coming. She shared that when that happens she just takes a break, or a walk then resumes later. P9 also mentioned she is easily distracted and sometimes has issues with quieting the mind so she uses guided meditation during those times to help her focus. She also wanted to attain the focus quicker and found that challenging at times.

Turning to the shared challenge and change of finding more time to meditate, participants talked of hurdles that included busy work and family life and needing to make meditation a priority. PP offered this response: "So the only thing is I wish, you know, I wish I could arrange my life to build in a couple of sessions a day rather than just one and have more time for the other practices that we do, which are with mantra and visualization and so on." P7 spoke of the difficulty of a consistent meditation practice and fitting everything in "with a full-time job and kids." P1 added an independent dimension: "Well, definitely doing more on a more regular basis and more self-directed; being able to do it on my own." Even when making a priority or commitment, P2 shared this struggle: "If I'm sitting in a traffic jam I breathe more now. So it's more like throughout the day I pull the techniques rather than sitting solidly for 30 minutes. So when I'm feeling disciplined I will say, 'Okay, I'm only going to do 10 minutes a day and I'll do that.' But that usually only lasts for so long, because my schedule's such that

it's hard for me to commit to a specific time to just say I'm going to do it." She lamented she wished she was "more diligent and less sporadic" and then shared a humorous story about having a mobile mindfulness application that reminds her three times a day but if she is on a task she may ignore it multiple times that day. P4 shared the desire of more structure and consistency in his meditation practice: "And I feel that if I focus a bit more on it and put a little bit more structure into it I think I might get more out of it, as opposed to the unstructured second nature thing which has sustained me for quite a while now. Now, getting back into it as a regular practice is something that's been on my mind a bit and…, that getting into a little bit more structured meditative work would be beneficial to me getting to the next level." The other change mentioned by some of the participants was creating a meditation space. P3 described it this way: "I think the only thing that I would like to do is have a more designated place in my home, you know, than I do. It would be a place where I would have, you know, my cushion and candles and incense and where I could just let nothing else happen there except sitting and meditating. Totally dedicated space." P6 shared her vision: "Well, I've thought I'd like to have a nice little room, [scarlet] Buddha here and some nice plants and a water feature and all that. P8 blended consistency and space: "I know I keep telling myself I'm going to, you know, kind of create a space that's more conducive to it in my home, but again that hasn't happened yet. So there are things I know I can improve. I can improve consistency of time, consistency of space or landscape, if you will."

Textural Description of Participants' Meditation Experience: Participants described their meditation practice as a journey or on a path – seeking and learning. While each interviewee offered a unique story of their meditation journey and practice, a

shared experience emerged. The definition, motivations, and effects of meditation included overlapping descriptors such as focused, non-distraction, centered, connected, intentional, present, peace, and calm. The concept of being centered and grounded was stressed by participants. Motivations were secular such as a desire to relieve stress or harness the mind; spiritual as in seeking a connection with yourself, others, or the divine; or some combination of both.

Meditation led to positive effects and realizations that included clarity of thought, deep insight, harmony with others and nature, feeling awakened and alive, unencumbered, having compassion for others, joy, contentment, and being a better person. The notion of self-exploration and becoming non-judgmental of yourself and others was apparent. Participants sought and achieved balance, alignment, and harmony within themselves and the world around them. They felt they were better able to appreciate and live in the present. Meditation was viewed as an important aspect of self-care and self-compassion, as well as a mechanism for self-betterment leading to improved relationships with others.

Structural Description of Participants' Meditation Experience: Participants experienced meditation in multiple ways. Some preferred self-directed and private meditation while others enjoyed guided meditation alone or in a group. Meditation occurred at home, in yoga and meditation classes at studios, sitting in the car, at the office, or other non-home venues. Some participants expressed the desire for a dedicated home space designed for meditation. Learning methods included self-study, group meditation, guided meditation both in person and with technology such as podcasts or recordings on tapes and CD's, and formal meditation and yoga instruction, including

teacher training. For almost half the participants, meditation also included teaching and serving others. Several of the teachers had mentors or meditation or spiritual experts that provided guidance and support.

Different styles of meditation were utilized such as breath-focused, visualization, mantra-based, and object focused. Meditation occurred as a dedicated event to start the day or at scheduled dedicated time intervals generally 20-40 minutes in duration. Conversely meditation also occurred in small increments throughout the day. Flexibility and appreciation of different approaches appeared to be an example of acceptance and being non-judgmental. Challenges and desired changes centered on finding ways to cope with distraction and quiet the mind as well as finding more time and being more consistent in their meditation practice.

Composite Description of Participants' Meditation Experience: Meditation is a continuous journey that involves seeking knowledge of yourself, learning about yourself, and understanding how you relate to others and the universe. It involves self-regulation, learning to focus, finding balance in your life, living in and appreciating the present, and developing a non-judgmental perspective. The benefits of meditation are many including clarity of thought, sense of purpose, stress reduction, connection with a higher power, improved relationships, self-betterment, and compassion for yourself and others. Meditation occurs in many forms and can be practiced in multiple ways, both individually and in a group, at home, at work, or in nature. Yet there is a common experience of feeling centered, grounded, connected, and calm. Meditation can build resiliency in dealing with everyday life and bring joy, contentment, and a sense of harmony within and without. The essence of meditation is exploration and discovery

while practicing self-care for the mind, the body, and the spirit that not only improves practitioner well-being, but makes a positive difference to others.

Post-Activity Interview Data

Post-activity interviews on technology-supported meditation (TSM) with Sanctuarium ranged from 7.32 minutes to 20.67 minutes with an average of 11.3 minutes. After three rounds of reviewing the interview transcripts resulting from seven questions, the investigator identified 175 significant statements across five broad themes. The themes included: previous technology use, design-driven experience of TSM, design suggestions for TSM, effects of TSM, and facilitation of meditation. Table 10 presents the themes along with examples of corresponding significant statements. A full listing of post-activity themes and significant statements is provided in Appendix Q.

As with the pre-activity interview analysis, the researcher bracketed her own meditation experience during analysis of the post-activity interview transcripts. The research protocol contained reminders to bracket her experience before conducting the post-activity interviews. The researcher conducted the post-activity analysis following the pre-activity analysis which allowed considerable time between the interviews and analysis, encouraging a "fresh perspective." The investigator also had the opportunity to learn from the bracketing process during the pre-activity analysis.

In the remainder of this section, the thematic descriptions are presented first. Next, both a composite textural narrative and a composite structural narrative are provided. The section ends with a holistic description of the essence of participants' technology-supported meditation experience using Sanctuarium.

Table 10

Post-Activity Themes and Sample Significant Statements

Theme	**Sample Significant Statements**
Previous Technology Use	iPhone app, Insight Timer, Dharmaseed, That's a lot of talks and guided meditation. And I use that as regularly… For meditation I might put in my earphones and listen to the talks. I use this pretty much every morning just because it helps me to stay… you know, helps me stay focused. I have like an app on it that's a timer that will sound like a gong. Guided meditation tracks at times.
Design-Driven Experience of TSM	And then the sound was quite relaxing. It was, you know, jungle noises and water and… You know, it was quite nice. And I could really relax into, you know, and just imagine I was walking along and see the bamboo go by. And the butterflies were a nice touch. I found it different from what I've done before. So it was a total new experience. I was totally fascinated by all the visuals that were there as she was walking the path. To be honest I got really taken… I mean, you know, I picked up on the bamboo beside her and looking at her path and, and, you know, when you went by wherever the Tibetan bells chimed, you know, the butterflies that came out…
Design Suggestions for TSM	Or just have the avatar start with leading them into their breath….And then just go into it so that the avatar's not directing their breath. So they get into their breath before they actually start on the journey. Maybe just to give people different choices…you might hike up to an alpine lake....An underwater one for someone who's into scuba; that they would, you know, swim down to some, you know, great coral reef and look at the fish ... another one might be like someone who's into flying; that they would actually fly up through clouds and, you know, sort of just glide around over a nice green earth.

Theme	Sample Significant Statements
Effects of TSM	Good. Relaxed. Still; calm…positive emotions and sort of a feeling of accomplishment…
	However, I felt the sense of clarity after the meditation, so I kind of feel like I heard more sounds coming back, noticed more plants and flowers that I hadn't noticed in the beginning.
Facilitation of Meditation	First timer or an early meditator combining it with this could really help them get the focus a little bit better.
	I wasn't sure what to expect. So I felt actually the whole experience to be somewhat meditative. Even the walk to the center of the labyrinth to me was very meditative. I found myself very engaged and sort of followed the avatar almost like being the avatar. I just kind of like enjoyed everything that… It was visually very beautiful and I noticed myself being completely engaged in it.

Previous Technology Use: Every participant indicated some previous use of technology for supporting meditation activities but the types and purposes varied. For some, this involved simple mobile applications (apps) timers and reminders. Others used CD's, YouTube, Internet downloads, or mobile apps for guided meditation. P8 used podcasts on her phone for both guided meditation and educational purposes. She described it this way: "I do a lot of walking and I love to listen to podcasts while I'm walking, and I thought it would be a good way to just continue my education. ...And then I've actually done meditation through some of these online… I guess you could call it service or online." P3 shared her technology use and purpose which included a simple timer, education, and guided meditations: [I use the] "iPhone app called Insight Timer; and Dharmaseed, that's a lot of talks and guided meditation. And I use that regularly… For meditation I might put in my earphones and listen to the talks. I use this pretty much

every morning just because it helps me to stay… you know, helps me stay focused. PP explained in her Tibetan type of meditation which is done in silence, they use videos for education and connecting to their mentor. "We use technology quite a bit to watch teachings from Sogyal Rinpoche. So they're on… you know, they're videos. And he's just sitting still and you're sitting there with a video. He is able to kind of project this sense of spaciousness that helps take you into that feeling of non-distraction – even on video."

Design-driven TSM Experience: This theme represents participants' views or reactions to various design elements in Sanctuarium, as well as how they interpreted and described the overall experience based on the design. See Appendix A for a detailed description of the design of Sanctuarium including major design elements, an end-to-end description of the user experience, and sample screenshots. Appendix L displays the avatar choices.

At times, some of the significant statements cross boundaries of one of more themes. For instance a participant may indicate that sounds in Sanctuarium assisted in their meditation in some way. That could be categorized either as design-driven TSM experience or as an example of how something in Sanctuarium facilitated mediation. The researcher has attempted to select the theme most represented by a significant statement. In a few cases a statement, or portion of the same statement, may be mentioned in multiple themes.

Overwhelmingly, participants expressed positive views on the majority of the design elements – including the island beach scene, water (visual and sounds), ambient sounds, colors, the ground path, the bridge, the entry gate, the bamboo forest, clouds,

birds, dolphins, flowers, bowls, butterflies, the tones marking entry to the next path, and the design in the center of the labyrinth which incorporated lit candles, a fountain, a cushion on a rug, and the wind in the trees. PP described the Sanctuarium experience this way: "And then the sound was quite relaxing. It was, you know, jungle noises and water and… it was quite nice. And I could really relax into, you know, and just imagine I was walking along and see the bamboo go by. And the butterflies were a nice touch….And then when I got to the center and sat down, that was very settling. To sit and have the noise of the water was very settling and it was a beautiful spot….Didn't want to leave. And then coming back was the same, and then when we actually went to the beach I wanted to stay longer." P3 offered this short description which was inclusive and gave some examples of design elements: "I mean, it had all the things that I love – the Tibetan bells…. I love the bamboo along the side. So it's very visual. I love the dolphins." P7 shared his end to end experience calling out design elements, and behavioral and experiential aspects: "Well, I would say that I stand in front of a computer screen and an avatar - a cartoon me - that I had picked out walked down this long path to get to a little meditation spot and he's sat down in front of a fountain with some candles around it and just kind of chilled out for five minutes, then you walk back out. And it's quiet and you can hear the ocean in the background and you can hear some birds, and it's just very calming and it's all right there in front of you. Sometimes you close your eyes because the walk in and out sort of takes a long time. So sometimes you close your eyes, and then you'd hear the gong and then you'd know that you were passing these little pots with the butterflies, and so I'd open my eyes for that …And then it's over...it was calm and relaxing."

Nine of 12 participants mentioned the butterflies floating up from the bowls as they entered or exited a circuit in the labyrinth and eight of those 12 commented positively or neutrally. P2 shared this comment: "I found myself looking forward to the butterflies popping up," and P3 was similar with "…. and the butterflies coming out, I was looking for the next one." P10 described a different reaction: "The butterflies to me were almost kind of a distraction. They didn't look like they were colors found in nature. And, you know, I love butterflies…"

While the visual portion of Sanctuarium was well received, the importance of sound was also stressed. P6 described it this way: "I believe, though, sound helped a lot, because when I've done guided meditations using recorded guided meditations, the ones that I have the most success with always have some kind of sound, either toning or some music, or water, or air, or something. And I'm pretty sure that what that does is it helps to keep those channels of the right brain, left brain open. So I think that was very beneficial." P8 offered her perspective highlighting sound: "I like the way it worked. I think the sounds are so important, and the colors, and, like I said, the things that make you aware, and that things are a little bit changing in it." For P11, sounds were very important: "Definitely the sounds…Sounds for me are huge. I think they can aid a lot in practices for people. I feel a strong connection to the beach. So the fact that I heard water felt very connected to me, because I've done several retreats close to water before, because any time I'm by the beach I feel very connected to meditation practice. So definitely sounds." P1 even commented that she was surprised that the engagement questionnaire did not ask about auditory stimulation in the same way it asked about visual stimulation.

Simplicity was another design dimension that resonated with participants both in terms of non-distraction and interaction, including instructions. P2 recalled a computer-generated imagery meditation and commented "I think there were too many things to do, whereas this was... you had the luxury of just being to meditate in this one." P10 stated "You know, I really like the simplicity of this." Participants commented on navigation being easy and instructions easy to follow. P11 liked the simple interaction: "Pretty simple instructions around just, you know, touch the screen to start moving through." P6 liked the fact that the instructions did not tell you what you would experience. Other participants appreciated simple reminders of breathing or setting an intention as well as the message which offered the option to perform seated meditation with eyes open or closed.

Participants also mentioned the newness and/or uniqueness of the experience as well as not being sure what to expect. PP commented on the uniqueness of movement with meditation: "I don't know that I have ever meditated on anything that was moving. In my tradition we have visualizations and thangkas and these things, but they're not moving; they're still. … I can't think of any other visual experience where there was kind of a sense of movement. . ." (A thangka is a 3D piece of artwork, see Definitions of Terms for a full description.) P3 expressed the new and different experience in this manner: "I found it different from what I've done before. So it was a total new experience. I was totally fascinated by all the visuals that were there as she was walking the path. To be honest I got really taken…" Five other participants said they had never had a similar experience. P9 summed it up this way when sharing how she would describe it to another person: "like nothing you've experienced before. It's like being

dipped into this peaceful world and your senses are stimulated. To just keep yourself open to the experience and just go with it because it's really beautiful."

Some participants expressed pleasant surprise, and some went into the experience with a definite skepticism or even worry and were pleased with a different outcome. P2 combined these aspects with this commentary: "I was actually pleasantly surprised, because what I was really concerned about is that it would take you out of yourself. And this was a nice way to first expose you to a different environment, slow you down, and then allow you to go in. I thought that was a nice blend." P8 shared her view describing initial apprehension followed by success: "But I will say that I was uncertain how I would be able to adapt to it or fit in, and I thought it was easy. I thought it was easy to make that jump into that [the virtual environment]."

Design Suggestions for TSM: In a related theme to design-driven experience, participants also shared design suggestions. Many participants really enjoyed the beach theme and would not change it, but several also suggested offering multiple nature themes such as a wooded area, mountain hike, waterfalls, and others. The notion of multiple themes was the most common suggestion. P7 offered some creative options: "An underwater one for someone who's into scuba; that they would, you know, swim down to some, you know, great coral reef and look at the fish and all that....Another one might be like someone who's into flying; that they would actually fly up through clouds and, you know, sort of just glide around over a nice green earth." Besides different nature themes, some of the "teacher" participants suggested offering an option that let you focus on a still object, providing more guidance such as giving the meditator a focus point, having the avatar provide instructional breathing at the beginning, and also

providing options for walking meditation, seated meditation, or both, along with duration choices. P11 covered several of these suggestions: "So designing something like that might be interesting if there are like different tracks where there's like one… whether it has the walking that goes to sitting, or you could set how long you would want the track to be…And how long you'd want to sit. Or if you want to do more sitting and more walking. Also maybe choosing which kind of atmosphere you want to be in. Another one that I would think of is like either maybe even like walking on the beach, hiking in mountains…" P11 also addressed the "teaching aspect" with this commentary: "if there was also a couple of statements on there like 'you may choose to continue looking at the screen or at some point you may if you wish close your eyes – it can be helpful' and then you could say like, you know, 'It can be helpful to focus on the avatar. It can be helpful to focus on the trees,' – whatever it is. Giving people a visualization point." A few participants commented on wanting to get other senses involved besides sight and sound. Acknowledging the possible technology limitations, they suggested somehow incorporating smell by including smells that reflected the environment such as the smell of water or the woods.

Participants also raised some issues they had with the current design and offered suggestions for improvement. Many participants did not readily comment on the labyrinth but described the experience as more of walking a path. PP was familiar with labyrinths and had the expectation that she would be able to see the pattern which is common if the labyrinth is made from stones, rope, pavers, or low hedges for example. She suggested lowering the trees to have a better sense of the labyrinth and commented that her expectation did create a few distracting thoughts initially but then she chose to let

them go. She wondered if people could see the pattern if that would produce different effects or experiences. P2 shared that she had some distortion walking through the bamboo and posited it had to do with pace and control: "when we were doing the labyrinth walk unless I concentrated on the flowers, the butterflies and the birds overhead, I was getting a sense of distortion as we were walking through the bamboo. It's kind of like her pace and my pace weren't in sync. So I didn't feel like I had - and again this is me - I didn't feel like I had control of the walk or the pace of the walk." P10 wanted more natural environmental responses such as the sun changing overhead to indicate passing of time and more shadow even though he knew the time of the activity was around 22 minutes. He shared this perception: "The shadow was always directly beneath the avatar and the shadows of the folds in the garment didn't change at all, and yet I felt… So I know I was trying to synchronize this in my mind – why are the shadows and light not changing when I feel that…? I mean, I felt like hours could have passed… I was sort of at a distance and I knew that hours hadn't passed, but in some way it felt that way. So I'd like to see more visual evidence of the passing of time. ...And so shade… Also it seemed like the sun was very high in the sky and yet it wasn't hot. I didn't feel hot at all and so that didn't really ring true." From a path and direction perspective P10 also commented he preferred going to the right or clockwise. P8 described her sense of the labyrinth paths this way: "Like on this one there was a time that I almost thought I was walking in a circle, and that's a little bit uncomfortable. But then the path changes. So just when you think that you're maybe taking off in a circle and that's a little bit… er… where you don't want to be, you kind of come out of it and go forward."

Effects of TSM: This theme includes perceived effects of TSM with Sanctuarium, participant descriptions of physical responses, and memories that were triggered during TSM. Some words used to describe the perceived effects of TSM were calm, peaceful, relaxed, sense of clarity, still, alert, energized, focused, and settled. P4 shared this: "But I found it very relaxing. In the absence of an actual guided voice it did provide a relaxing context for it. Very calm, very zoned out. Good, yeah." P4, P5, and P11 all reported feeling very relaxed, even a little groggy or sleepy. P7 offered his perception on effects tying it together with the design: "Very enjoyable. I didn't know what to expect but I kind of just went with it. And enjoyed watching the display and the calming flora and fauna and the butterflies flying up, and the sounds. I thought the visual and the sounds was a good combination, very relaxing. And I felt very relaxed and I noticed that my limbs got heavy and I just felt very calm and relaxed." P8 described her feelings after TSM as "I really liked it. One thing I liked about it was that it did provide the stillness but it also was great and it made me notice things, and I like that. It kept me focused. It kept me noticing. It kept me with a still mind but an alert mind… Good. Relaxed. Still; calm…...positive emotions and sort of a feeling of accomplishment…"

A few of the participants described physical reactions during TSM with Sanctuarium. PP shared that she sometimes gets sick doing virtual reality activities and she had a bit of that feeling a few times. That said, she also described being non-distracted and fully meditated by the end of her interaction with Sanctuarium. P10 was completely surprised at an olfactory response. He exclaimed "I smelled water today. It was around the time I first heard the sound of running water and I thought, 'Wow that is wild.' So I've never had that kind of an olfactory reaction to a video screen." P6

described experiencing a tingling sensation during TSM: "And I had a very, very similar experience to where I have like a tingling all over. Sometimes I feel… If I'm laying down, I feel almost like I'm levitating. And I thought, 'Well, this is very interesting, to be able to have this physical sensation in this environment.' And I thought that was pretty cool, because usually it's a very private, quiet… And so I like that." She added that after TSM she felt much calmer than before TSM, and also had a sweet taste in her mouth, which has happened to her after other meditation.

Finally, TSM with Sanctuarium triggered different memories. For some it was a reminder of a similar meditation experience on the beach or a reminder of visiting a beach, for others it was very distinct and personal. When asked about similar experiences, P8 recalled a specific walking meditation and a labyrinth. "… the day we did that contemplative meditation that was in the Duke Gardens… And it was a walking meditation. And it was a silent walking meditation and it was through a lot of growth and sort of a labyrinth and all that. And I kept thinking about that. Life is a garden not a road; we enter and exit through the same gate; wondering where we go matters less than what we notice.' So they had told us that day to notice – just notice. So I use that now in a lot of things that I do and I tell my classes that. And so here I was just… I tried to notice." P10 had an intense experience but first he described his perceived effects after TSM: "Well, I felt like it was a very positive… it was a very good experience and it was surprising to me in a lot of ways. But I felt that it achieved all of what I typically would achieve in a period of meditation - meaning calmness, serenity - and I was surprised how much I felt like I really was in that place. And I noticed several things about it. I really enjoyed the path to the destination and then I really enjoyed being in the destination and I

enjoyed the path out. And I thought the time spent getting there and being there was just about perfect…" During the post-activity interview, P10 also shared it was the anniversary of his father's death. He proceeded to then describe an intense memory of his father that occurred during TSM with Sanctuarium: "And I chose the avatar without thinking whether he looked like me or not, but I felt specifically connected to my father [cries]. I'm sorry. But that avatar reminded me of him but it also reminded me of my son, and I felt like sometimes I was the avatar and sometimes he was the avatar and it was just very emotional for me. But I remembered how many times I walked following my father and then it seemed like I was the avatar and my father was behind me. I could feel his hand on my shoulder. And it looked like my father the way it walked. And he and I walked a lot. He loved to be in nature and he would have enjoyed that. I thought it was very realistic. We grew up in Florida, so the beginning scene with the thatched roof hut with no walls is typical Seminole Indian. And we camped among the Indians, and the palm trees and the dolphins and the beach were very much scenes that I saw every day growing up and it really reminded me of home."

Facilitation of Meditation: This theme focuses on ways Sanctuarium helped facilitate the meditation experience. It includes participants' perceptions of being aided in their meditation, participants' assessment of effectiveness, and participant thoughts on how TSM with Sanctuarium could be beneficial to others. Participants described different aspects of Sanctuarium that facilitated their meditation experience including being non-distracting, helping to achieve or maintain focus, and helping to achieve the meditative state. PP shared this description: "So it was very relaxing and absorbing. It was visually beautiful and interesting but not so interesting that it was a distraction. And

after a while the movement of the avatar was almost, you know, like mesmerizing… and the environment sort of helped you to let go of other thoughts and emotions that might have come in." Even so, PP felt she would probably not use something like Sanctuarium but saw the potential for others while also commenting that Sanctuarium was "helpful for . . . kind of bringing you to a certain place, you know, like making you be where you are; that it's not distracting from… As an experienced meditator I didn't find it distracting – and there are things that could be." P1 simply stated: "Well, it was quite easy for me to concentrate on the walk with Isabelle [avatar]. I mean, I got right into it." P4 similarly commented: "It's obviously very simple but what it does is important. It helps you get into a zone that you may not otherwise be able to get into. The distraction of focusing your attention on the avatar helps you let go of those other distracting thoughts that might… While you're watching this guy's back it kind of like. . . it helps you let go." P6 offered this perspective on focus and non-distraction: "Well, I was surprised that I was able to get right into it. And I think coming from behind helped with that because then I was not distracted." P8 shared her view on how TSM with Sanctuarium facilitated meditation: "And I would describe it to someone as a way of following, a way of sort of being brought into an experience that really assists you. That you're not trying to create everything yourself; that this is a guide. It's creating the environment that you're looking for without (1) having to do it yourself and (2) without actually being there."

Several participants also commented on the effectiveness of TSM with Sanctuarium. P4 commented that even though he would have chosen some kind of pattern and color display (being a child of the 1960's) instead of the avatar approach, he felt if definitely worked. In her description of telling someone else about Sanctuarium,

P9 explained with surprise on the effectiveness: “I just experienced virtual meditation which to my amazement was every bit as effective as if we were being guided by a voice. And it’s multidimensional when you experience it. It’s a new experience really…” P10 characterized his experience as successful and effective: “But I felt that it achieved all of what I typically would achieve in a period of meditation - meaning calmness, serenity…”

Lastly, a number of participants thought Sanctuarium would be beneficial for others, and also for themselves and wanted to know more. The topic of new or beginning meditators finding benefit emerged. P2 stated: “A first time or an early meditator combining it with this could really help them get the focus a little bit better.” P3 shared her view: “I think it’s a wonderful tool for somebody that’s new to meditation. Because it really very discretely has all the components that, you know, that are important...somehow I knew it would be a good non-threatening way to get them started.” P6 offered this perspective on helping new meditators: “Well, for someone who has no idea of what meditation is, what does it feel like, this would be, I think, an incredible way to get them introduced, because a lot of things happen… There’s a center; there’s so many things. ...are all designed to help bring you back, bring you back to the minute.” Participants saw value for themselves and others. P1 said “I mean, I think this would be incredibly wonderful for people to have on their computer in the office.” Participants asked about more information, inquired about existence of a link to Sanctuarium, or plans for creating some type of mobile app. P9 encapsulated the desire for future access to, and benefit of, Sanctuarium, along with the reasons why, which cross multiple themes: “[I] really cannot wait for this to go like viral ! Yes – to take off, because I really believe it’s very well done. It’s very well designed. You’ve taken into

consideration everything that's important about meditation in my opinion … First of all it's the feeling that it gives you by the design you've chosen. Elements that are peaceful to most people – the sound of the water, the greenery – it's not overly done. The walk itself is a process in the meditation in my opinion. The amount of time that it takes you to enter the center, reach the center of the labyrinth puts you in mind for what you're about to experience. And then you sit there, you have that little fountain in front of you, some candles…The sound of the water was extremely peaceful, very, very pleasant. It wasn't splashy. It wasn't loud. It wasn't anything that was distracting. It completely pulled me in … And again the walk back sort of gave you a chance to kind of review what you had experienced and to just slowly sort of come back to the present, you know, like reality ....It was a beautiful exit out."

Textural Description of Participants' TSM Experience: Participants described their TSM experience with Sanctuarium as visually and aurally pleasing, as a stimulation to the senses of sight and sound that facilitated meditation with a naturally calming environment, simple interaction and instructions, and a balance of consistent and changing elements that guided them through walking and seated meditation. Meditators identified strongly with the islandscape enjoying the beach, the opening gate to the labyrinth, the path through the bamboo forest, the flowers, the birds, the bowls, the butterflies, the clearing in the center with the trickling fountain, and the dolphins at the end. Along with the visual landscape, participants experienced ambient sounds, tones marking the beginning of a circuit in the labyrinth, as well as the sound of the ocean, and the trickling water of the fountain. According to participants, the blend of sight and sound elements created a relaxing and calming environment with several meditators

commenting on the importance of the sound as contributing to the effectiveness of the mediation experience.

Meditators felt guided and supported during TSM with Sanctuarium. This included the path in and out, the simple instructions of breathing or setting an intention, different focal points such as following behind the avatar or walking with the avatar, being drawn in, getting into the zone, and remaining alert but not distracted by the sights and sounds of Sanctuarium. After completing the TSM experience with Sanctuarium, participants described feeling calm, very relaxed, peaceful, focused, having more clarity, being fully meditated, and achieving the same results as meditation without Sanctuarium. Meditators were surprised, even to amazement, at the effectiveness of TSM with Sanctuarium and saw value to themselves and others, especially commenting on Sanctuarium being very helpful to new meditators.

Structural Description of Participants' TSM Experience: All participants were experienced meditators who utilized a variety of styles (e.g., breath-focused, guided, contemplative) and came from different schools of thought (e.g., Buddhist, Hindu, secular). They interacted with Sanctuarium in the same procedural and physical context. This included the same research protocol as well as being alone, seated in a chair, in front of a touchscreen tablet, and in the same room at a local yoga studio. Ten of 12 meditators participated in a day-time slot and two participated in the evening. One night-time participant felt the lighting was a little distracting. The room was generally quiet but periodic noise from adjacent classrooms occurred.

Interaction involved viewing Sanctuarium, listening to sounds in Sanctuarium, reading instructions on the screen, and touching the screen to dismiss an instruction.

Participants chose to open and close their eyes at different times during TSM with Sanctuarium and some shared they set specific intentions for their meditation. Several participants approached the experience with skepticism, apprehension, or uncertainty but were generally pleasantly surprised at the positive effects and effectiveness of TSM with Sanctuarium. Some participants had physical reactions to the environment which involved a slight feeling of sickness, sense of distortion, and uncomfortableness. Even so these participants also reported success. Other physical reactions included a tingling sensation, sweet taste in the mouth, and the smell of water. While most participants had utilized some form of technology to support their meditation practice, most also remarked on the newness and uniqueness of TSM with Sanctuarium as being very different than anything else they had experienced.

Composite Description of Participants' TSM Experience: TSM with Sanctuarium began with a sense of skepticism, apprehension, or not knowing what to expect. How would this technology affect meditation? Could it help or would it get in the way? What would this VW called Sanctuarium look like?

Alone in a softly lit room, each participant sat in a chair in front of a tablet computer and touched the screen to begin their meditation journey. Following behind the previously selected avatar as it walked, participants encountered a bridge and a gate. The gate opened upon approach and the avatar settled into a regular pace, drawing participants in. Along the way, tones sounded as the avatar passed a bowl and different colored butterflies flew up into the air. Participants noticed details in the environment, took in the greenery of the trees, saw flowers, and heard the sound of the ocean. They begin to feel calm and relaxed, some kept their eyes open, some closed them, opening

them again upon hearing a tone as they passed another bowl, wanting to see the butterflies again. When the avatar reached the center, participants discovered a small fountain surrounded by candles. Here they performed seated meditation as the avatar sat on a mat in front of the trickling fountain. Some participants kept their eyes open enjoying the bamboo forest and flowers, others closed them and listened to the fountain. After seated meditation, the avatar began the walk out of the labyrinth. Participants noticed more or felt a distinct sense of being guided back out of the labyrinth to the beach. Upon arrival at the beach, participants enjoyed the dolphins jumping out of the water. Some were reminded of other meditation on the beach or just a time they visited a beach, where they felt calm and enjoyed the surroundings. Some experienced an overall deep connection, another connected strongly with family.

The simple interaction and taking in the sights and sounds offered the "luxury of just being" to support meditation. Sanctuarium created the environment and brought them into it, guiding and assisting the meditation experience. Following the avatar or noticing tones and movement providing focus but without distraction. Participants were engaged, drawn in, transported, mesmerized, or taken on a journey. After completing TSM with Sanctuarium, participants described a successful and effective meditation experience. Several participants were surprised and amazed this was possible, especially considering some had been taught that technology would get in the way. Participants used words such as calm, peaceful, relaxed, sense of clarity, still, alert, energized, focused, and settled. Several participants asked for more information for their own use, or suggested Sanctuarium as a very useful tool to help guide new meditators. The essence of TSM with Sanctuarium was easily experiencing a beautiful and peaceful VW

that combined visual and aural elements along with simple interaction to guide and facilitate a successful and effective meditation experience that was generally unexpected.

Findings

This section integrates quantitative and qualitative information and results to provide a holistic evaluation of TSM with Sanctuarium. To understand meditation with and without the use of Sanctuarium, the results of the pre and post activity interviews were compared and contrasted for commonalities and differences. Results of the EOM-DM were also included to present a measure of effectiveness for TSM with Sanctuarium. Next, a combination of quantitative and qualitative results was used to address the three research questions. Evidence was drawn from the demographics information, sub-scale scores of the UESs-z and the EOM-DM, and pre and post-activity phenomenological analysis, including specific participant input for illustrative purposes.

Meditation With and Without Sanctuarium.

The formal definition of meditation first presented in this report is: a concentration-based individual activity involving self-regulation of attention and awareness associated with well-being and self-actualization (MacDonald et al., 2013). This can be characterized as an external or observational perspective. The pre-activity interview provided an experiential view of meditation. After phenomenological analysis, the essence of participants' meditation emerged as: exploration and discovery while practicing self-care for the mind, the body, and the spirit that not only improves practitioner well-being, but makes a positive difference to others. Both the definition and the experience of meditation highlight the outcome of well-being. The formal

definition and the experiential view together provide the basis for comparing and contrasting meditation with and without Sanctuarium.

The original intention was to compare meditation with and without technology involved. However, all participants reported the use of some form of technology. In essence, participants had experienced some degree of TSM. Technology examples included mobile apps for timing meditation and reminding them to meditate; and CDs, tapes, YouTube videos, podcasts, and digital recordings primarily used for guided meditation. Meditators had also performed meditation via human-led guided meditation. Guided meditation usually focused on "listening," often with eyes closed. In Sanctuarium, meditators sometimes closed their eyes, and other times kept their eyes open. While participants generally characterized TSM with Sanctuarium as guided meditation, they made the distinction that it was a new and unique experience. Meditators had not previously experienced meditation using a VW. Participants also described TSM with Sanctuarium as effective as other meditation, and in several ways as very facilitative. Those particulars are discussed in the findings of RQ1 and RQ2. Meditators offered similar positive descriptors on the perceived effects of meditation with and without Sanctuarium, indicating a successful meditation experience in Sanctuarium. The results of the EOM-DM instrument also indicated a successful meditation experience with Sanctuarium. Aggregate results consisted of relatively high ratings on CE and RE (cognitive effects and relaxation), combined with relatively low ratings on the negative sub-scales of EE and PD (emotional effects and physical discomfort), plus a medium rating on ME (mystical experience). (See Table 8 for individual and aggregate sub-scale scores for the EOM-DM.) Table 11 compares the essence of the experiences derived

from the pre and post interviews, and presents participant descriptors of perceived effects of meditation with and without the use of Sanctuarium.

Table 11

Comparing Meditation Without and With Sanctuarium

	Meditation w/o Sanctuarium	**Meditation w/Sanctuarium**
Essence	The essence of meditation is exploration and discovery while practicing self-care for the mind, the body, and the spirit that not only improves practitioner well-being, but makes a positive difference to others.	The essence of TSM with Sanctuarium was easily experiencing a beautiful and peaceful virtual world that combined visual and aural elements along with simple interaction to guide and facilitate a successful and effective meditation experience that was generally unexpected.
Descriptors of Effects	Focused, Non-distraction, Centered, Connected, Peace, Intentional, Present, and Calm	Calm, Peaceful, Relaxed, Sense of Clarity, Still, Alert, Energized, Focused, and Settled

To summarize, more commonalities existed than differences. The general differences included no previous use of VWs for meditation purposes, and even though all participants had utilized technology in some way to support meditation, they described meditation using Sanctuarium as a new and unique experience. For commonalities, meditators characterized the Sanctuarium experience as a form of guided meditation, described similar effects of meditation with and without Sanctuarium, and assessed meditation with Sanctuarium as effective as meditation without Sanctuarium. EOM-DM results also indicated meditating with Sanctuarium was effective. Examining the specific support and enhancement of meditation using Sanctuarium along with a deeper

understanding of the nature of engagement is provided in answers to the three research questions which follow this section.

RQ1. Does the 3D virtual world Sanctuarium support the meditation experience (a well-being activity)?

As previously defined, "support" refers to not interfering or negatively impacting the act of meditating. One of the strongest indicators for support of meditation was the characterization (from interviews) that Sanctuarium was non-distracting. Non-distraction is a key goal in meditation (Fontana, 2015; Sedlmeier et al., 2012). As an example, PP described Sanctuarium as: "very relaxing and absorbing. It was visually beautiful and interesting but not so interesting that it was a distraction." PP later remarked that she felt undistracted and fully meditated at the conclusion of interaction with Sanctuarium. P8 commented that Sanctuarium: "kept me with a still mind but an alert mind … Sometimes when you meditate you get to your monkey mind. And if I got to my monkey mind it [Sanctuarium] was able to bring me back to where I needed to be."

The simplicity of the design and interaction offered the "luxury of just being" to meditate as described by P2. P1 found it easy to concentrate as she virtually followed the avatar. P3 commented it was nice to relax and just follow the avatar. She also noted the clear and easy instructions and said she had no trouble meditating. P5 and P10 felt comfortable to bring in their own intentions for meditation with Sanctuarium. Setting an intention is a common practice in meditation and yoga (Eisler, 2014).

The UESz-m sub-scale score of Focused Attention was 4.15/5.0. The EOM-DM sub-scale score of Cognitive Effects was 4.61/6.0. These scale scores are related to the concepts of focus, non-distraction, and concentration. These results combined with

associated participant descriptions of TSM with Sanctuarium indicate that TSM with Sanctuarium supported the meditation experience.

On a related note, Sanctuarium was also perceived as restorative. Participants remarked on the calming aspects of the natural scene including multiple visual and sound elements as well as feeling relaxed (see PP and P3 remarks in this section). P4, P5, and P11 all reported feeling very relaxed, even a little groggy or sleepy. P7 commented "I thought the visuals and the sounds was a good combination, very relaxing." P6 felt calmer after meditating with Sanctuarium. P10 reported achieving calmness. Additionally the Relaxation (RE) sub-scale score of the EOM-DM was relatively high at 4.05/6.0.

RQ2. Does the 3D virtual world Sanctuarium enhance the meditation experience (a well-being activity)?

"Enhance" refers to adding something to the meditation experience, e.g., enabling a perceived quicker attainment of a meditative state, enabling a perceived deeper meditative state, aiding focus, or adding more enjoyment. While participants described TSM with Sanctuarium as a new and different experience, they categorized TSM with Sanctuarium as guided meditation. This is a strong indicator that participants assessed Sanctuarium as aiding the meditation experience. P4 commented: "It [Sanctuarium] helps you get into a zone that you may not otherwise be able to get into. P5 described the virtual walk to the center as a way of getting grounded and centered before doing the seated meditation in the center of the labyrinth. Participants commented on visual and sound elements helping them focus and relax. P8 shared her view on how TSM with Sanctuarium facilitated meditation: "And I would describe it to someone as a way of

following, a way of sort of being brought into an experience that really assists you. That you're not trying to create everything yourself; that this is a guide. It's creating the environment that you're looking for without (1) having to do it yourself and (2) without actually being there." She went on to further say that Sanctuarium "was very directional. I thought it was a good guide and it really continued to bring me back. . . It kept me focused. It kept me noticing. It kept me with a still mind but an alert mind."

Participants also described Sanctuarium as a great tool for new meditators in helping them learnt to meditate. P1 who had little experience with technology remarked that: "when I was working… I mean, I think this would be incredibly wonderful for people to have on their computer in the office." P2 stated: "A first time or an early meditator combining it with this could really help them get the focus a little bit better." P3 shared her view: "I think it's a wonderful tool for somebody that's new to meditation. Because it really very discretely has all the components that. . . somehow I knew it would be a good non-threatening way to get them started." P6 offered this perspective on helping new meditators: "Well, for someone who has no idea of what meditation is, what does it feel like, this would be, I think, an incredible way to get them introduced, because a lot of things happen… There's a center; there's so many things. ...are all designed to help bring you back, bring you back to the minute."

Participants descriptions and assessments of Sanctuarium regarding "getting in the zone," being assisted and aided in focus, getting grounded and centered as preparation for meditation, being guided in the meditation experience, as well as Sanctuarium being useful to new meditators, are all indicators of TSM with Sanctuarium enhancing the meditation experience.

RQ3. What is the nature of user engagement during technology-supported meditation utilizing the 3D virtual world Sanctuarium?

O'Brien and Toms (2008) defined engagement as a component of user experience that includes the elements of challenge, positive affect, endurability, aesthetic and sensory appeal, attention, feedback, variety/novelty, interactivity, and perceived user control. Participants offered positive feedback on multiple design elements (sight and sound) within Sanctuarium such as the island beach scene, water, ambient sounds, colors, the ground path, the bridge, the entry gate, the bamboo forest, clouds, birds, dolphins, flowers, butterflies, bowls, the tones marking entry to the next path, and the design in the center of the labyrinth which incorporated lit candles, a fountain, a cushion on a rug, and the wind in the trees. PP described part of the Sanctuarium experience this way: ". . . And then when I got to the center and sat down, that was very settling. To sit and have the noise of the water was very settling and it was a beautiful spot….Didn't want to leave. And then coming back was the same, and then when we actually went to the beach I wanted to stay longer." Participants were focused and engaged, taking in the environment and positively anticipating elements. P2 shared this comment: "I found myself looking forward to the butterflies popping up," and P3 was similar with "…. and the butterflies coming out, I was looking for the next one." P8 offered her perspective highlighting sound: "I like the way it worked. I think the sounds are so important, and the colors, and, like I said, the things that make you aware, and that things are a little bit changing in it."

Participants felt drawn in and connected. For P11, sounds were very important and helped create the connection: "So the fact that I heard water felt very connected to

me, because I've done several retreats close to water before, because any time I'm by the beach I feel very connected to meditation practice." P3 shared that she "was totally fascinated by all the visuals that were there as she was walking the path. To be honest I got really taken…" PP stated: "And after a while the movement of the avatar was almost, you know, like mesmerizing… and the environment sort of helped you to let go of other thoughts and emotions that might have come in." Others also appreciated the focal points offered including the avatar. P4 commented "Focusing your attention on the avatar helps you let go of those other distracting thoughts…" P9 commented on the avatar and feeling very engaged overall: "So I felt actually the whole experience to be somewhat meditative. Even the walk to the center of the labyrinth to me was very meditative. I found myself very engaged and sort of followed the avatar almost like being the avatar. I just kind of like enjoyed everything that… It was visually very beautiful and I noticed myself being completely engaged in it."

The design of Sanctuarium created an engaging experience as described by participants; some to the extent of creating positive physical reactions. P7 offered this commentary: "I thought the visuals and the sounds was a good combination, very relaxing. And I felt very relaxed and I noticed that my limbs got heavy and I just felt very calm." P10 experienced "smelling water" while interacting with Sanctuarium. P6 described experiencing a tingling sensation during TSM: "And I had a very, very similar experience to where I have like a tingling all over. And I thought, 'Well, this is very interesting, to be able to have this physical sensation in this environment.' " She added that after TSM she also had a sweet taste in her mouth, which has happened to her after other meditation.

Some participants felt transported to this environment or immersed. P3 talked about being taken to another place. PP commented on Sanctuarium being an environment you can immerse yourself in and that it was helpful in bringing you to a place within. P9 described the experience as "It's like being dipped into this peaceful world and your senses are stimulated." She felt completely pulled in.

TSM with Sanctuarium also triggered different memories indicating a strong sense of engagement and connection. For some it was a reminder of a similar meditation experience on the beach or a reminder of visiting a beach, for others it was very distinct and personal. P10 had an intense experience. He felt like he was really "in" Sanctuarium and it reminded him of growing up in Florida. He also had strong memories of his deceased father and shared he felt his father's hand on his shoulder. The avatar reminded P10 of his son and his father.

Finally, the UESz-m results also indicated a high level of engagement with Sanctuarium. All aggregate sub-scale scores exceeded 4.0 on a one-to-five Likert scale (See Table 7). The combination of participant descriptions and experience of TSM with Sanctuarium, along with the engagement scale scores, provided a multi-dimensional view on the nature of engagement.

Summary

The data analysis section presented detailed results for participant demographics, the UESz-m scale, the EOM-DM scale, and phenomenological analyses of the pre and post activity interview transcripts. All 12 participants were experienced meditators with eight of 12 participants meditating seven or more years. Participants were primarily adult women (nine of 12), with a median age of 49 (range 32-75), and Caucasian (11 of 12).

The UESz-m scores indicated a high degree of engagement with all aggregate sub-scale scores exceeding 4.0 on a one to five Likert scale. The EOM-DM results indicated a successful meditation experience with Sanctuarium with relatively high ratings on CE and RE, and relatively low ratings on the negative sub-scales of EE and PD, plus a medium rating on ME.

Phenomenological analysis of the pre-activity interview transcripts resulted in 140 significant statements and seven themes. The themes included: definition of meditation, motivations for meditation, learning meditation, teaching meditation/serving others, effects of meditation, realizations of meditation, and challenges and changes to meditation practice. Analysis revealed the following essence of the meditation experience: exploration and discovery while practicing self-care for the mind, the body, and the spirit that not only improves practitioner well-being, but makes a positive difference to others.

Post-activity analysis resulted in 175 significant statements grouped into five broad themes. The themes included: previous technology use, design-driven experience of TSM, design suggestions for TSM, effects of TSM, and facilitation of meditation. The essence of TSM with Sanctuarium emerged as: easily experiencing a beautiful and peaceful virtual world that combined visual and aural elements along with simple interaction to guide and facilitate a successful and effective meditation experience that was generally unexpected.

The findings section compared and contrasted meditation without and with Sanctuarium and provided answers to the three research questions. Qualitative and quantitative data was integrated to create a holistic picture. While meditators described

TSM with Sanctuarium as a new and unique experience, they characterized the Sanctuarium experience as a form of guided meditation, described similar effects of meditation with and without Sanctuarium, and assessed meditation with Sanctuarium as effective as mediation without Sanctuarium. Positive EOM-DM results provided further support that meditating with Sanctuarium was effective.

For RQ1, a combination of descriptions of experience and data from particular sub-scale scores of the UESz-m and EOM-DM indicated a positive answer to RQ1 on whether Sanctuarium supported meditation. Aspects of meditation support centered on the concepts of non-distraction, concentration, and simplicity of design and instructions. Sanctuarium was also viewed as restorative based on participants' descriptions and perceptions of a calm and peaceful environment as well as feelings of calmness and relaxation. The EOM-DM Relaxation sub-scale score also supported the restorative nature with a rating of 4.05/6.0.

For RQ2, experiential accounts provided support for answering RQ2 in the affirmative. Participant descriptions and assessments of Sanctuarium regarding "getting in the zone," being assisted and aided in focus, getting grounded and centered as preparation for meditation, being guided in the meditation experience, as well as Sanctuarium being useful to new meditators, were all indicators of TSM with Sanctuarium enhancing the meditation experience.

For RQ3, a series of examples demonstrating engagement aspects as well as the UESz-m scores were combined to provide an explanation and description of the nature of engagement while using Sanctuarium for meditation. Engagement examples included positive descriptions and assessments of design elements in Sanctuarium that helped aid

focus and hold attention, e.g., the avatar. Participants also shared that Sanctuarium provided a visually and aurally pleasing and interesting environment with some feeling they were transported or immersed in the environment and not wanting to leave. Participants were drawn in and felt connected with the island theme and water sounds which helped them settle and maintain an alert but still mind. Some were reminded of other beach scenes or meditation on the beach, while others had strong physical and emotional responses such as smelling water, feeling tingling, being reminded of home, or sensing the presence of a lost loved one. Finally participants felt guided in the meditation experience and also thought Sanctuarium would be useful in the workplace, and especially useful to help new meditators focus and be successful in learning to meditate. All of these examples as well as several others uncovered during the phenomenological analysis provided a rich view into the nature of engagement. Along with positive qualitative outcomes, the UESz-m results indicated a high level of engagement with Sanctuarium. All aggregate sub-scale scores exceeded 4.0 on a one-to-five Likert scale. Combining the experiential accounts with the sub-scale scores created a holistic view of the nature of engagement while meditating with Sanctuarium.

Chapter 5

Conclusions, Implications, Recommendations, and Summary

Overview

This chapter begins with the conclusions of the research then outlines the research implications, including study limitations, lessons learned, and research contributions. The recommendations section focuses on related future research. The chapter ends with a summary of the dissertation.

Conclusions

The dissertation goal was to gain a richer understanding of user engagement and the human experience of technology-supported meditation (TSM) in a 3D virtual world as an integral element of how best to leverage technology to promote and support well-being activities. Study results indicate the goal was met based on the following:

- Sanctuarium was perceived as a restorative environment demonstrating that restorative environments can be created in virtual worlds. The meditators overwhelmingly enjoyed the Sanctuarium environment and characterized it as calm and peaceful. Participants identified multiple design elements as positive and stressed that sound was an important element, especially the sound of the water.
- Sanctuarium meditation was effective and successful. Positive effects were reported via interviews and also via the scale titled Effects of Meditation During

Meditation (EOM-DM). Descriptors included: calm, peaceful, relaxed, sense of clarity, still, alert, energized, focused, and settled. Meditation with and without Sanctuarium was similarly described in terms of effectiveness and success.

- Sanctuarium facilitated the meditation experience, similar to guided meditation. Aspects of facilitation centered on the concepts of non-distraction, focus, and simplicity of design and instructions.
- Participants identified Sanctuarium as a good tool for helping those new to meditation.
- Phenomenological analysis provided a rich description of the nature of engagement while meditating with Sanctuarium. Meditators also rated engagement as high via an adapted User Engagement Scale (UESz-m).

While study results were very positive, it should be noted that a few participants experienced some minor uncomfortableness while interacting with Sanctuarium such as a feeling of distortion, feeling sick, or not liking a particular direction. These same participants also reported positive perceptions and results. Other physical reactions included smelling water, a tingling sensation, and a sweet taste in the mouth. On a perceptual level, for some meditators, Sanctuarium triggered positive memories of other activities and events such as meditating on a beach or walking a labyrinth. One participant experienced an intense memory of his father which led to a momentary emotional response of crying during a very positive description of his meditation experience with Sanctuarium. This demonstrates a need to pay particular attention to emotional outcomes when designing technology for well-being.

Sanctuarium and other technology-supported well-being environments have the potential to increase individual well-being and also organizational well-being if applied in the work setting. While one experienced meditator doubted she would use Sanctuarium she saw the potential for others. Several other participants also expressed an interest in whether Sanctuarium would be available for future use via a link on the internet or as a downloadable application. Future plans include some form of Sanctuarium being made available via the internet or as a downloadable application.

TSM with Sanctuarium began with a sense of skepticism, apprehension, or not knowing what to expect. How would this technology affect meditation? Could it help or would it get in the way? In the end, the essence of TSM with Sanctuarium was easily experiencing a beautiful and peaceful virtual world that combined visual and aural elements along with simple interaction to guide and facilitate a successful and effective meditation experience that was generally unexpected.

Implications

This section covers study limitations, lessons learned, and research contributions.

Study Limitations

One limitation of the study pertains to generalizability. Although volumes of data were created from the semi-structured interviews and validated instruments were used to subjectively assess engagement and effects of meditation, results from a small purposeful sample (N = 12) cannot be generalized. On a related note, for both instruments used in the study (UESz-m, EOM-DM), factor analysis in this specific context was not achievable because of the small number of participants.

Both the UESz-m and the EOM-DM use Likert scales. Likert scales are not technically interval data but it is common to treat them as such in UX; assumptions include that there is a degree of intervalness between items in a Likert scale and that numbers between the items on a Likert scale have meaning (Tullis & Albert, 2013). As best can be determined, this was the first use of the EOM-DM as reported in the literature. At the writing of this dissertation, research examining the factor structure of the EOM-DM was published which reduced the number of items from 29 to 18 while retaining the five factor structure (Skipper, O'Donovan, Conlon, & Clough, 2015).

Other potential issues emerged regarding both scales. The UES and UESz did not include a question on auditory stimulation. This was noted by one participant who was surprised that visual elements were referenced but not sound elements in terms of engagement. Several participants identified sound as an important element in the overall experience with Sanctuarium. For the EOM-DM scale, two of the sub-scales (EE and PD) each had one question that appeared to need reverse coding as the scores generally appeared opposite of the other items in the scale. For the EE scale this was Q3 and for the PD scale Q20 appeared to be a candidate for reverse coding. Further research is needed to make this determination. Details of these issues are provided in Chapter 4.

Another limitation of the study was the lack of multiple assessors of the qualitative data. As this was dissertation work, the research and analysis was done by a single researcher. For this reason, intercoder agreement was not applicable.

Lessons Learned

Lessons learned focus primarily on the amount of qualitative data and the phenomenological method. The pre and post activity semi-structured interviews yielded

voluminous amounts of data. A dissertation could have been written on the phenomenological analysis of the pre-activity interview data. That said, it did provide rich and valuable insight for comparison to meditation using Sanctuarium.

The researcher has years of qualitative analysis experience but more from a content analysis and highlights perspective. The structure and steps of phenomenological analysis were intense and time-consuming even when using the Moerer-Urdahl and Creswell (2004) approach which is shortened from the original Moustakas (1994) phenomenological method. However, the approach did yield a rich description and understanding of engagement and the TSM experience using Sanctuarium. The primary lesson is to think carefully about questions (and the number of questions) on a semi-structured interview and to not underestimate the time it takes to do meaningful qualitative analysis.

Research Contributions

Research results furthered understanding of 1) engagement in 3D VWs, 2) TSM, 3) evaluation of positive technology, positive computing, and well-being technology 4) third wave HCI, 5) meditation research, and 6) the impact of technology used for well-being activities. By using an exploratory formative blended approach from a third wave HCI perspective valuable insight was gained about using technology to support and promote well-being activities. This type of experiential perspective can be utilized across multiple fields such as HCI, IS, virtual worlds, positive technology, positive computing, and well-being technology.

The rich description of engagement coupled with relatively high engagement ratings adds to the body of knowledge on engagement in HCI and UX, as well as

furthering understanding of engagement in VWs. As best can be determined, this was the first use of the EOM-DM as reported in the literature and of applying it in a virtual environment. The research also adapted the UESz from gaming and applied it to VWs. The third wave HCI approach of looking at a dimension beyond cognition such as engagement and at the experiential aspects, contributes to third wave HCI evaluation. So too does the blended methodology of combining phenomenological analysis with validated instruments. Using validated instruments addresses the issue of too often use of ad hoc questionnaires in HCI and UX.

The evaluation approach also contributes to a foundation for evaluating positive technology, positive computing, and well-being technology, furthering knowledge in these nascent research areas. Results of this study demonstrate a positive impact of using technology to support a well-being activity, specifically meditation. Research findings specifically contribute to knowledge on TSM in terms of design, evaluation, and success. The rich phenomenological post-activity themes can be mined for design elements and design suggestions. The phenomenological analysis of the pre-activity interviews contributes to meditation research by providing a deep description of the meditation experience. Finally, while an interdisciplinary approach across multiple fields is challenging, it yields rich results that can be applied across multiple fields.

Unlike much of the current work in positive technology and TSM, this study included development of TSM in an environment that does not require special equipment such as head-mounted displays or sensors. This makes Sanctuarium a more accessible well-being technology. TSM may provide the base for a class of technologies deemed well-being technologies as an evolution towards personal health information systems and

organizational well-being supported by technology. The results of this study will help researchers and practitioners better understand how to utilize technology to support well-being activities. Ultimately, the hope is that this work will contribute to promoting more well-being in the world through creative and innovative use of technology.

Recommendations

Multiple possibilities exist for extending this research study. The major areas include 1) further validation of Sanctuarium with different approaches, different validated instruments, and different user groups, and 2) applying and refining the evaluation approach to other examples of VWs, positive technology, positive computing, and well-being technology to advance knowledge supporting a third wave HCI approach, or an evaluation framework specifically targeted to positive technology, positive computing, and well-being technology.

First, the study could be repeated using a formal mixed methods approach (Venkatesh et al., 2013) instead of the blended formative approach to further validate Sanctuarium supporting and enhancing the meditation experience. To confirm the experienced meditators' view that Sanctuarium would be useful to novices, research could be constructed to evaluate Sanctuarium with those new to meditation. Similarly, the study could be repeated with participants that regularly use labyrinths for meditation. Only two of 12 participants commented on the labyrinth aspect. Most meditators characterized the walking meditation as following a path through the bamboo forest rather than specifically walking the circuits of a labyrinth design for meditation purposes. Research could also be designed to utilize different validated instruments such as the Flow State Scale (FSS) (Jackson & Marsh, 1996; Marsh & Jackson, 1999) or to compare

engagement and flow. Riva et al. (2014) identified flow as critical variable to drive design and development of positive technology at the eudaimonic level. According to O'Brien and Toms (2010a) "flow requires sustained long-term focus" (p. 939) whereas engagement can occur in a more short-term period. Wiebe et al. (2014) found that the UESz and FSS were complementary in the video-game context but did note possible overlaps and lack of the UESz to adequately assess flow. The UESz appeared to better measure usability and hedonic qualities. Additionally, the UESz better predicted game performance (reaching a higher level) than the FSS. Creating a study that included factor analysis of both instruments in the VW context or in the context of some form of positive technology, positive computing, or other well-being technology would further knowledge in multiple domains. Finally, the evaluation approach of the current study could be adapted in some way to help support third wave HCI in an agile environment. A different, less time consuming qualitative method would need to be employed to support agile development. On the other end of the spectrum the evaluation approach could be applied and tested in a longitudinal study.

Emerging HCI research on well-being technologies demonstrates the complexity and diversity of evaluation approaches which are trending towards a third wave HCI perspective. UX researchers and practitioners are advocating for experience-driven design and third wave HCI that focuses on multi-dimensional, interpretive, situated, and phenomenological aspects (Harrison et al., 2007; Hassenzahl, 2013). Further research is needed on designing and evaluating for this third wave called user experience (Harrison et al, 2007; Law et al., 2014; MacDonald & Atwood, 2013; Roto & Lund, 2013). Further study is also needed in the emerging research areas of positive technology,

positive computing, and well-being technology. HCI will play a critical role in these new research areas.

Summary

Meditation is an ancient practice that has become a modern phenomenon (Plaza et al., 2013; Suchday et al., 2014). Millions of Americans meditate (Barnes et al., 2008; Suchday et al., 2014) and more are increasingly turning to well-being activities such as meditation (Suchday et al., 2014) to relax and relieve stress (self-regulation) or to find balance and wisdom (positive transformation) (Sedlmeier et al., 2012). Meditation may be concisely defined as a concentration-based individual activity involving self-regulation of attention and awareness associated with well-being and self-actualization (MacDonald et al., 2013). Benefits of meditation include: increased well-being, stress reduction, anxiety reduction, pain management, increased focus, more effective leadership, and clarity of thinking (Baer, 2013; Carroll, 2013; Dolman & Bond, 2011; MacDonald et al., 2013; Mayo Clinic Staff, n.d.; Sedlmeier et al., 2012; Seppala, 2013; Suchday et al., 2014). Pickert (2014) reported on the increasing interest and practice of meditation including the combination of technology and meditation.

Well-being and Technology

The theory of positive technology formalizes the scientific approach for technology supporting well-being activities such as meditation as a mechanism to nurture human flourishing (Riva et al., 2012). The positive technology framework combines positive psychology and technology to enhance the quality of personal experience in three areas: affective quality, engagement/actualization, and connectedness. The potential for positive technology and its effect on well-being has been recognized

(Botella et al., 2012; Calvo & Peters, 2013, 2014; Coyle et al., 2014; Riva et al., 2012; Wiederhold, 2012). However, the impact of technology on well-being remains unresolved (Riva et al., 2012). Limited evidence exists on the effectiveness of self-managing well-being with technology (Gaggioli & Riva, 2013). Designing and evaluating technology for well-being support is complex and challenging (Botella et al., 2012, Calvo & Peters, 2014; Coyle et al., 2014). Further, although VWs have been used in positive technology applications (Botella et al., 2012; Riva et al., 2012; Wiederhold & Wiederhold, 2013), measuring and understanding the experience of engagement remains an open question (Jensen, 2012; O'Brien & Toms, 2010; Wasko et al., 2011). This study investigated a TSM experience to examine how technology could support user engagement, self-empowerment, and individual well-being. The researcher designed and evaluated an islandscape named Sanctuarium based on restorative concepts (e.g., naturescapes and water) and the meditation concepts of walking meditation via a labyrinth, and seated meditation. Sanctuarium is a 3D VW that includes a tropical island with a labyrinth cut through a bamboo forest with a seated meditation environment in the center.

Interdisciplinary Context

The research draws insight and information from multiple domains: positive technology, positive computing, VWs, IS, HCI, and TSM. Looking across the research domains revealed the threads of needing to understand 1) engagement and 2) (user) experience with technology in non-work related activities. These two elements are fundamental to third wave HCI which advances beyond cognition to include emotions, values, culture, and experience (Bødker, 2006). Engagement is a critical element in HCI

(O'Brien & Toms, 2010a), positive computing (Sander, 2011), and VWs (Jensen, 2012). The IS literature highlighted the need to better understand how humans engage with VWs, information systems, and technology (Wasko et al., 2011; Yoo, 2010; Zhang et al., 2009). IS and HCI have both called for experiential approaches (Bødker, 2006, Hassenzhal, 2013; Yoo, 2010). This perspective is needed to advance beyond the instrumental value of technology to how technology can add to the inherent value of human activities and experience (Yoo, 2010).

Study Approach

The study utilized an exploratory formative blended methodology and included three research questions:

RQ1. Does the 3D VW Sanctuarium support the meditation experience?

RQ2. Does the 3D VW Sanctuarium enhance the meditation experience?

RQ3. What is the nature of user engagement during TSM utilizing the 3D VW Sanctuarium?

The research questions and protocol were designed from an experiential aspect. The methodology included the most common data collection methods in UX: surveys and semi-structured interviews (Bargas-Avila & Hornbæk, 2011) and used two validated instruments: the UESz-m and the EOM-DM. Using purposive sampling, participants (N = 12) interacted with Sanctuarium to perform virtual walking meditation and seated meditation. Data collection occurred both pre and post-activity and included a demographic questionnaire, an interview on current meditation experience, engagement scale data, a survey on the perceived effects of the TSM experience, and a final interview about the TSM experience. The collection of different kinds of data (both quantitative

and qualitative) gathered at different points and in different ways enabled a holistic picture not obtainable by any singular means.

Results and Findings

All 12 participants were experienced meditators and primarily Caucasian women (nine of 12). The UESz-m scores indicated a high degree of engagement with all aggregate sub-scale scores exceeding 4.0 on a one to five Likert scale. The EOM-DM results indicated a successful meditation experience with Sanctuarium with relatively high ratings on CE (cognitive effects) and RE (relaxation), and relatively low ratings on the negative sub-scales of EE (emotional effects) and PD (physical discomfort), plus a medium rating on ME (mystical experiences).

Phenomenological analysis of the pre-activity interview transcripts resulted in seven themes: definition of meditation, motivations for meditation, learning meditation, teaching meditation/serving others, effects of meditation, realizations of meditation, and challenges and changes to meditation practice. Post-activity analysis resulted in five broad themes: previous technology use, design-driven experience of TSM, design suggestions for TSM, effects of TSM, and facilitation of meditation. The essence of TSM with Sanctuarium was easily experiencing a beautiful and peaceful virtual world that combined visual and aural elements along with simple interaction to guide and facilitate a successful and effective meditation experience that was generally unexpected.

For RQ1, a combination of descriptions of experience and data from particular sub-scale scores of the UESz-m and EOM-DM indicated a positive answer to RQ1 on whether Sanctuarium supported meditation. Aspects of meditation support centered on

the concepts of non-distraction, concentration, and simplicity of design and instructions. Sanctuarium was also viewed as restorative.

For RQ2, experiential accounts provided support for answering RQ2 in the affirmative. Participant descriptions and assessments of Sanctuarium regarding "getting in the zone," being assisted and aided in focus, getting grounded and centered as preparation for meditation, being guided in the meditation experience, as well as Sanctuarium being useful to new meditators, were all indicators of TSM with Sanctuarium enhancing the meditation experience.

For RQ3, a series of examples demonstrating engagement aspects as well as the UESz-m scores were combined to provide an explanation of the nature of engagement while using Sanctuarium for meditation. Examples included positive assessments of design elements in Sanctuarium that helped aid focus and hold attention; and feelings of being transported, immersed, connected, and drawn in. Along with positive qualitative outcomes, the UESz-m results indicated a high level of engagement with Sanctuarium.

Conclusions, Implications, Recommendations

The goal of the research was to gain a richer understanding of user engagement and the human experience of TSM as an integral element of how best to leverage technology to promote and support well-being activities. Study results indicate the goal was met based on the following:

- Sanctuarium was perceived as a restorative environment.
- Sanctuarium meditation was effective and successful based on phenomenological analysis and results of the scale on effects of meditation (EOM-DM).

- Sanctuarium facilitated the meditation experience, similar to guided meditation. Aspects of facilitation centered on the concepts of non-distraction, focus, and simplicity of design and instructions.
- Participants identified Sanctuarium as a good tool for helping those new to meditation.
- Sanctuarium was engaging based on phenomenological analysis and high engagement ratings via the engagement scale (UESz-m)

A few participants experienced some uncomfortableness in Sanctuarium while also reporting positive results. Others had some interesting physical reactions such as smelling water. One meditator had a momentary intense reaction while still describing a positive experience demonstrating the need to pay particular attention to emotions when designing for well-being technology. The main limitation of the study was non-generalizability due to the exploratory formative nature of the study and the small number of participants.

Research results furthered understanding of 1) engagement in 3D VWs, 2) TSM, 3) evaluation of positive technology, positive computing, and well-being technology 4) third wave HCI, 5) meditation research, and 6) the impact of technology used for well-being activities. By using an exploratory formative blended approach from a third wave HCI perspective valuable insight was gained about using technology to support and promote well-being activities. This type of experiential perspective can be utilized across multiple fields such as HCI, IS, VWs, positive technology, positive computing, and well-being technology.

Multiple possibilities exist for extending this research study. The major areas include 1) further validation of Sanctuarium with different approaches, different validated instruments, and different user groups, and 2) applying and refining the evaluation approach to other examples of VWs, positive technology, positive computing, and well-being technology to advance knowledge of a third wave HCI approach or an evaluation framework specifically targeted to positive technology, positive computing, and well-being technology. Further research is needed on designing and evaluating for this third wave called user experience (Harrison, et al, 2007; Law et al., 2014; MacDonald & Atwood, 2013; Roto & Lund, 2013). UX researchers and practitioners are advocating for experience-driven design and third wave HCI that focuses on multi-dimensional, interpretive, situated, and phenomenological aspects (Harrison et al., 2007; Hassenzahl, 2013). Further study is also needed in the emerging research areas of positive technology, positive computing, and well-being technology. Results will promote and support well-being and further human flourishing (Calvo & Peters, 2013; 2014; Coyle et al., 2014; Wiederhold, 2012). HCI will play a critical role in these new research areas.

In a world full of health problems and technology overload, how can technology support engagement, self-empowerment, and well-being? TSM with Sanctuarium demonstrated one way. The results of this study will help researchers and practitioners better understand how to utilize technology to support well-being activities. TSM may provide the base for a class of technologies deemed well-being technologies as an evolution towards personal health information systems and organizational well-being supported by technology. Ultimately, the hope is that this work will contribute to

promoting more well-being in the world through creative and innovative use of technology.

Appendix A

Design of Sanctuarium

Introduction

This appendix describes the design of Sanctuarium, and is organized as follows: Introduction, Sanctuarium Elements and Design Rationale, the Sanctuarium Experience, and System Hardware and Software. Sample screen shots are included to convey a general sense of the virtual world through a participant's eyes. The introduction provides relevant literature support for the design. Following the introduction, the main elements of Sanctuarium are listed including background on meditation and labyrinths. Next, the Sanctuarium experience is described highlighting the link to positive technology and third wave HCI. Lastly, major components of the system hardware and software are presented.

The design of Sanctuarium is based on research utilizing virtual worlds as restorative environments, for positive technology applications, and in technology-supported meditation (Botella et al., 2012; Gromala et al., 2011; Knight et al., 2012; Moire et al., 2012; Riva et al., 2012). Nature settings reduce stress (physiological and perceived) and improve well-being therefore nature settings are restorative environments (Knight et al., 2012; Valtchanov, 2013). Moire et al. identified virtual worlds as having the ability to recreate restorative environments that promote psychological health and well-being. Knight et al. found that overall virtual environments are good candidates for restorative environments especially when sound is added. Multiple studies have validated that viewing nature, including within virtual environments, has restorative

effects (Valtchanov, 2013). Results also pointed towards water as a positive therapeutic factor to include in virtual restorative environments (Knight et al., 2012). Research examining water in both natural and built environments has also indicated a greater preference, higher positive affect, and higher perceived restorative value than environments without water (White, Smith, Humphryes, Pahl, Spelling, & Depledge, 2010). Villani and Riva (2008) looked at relaxation across four treatments using the same narrative, two with restorative environments: 1) DVDs (which displayed photo quality nature scenes), 2) VR (termed Relaxation Island with multiple natural settings), 3) audio, and 4) a control group. Both the DVD group and the VR environment group incorporated nature settings and showed significant relaxed states. Stetz et al. (2011) utilized Villani and Riva's VR island landscape with audio narrative and found a reduction in anxiety post-treatment.

Multiple examples exist that demonstrate the use of natural settings in virtual worlds for well-being support. Researchers have utilized park-like settings in virtual worlds for positive technology applications (Botella et al., 2012; Riva et al., 2007). The Positive Technology App uses several natural settings including the beach, forest, mountains, and a campfire (ATN-P, n.d.; Gaggioli et al., 2014). The Meditation Chamber displays a virtual sun setting, a peaceful nighttime landscape with the moon, and chirping crickets (Shaw et al., 2011). Relaxation Island includes two beach scenes, a cloud scene, and a waterfall scene (Villani & Riva, 2008).

Sanctuarium Elements and Design Rationale

Sanctuarium is designed as an island setting with a bamboo forest (a natural restorative environment with water). It includes the following elements:

- A welcoming gazebo
- A bridge across an ocean inlet
- A beach
- The surrounding ocean
- A bamboo forest with associated flowering plants
- A Cretan labyrinth cut through the forest with low walls made of thatch
- Urns with floating flowers that are color coded to indicate the beginning of a labyrinth circuit and the associated chakra (explained below)
- Palm trees and other tropical foliage
- A fountain
- Meditation bells and chakra tones, and
- Ambient sounds.

Taken together, the elements in Sanctuarium are designed to support and enhance meditation. Meditation is a concentration-based individual activity involving self-regulation of attention and awareness associated with well-being and self-actualization (MacDonald et al., 2013). Butera (2014) categorized meditation into six types: 1) breath, 2) visualization, 3) mantra, 4) devotion, prayer, intentionality, 5) mindfulness, and 6) contemplative inquiry. Sanctuarium supports any of these types of meditation via design and messages, and/or a participant's choice to practice a specific type while interacting with Sanctuarium.

A timeless tool for meditation is a labyrinth (Compton, 2007; Lonegren, 2007). According to Compton, the labyrinth is an ancient symbol of spirituality, a sacred space, and a form of art. People walk labyrinths as a form of meditation, reflection, problem-solving, to access inner wisdom, and tacit knowledge (Compton, 2007; Johnston, 2000; Lonegren, 2007). Labyrinths are unicursal (one way in, one way out) and meant to portray wholeness and promote clarity, deep thought, and connectedness (Bloos, 2005). People that walk labyrinths often set an intention or think about a problem they want to solve before beginning, then pause in the center of the labyrinth, or meditate in the center (Bloos, 2005; Shapiro, 2014). Upon leaving the center, the walker also focuses and contemplates on the walk out (Shapiro, 2014). The choice to use a labyrinth in Sanctuarium was driven by its long standing use over centuries to support meditation, the ability to visualize and reproduce the design in a virtual world, and the positive effects of labyrinths. Rhodes (2008) reviewed existing labyrinth research (16 studies) and summarized commonly reported effects of labyrinth walkers. Effects included reduction in agitation, anxiety, and stress; and increased calm, centeredness, clarity, openness, peacefulness, mental quiet, reflectiveness, relaxation, and wellness. Labyrinth proponents have also identified the need for empirical research on labyrinths (Artress, 2006; Rhodes, 2007).

Sanctuarium includes a classical seven circuit labyrinth often termed a Cretan labyrinth (see Figure A1 for an aerial view). Cretan labyrinths, so named for ancient coins from Crete that displayed the labyrinth symbol, contain circuits numbered one through seven from the outside to the inside (Curry, 2000; Johnston, 2000; Lonegren, 2007). However, the walker enters the labyrinth at circuit three; proceeds to circuits two,

one, four, seven, six, and five; and ends in the center (Johnston, 2000; Lonegren, 2007). Each circuit may be associated with a specific chakra (Johnston, 2000; Lonegren, 2007). A chakra is a physical point in the body that represents a spiritual energy center (Johnston, 2000; Lonegren, 2007; Shapiro, 2014). Chakras are linked with specific areas of the body, spiritual/emotional elements, and also a specific color (Johnston, 2000; Lonegren, 2007; Shapiro, 2014). See Appendix B for the associated mappings to the chakras.

Figure A1. Aerial View of Labyrinth in Sanctuarium

For some, the notion of "breathing" through a particular chakra is a powerful act – essentially charging up that specific chakra and focusing attention on the associated spiritual and/or skill element (Butera, 2012). For example, the third chakra is physically associated with the solar plexus and spiritually associated with self-esteem (Butera, 2012).

The Sanctuarium circuits display subtle indicators of the chakra associations via colored flowers floating in a bowl at the beginning of each circuit (See Figure A2). Also, a soft tone associated with the chakras sounds when the participant enters the circuit. This provides support for those that connect the chakras with a circuit without distracting those unfamiliar. For those participants unfamiliar with chakras or the association with a labyrinth circuit, the soft tone and the bowls with colored flowers appear to simply mark the beginning of a circuit and indicate progress.

Figure A2. Bowls with Flowers Marking Beginning of a Circuit in the Labyrinth

Limited messages appear at the beginning of Sanctuarium and before and after seated meditation at the center of the labyrinth. When the participant is finished reading a message and ready to resume interaction with Sanctuarium, touching the message will remove the message and the avatar will proceed. Since meditation is a very concentration-based activity, the only interaction the participant will have with

Sanctuarium is an occasional screen touch to indicate a message or instruction has been read and the participant is ready to continue. The combination of restorative elements, meditation elements, and limited distraction and interaction in Sanctuarium is designed to help promote engagement and focus to support the meditation activity.

Finally, because avatars play an important role in interacting with a virtual world (Cudworth, 2014), the avatar in Sanctuarium is designed to offer a general representation of the participant. Designing a highly customized and individualized avatar is beyond the scope of this research. However, to address diversity -- gender, skin color, and hair color were variated. Sanctuarium avatars wear loose-fitting clothing indicating comfortableness for walking meditation and seated meditation. Gender was differentiated by stereotypical characteristics, i.e., more angular-shaped and taller with shorter hair for a male, and more rounded-shaped, shorter, and longer hair for a female representation. Hair color choices included black, brown, blonde, red, and grey. Skin color options included black, brown, white, and yellow. During interaction with Sanctuarium, the participant views the avatar from the back and a very minimal amount of skin is displayed (e.g., hands and feet). The focus of the research is on technology supporting individual meditation, an internal activity, and not configuration of a human or fantasy character as a highly detailed representation of the participant in interacting with other participants. Participants chose an avatar from pre-interaction materials and the researcher configured Sanctuarium with the participant's selection prior to interaction.

The Sanctuarium Experience

Participants were seated in a quiet room at a local yoga studio with the tablet computer on a small table in front of them. To support the meditation activity in a realistic manner, visitors to Sanctuarium virtually walked (via an avatar) a Cretan labyrinth (walking meditation) and also performed seated meditation in the center of the labyrinth. Participants were given explanatory information to read before interacting with Sanctuarium. When the participant was ready, he or she started in the Sanctuarium gazebo where a welcoming message and short set of instructions was displayed (see Appendix C for a list of Sanctuarium messages/instructions). When the participant was ready, a touch to the screen activated the avatar which began walking. The avatar crossed a small wooden bridge over an ocean inlet. Upon arriving at the entrance to the labyrinth, the gate opened and a tone sounded that is associated with the circuit chakra. Along the way, shadows of the avatar's steps appeared and ambient nature sounds occurred to provide a realistic restorative environment. Wind blew, and trees and foliage swayed. Ocean and fountain sounds spatially occurred (got louder or softer depending on avatar proximity). It took approximately seven and a half minutes to reach the center of the labyrinth. The center contains a mat, a meditation pillow, lit candles, and a small water fountain with associated sound. Upon arrival in the center, the participant was instructed to seat their avatar. The participant was then presented with instructions for a five-minute seated meditation. The participant touched the screen above the avatar's head to indicate readiness for the seated mediation and three bells tolled to indicate the beginning of the seated meditation period. Participants had the option to concentrate on the fountain or close their eyes during the seated meditation (See Figure A3). A single

tone sounded indicating completion of the seated meditation and the avatar returned to a standing position. At this point, the participant touched the screen above the avatar's head to begin walking back out of the labyrinth.

Figure A3. Seated Meditation in Sanctuarium (center of the labyrinth)

No messages were presented on the way out, only the associated chakra tone as the participant entered a circuit. This portion of the activity was designed to be reflective and calming. After walking out of the labyrinth, the avatar walked to the beach and took a seated position on a grass mat. The participant viewed the ocean and native fauna and flora. Seagulls and dolphins appeared as well as an ending affirmation. The participant indicated completion by a screen touch above the head of the avatar. At this point, the researcher entered the room and began the post-Sanctuarium activities.

As defined by the positive technology framework, Sanctuarium is an example of positive technology at the eudaimonic level. It is designed to advance the quality of

experience via engaging augmentation (virtual worlds) to support meditation, a well-being activity aimed at self-actualization. The research with Sanctuarium was targeted towards engagement and the overall experience looking at the phenomenon of meditation and how it could be supported and enhanced with technology. This is a clear demonstration of third wave HCI which focuses on experience, engagement, emotions, values, and culture; and is multi-dimensional, interpretive, situated, and phenomenological (Bødker, 2006; Harrison et al., 2007; Hassenzahl, 2013). While care was taken to address standard HCI design issues for 3D interfaces and virtual worlds that are generally more associated with first and second wave HCI (Cudworth, 2014; Shneiderman et al., 2009), the focus of Sanctuarium and the research was on the holistic experience of technology-supported meditation as an instantiation of well-being technology.

System Hardware and Software

The system hardware consisted of a server, a tablet, and a router with the following technical specs:

- Server: Lenovo Yoga 2 Pro Ultrabook convertible laptop, 13.3 inch touchscreen with 3200X1800 pixels, 8 gigabytes memory, 512 gigabyte solid state hard drive, Intel Core i7-4500 chip, Intel 4400HD graphics card, Intel 7260-N WiFi card, and Windows 8.1 Pro.
- Tablet: Microsoft Surface Pro 3 tablet, 12 inch touchscreen with 2160X1440 pixels, 8 gigabytes memory, 256 gigabyte solid state hard drive, Intel Core i5-4500 chip, Intel 4400HD graphics card, WiFi card, and Windows 8.1 Pro.

- Router: Netgear N600 Wireless Dual Band Gigabit Router (The router is required to set up a local network so there are no dependencies on the Internet such as time lag or interruptions which could significantly impact the research.)

The system software included software capable of hosting a virtual world and a virtual world viewer (similar to a browser) used by the participant, and the researcher. The participant's viewer was mirrored to the hardware server (the Lenovo Yoga 2 laptop) so that the researcher could see what was displayed on the participant's screen (the Microsoft Surface Pro 3). The research was designed to be non-intrusive since meditation is a very concentration-based activity so the participant was in one room with the tablet, and the researcher was in another room with the router and the server. The software component descriptions are as follows:

- Server (all open source): OpenSimulator 0.7.6, a 3D application server (virtual world); Apache2 web server 2.2.11, MySQL database server 5.5.8, and PHP services 5
- Participant and Researcher Viewer (open source): Singularity 1.8.5 (5617)

Appendix B

Chakras

Table B1

Chakra Mappings

Number	Name	Body Association	Elements	Color
1	Root Chakra	Base of spine or tailbone	Groundedness, life force	Red
2	Sacral, Splenic, or Water Chakra	Two or three inches below the navel	Creativity, emotions, sexuality	Orange
3	Solar or Fire Chakra	Solar plexus	Self-esteem, willpower, mental activity	Yellow
4	Heart Chakra	Heart	Love, compassion, inner peace	Green
5	Throat Chakra (also known as Purity Wheel)	Throat	Communication, sound, truth	Blue
6	Brow Charka (also known as the Third Eye)	Middle of the forehead	Wisdom, dreams, vision, intuition	Indigo
7	Crown Chakra	Top of head	Oneness, God, spirituality	Purple or violet

Sources: Butera, 2012; Lonegren, 2007; Shapiro, 2014

Appendix C

Messages in Sanctuarium

Welcome Message

In a moment you will enter Sanctuarium. Take three slow deep breaths in and out. If desired, choose an intention for your meditation today. Once you begin, you will start in the welcome gazebo, proceed across a small bridge, then enter the bamboo forest labyrinth through a gate. Take a moment to focus with another deep breath in and out. To enter Sanctuarium, simply touch the screen.

Beginning Message

To begin your meditation journey, touch this message.

Center of the Labyrinth Message

You have reached the center of the labyrinth. Focus on the fountain and the flowing water. Be aware of each inhale and exhale. To seat your avatar, touch this message.

Before Seated Meditation Message

Three bell tones will sound to indicate the start of your seated meditation. After five minutes, a single bell tone will sound to indicate completion. Clear your mind and take a few deep breaths and settle. While meditating, you may focus on the fountain or close your eyes. To begin, touch this message.

After Seated Meditation Message

Feel a sense of renewal and peace surrounding you. To begin your virtual walk back out of the labyrinth, touch this message.

Ending Message

We are all islands of excellence – Samadhi Pada, *The Secret of the Yoga Sutra*

To indicate you are finished, touch this message.

Stopped Avatar Message (if user accidentally or purposefully stops the avatar during the activity by touching the screen)

To continue, touch this message.

Appendix D

IRB Approval Letter and Informed Consent Form

NOVA SOUTHEASTERN UNIVERSITY

MEMORANDUM

To: Laura Downey, M.S.
Graduate School of Computer and Information

From: Matthew Seamon, Pharm.D., JD
Chair, Institutional Review Board

Date: January 13, 2015

Re: *Well-being Technologies: Meditation Using Virtual World* – NSU IRB No. 12031406Exp.

I have reviewed the revisions to the above-referenced research protocol by an expedited procedure. On behalf of the Institutional Review Board of Nova Southeastern University, *Well-being Technologies: Meditation Using Virtual World* is approved in keeping with expedited review category #6 and #7. Your study is approved on **January 12, 2015** and is approved until **January 11, 2016**. You are required to submit for continuing review by **December 11, 2015**. As principal investigator, you must adhere to the following requirements:

1) CONSENT: You must use the stamped (dated consent forms) attached when consenting subjects. The consent forms must indicate the approval and its date. The forms must be administered in such a manner that they are clearly understood by the subjects. The subjects must be given a copy of the signed consent document, and a copy must be placed with the subjects' confidential chart/file.

2) ADVERSE EVENTS/UNANTICIPATED PROBLEMS: The principal investigator is required to notify the IRB chair of any adverse reactions that may develop as a result of this study. Approval may be withdrawn if the problem is serious.

3) AMENDMENTS: Any changes in the study (e.g., procedures, consent forms, investigators, etc.) must be approved by the IRB prior to implementation.

4) CONTINUING REVIEWS: A continuing review (progress report) must be submitted by the continuing review date noted above. Please see the IRB web site for continuing review information.

5) FINAL REPORT: You are required to notify the IRB Office within 30 days of the conclusion of the research that the study has ended via the IRB Closing Report form.

The NSU IRB is in compliance with the requirements for the protection of human subjects prescribed in Part 46 of Title 45 of the Code of Federal Regulations (45 CFR 46) revised June 18, 1991.

Cc: Dr. Maxine Cohen
Mr. William Smith

Institutional Review Board
3301 College Avenue • Fort Lauderdale, Florida 33314-7796
(954) 262-5369 • Fax: (954) 262-3977 • Email: irb@nsu.nova.edu • Web site: www.nova.edu/irb

Consent Form for Participation in the Research Study Entitled
Well-being Technologies: Meditation Using Virtual Worlds

Funding Source: None.

IRB protocol #

Principal investigator:
Laura L. Downey
3500 Spring Lake Terrace
Fairfax, VA 20030
703-944-8042

For questions/concerns about your research rights, contact:
Human Research Oversight Board (Institutional Review Board or IRB)
Nova Southeastern University
(954) 262-5369/Toll Free: 866-499-0790
IRB@nsu.nova.edu

Site Information:
Nova Southeastern University
Center for Psychological Studies
3301 College Avenue
Fort Lauderdale, FL 33314

What is the study about?
You are invited to participate in a research study being conducted at East Meets West Yoga Center. The goal of the study is to explore meditation experiences using a virtual world.

Why are you asking me?
You are invited to participate because you currently meditate. There will be between 10 and 15 participants in this research study.

What will I be doing if I agree to be in the study?
First, you will answer a short background survey (11 questions). Next, the researcher will interview you about your meditation practice. This will take 20-30 minutes. The researcher will give you some information to read about the virtual world. Next you will meditate for about 20 minutes using the virtual world technology. Once you are done, you will fill out two surveys: one on the technology (28 questions) and one on your meditation experience using the technology (29 questions). It will take approximately 10-20 minutes to complete both surveys. Finally, the researcher will interview you about your meditation experience using the virtual world. This interview will take 20-30 minutes. Total time is about two hours.

Is there any audio or video recording?
The researcher will record the interviews to help with analysis. These recordings will be available to be heard by the researcher, Ms. Laura Downey, personnel from the IRB, and the dissertation chair, Dr. Cohen. The recordings will be transcribed by Ms. Jane Doe. Ms. Doe will use earphones while transcribing the interviews to guard your privacy. The recordings will be kept securely in Ms. Downey's possession. The recordings will be kept for 36 months from the end of the study. The recordings will be destroyed after that time by shredding the tapes. Because your voice could be identified by anyone who hears the tapes, the confidentiality of your recorded words cannot be guaranteed. However, the researcher will limit access to the tapes as described here.

What are the dangers to me?
Risks to you are minimal. This means they are not thought to be greater than other risks you experience every day. Using software on a computer involves minimal risk. Meditation using a virtual world may not be preferred. Being recorded means that confidentiality cannot be promised. No harm is anticipated as a result of providing comments on meditation. If you have questions about the research, your research rights, or if you experience an injury because of the research please contact Ms. Downey at 703-944-8042. You may also contact the IRB at the numbers indicated above with questions about your research rights.

Are there any benefits to me for taking part in this research study?
There are no benefits to you for participating other than the possibility that meditation using a virtual world may support or enhance your experience.

Will I get paid for being in the study? Will it cost me anything?
There are no costs to you or payments made for participating in this study.

How will you keep my information private?
The surveys will not ask you for any information that could be linked to you. The transcripts will not have any information that could be linked to you. The research materials will not contain your name, only a participant number. This form will contain your signature and the recordings will contain your voice. That is the only identifying information being collected. All information obtained in this study is strictly confidential unless disclosure is required by law. The IRB, regulatory agencies, or Dr. Cohen may review research records.

What if I do not want to participate or I want to leave the study?
You have the right to leave this study at any time or refuse to participate. If you make either choice, you will not experience any penalty or loss of services you have a right to receive. If you choose to withdraw, any information collected about you **before** the date you leave the study will be kept in the research records for 36 months after the study ends. This information may be used as a part of the research.

Other Considerations:
If the researcher learns anything which might change your mind about being involved, you will be told of this information.

Voluntary Consent by Participant:
By signing below, you indicate that:

- this study has been explained to you
- you have read this document or it has been read to you
- your questions about this research study have been answered
- you have been told that you may ask the researchers any study questions in the future or contact them in the event of a research-related injury
- you have been told that you may ask IRB personnel questions about your study rights
- you are entitled to a copy of this form after you have read and signed it
- you voluntarily agree to participate in the study entitled *Well-being Technologies: Meditation Using Virtual Worlds.*

Participant's Signature: _____ Date: _____

Participant's Name: _____ Date: _____

Signature of Person Obtaining Consent:

_____ Date: _____

Appendix E

Demographic Questionnaire

1. Age _____
2. Profession

   _____

3. Gender – Male Female Prefer not to answer (circle one)
4. Are you _____ married _____ single _____ in a relationship _____ prefer not to answer. (check one)
5. What is your race/ethnicity? (check all that apply) ___ Caucasion ____ Hispanic, Latino, Spanish origin _____ Black _____ Asian _____Native American/Alaskan Native ____Hawaiian/Pacific Islander ____ Other (please list _____) _____ prefer not to answer.
6. How long have you meditated in years? _____ If less than a year, indicate number of months. _____
7. What is your meditation schedule? _____ Daily _____Weekly _____ Twice a Week _____ Monthly _____ Twice a Month _____ Occasional _____ Other (please list _____) (check one)
8. What general types of meditation do you practice? Indicate P for your primary method and check any others that apply. _____ breath-focused _____ visualization _____ mantra-based _____ devotion, prayer, intentionality _____mindfulness _____contemplative inquiry ___ Other (please list _____)
9. What is the average length of your meditation session in minutes? _____

10. Where do you meditate? Indicate P for primary location and check any others that apply. _____Home _____Yoga studio _____Meditation center _____Office _____Other (please list _____)
11. Do you meditate ____ alone _____ in a group _____ both alone and in a group? Indicate P for your primary method and check any others that apply.
12. Do you prefer ____ self-directed meditation _____ guided meditation _____ or _____ both styles? (check one)

Appendix F

Pre-Activity Interview Questions

1. Why did you decide to pursue meditation?
2. How did you learn to meditate?
3. How do you feel after meditation?
4. Why do you continue to meditate?
5. Describe anything you wish you could change about your meditation experience?

Appendix G

Explanatory Information About Sanctuarium

Sanctuarium is a virtual world dedicated to meditation and well-being. It is a lush tropical island surrounded by calm turquoise seas. The islandscape includes a bamboo forest, and a labyrinth cut through the bamboo forest. You will perform virtual walking meditation via the labyrinth and seated meditation in the center. It will take approximately seven and a half minutes to reach the center and the same to walk out. When you reach the center, you will perform five minutes of seated meditation. Total meditation time is 20 minutes.

You will be represented in Sanctuarium by a male or female avatar attired in loose comfortable clothing indicating comfortableness for walking and seated meditation. You will view the avatar from behind, looking over the right shoulder of the avatar. Messages and/or instructions will appear at the beginning of your interaction, during seated meditation while in the center of the labyrinth, and at the end of your time in Sanctuarium. To indicate you are finished reading a message and ready to continue, simply touch the screen or the message as instructed, and your avatar will continue. You do not need to control the avatar to walk or move, that will be done automatically so that you can concentrate on your meditation. Once you are finished interacting with Sanctuarium, the researcher will conduct the follow-up activities already discussed. Please let the researcher know if you have any questions and when you are ready to begin your Sanctuarium experience.

Appendix H

Post-Activity Interview Questions

1. Describe your experience meditating using Sanctuarium.
2. How did you feel after meditating using Sanctuarium?
3. Would you compare this experience to any other experience you have had?
4. Have you ever used any technology as an aid in your meditation practice? If yes, please describe your choice and why.
5. Describe how you would design a virtual world to help others with their meditation practice.
6. If you had to tell someone else about technology-supported meditation using Sanctuarium, how would you explain it?
7. Anything else you would like to add?

Appendix I

User Engagement Scale (UES)

Table I1

User Engagement Scale – Original and Adapted

Number	UES – O'Brien and Toms (2010a)	UESz – Wiebe et al. (2014)	UESz-m – Downey (2015)
1	I lost myself in this shopping experience. (FA1)	I lost myself in this gaming experience.	I lost myself in this meditation experience.
2	I was so involved in my shopping task that I lost track of time. (FA2)	I was so involved in my gaming task that I lost track of time.	I was so involved in my meditation that I lost track of time.
3	I blocked out things around me when I was shopping on this website. (FA3)	I blocked out things around me when I was playing the game on this website.	I blocked out things around me when I was meditating using Sanctuarium.
4	When I was shopping, I lost track of the world around me. (FA4)	When I was playing the game, I lost track of the world around me.	When I was meditating, I lost track of the world around me.
5	The time I spent shopping just slipped away. (FA5)	The time I spent playing the game just slipped away.	The time I spent meditating just slipped away.
6	I was absorbed in my shopping task. (FA6)	I was absorbed in my gaming task.	I was absorbed in my meditation.
7	During this shopping experience I let myself go. (FA7)	During this gaming experience I let myself go.	During this meditation experience I let myself go.

Number	UES – O'Brien and Toms (2010a)	UESz – Wiebe et al. (2014)	UESz-m – Downey (2015)
8	I was really drawn into my shopping task. (FI1)	I was really drawn into my gaming task. (FAz)	I was really drawn into my meditation.
9	I felt involved in this shopping task. (FI2)	Eliminated	
10	This shopping experience was fun. (FI3)	This gaming experience was fun. (SAz)	This meditation experience was fun.
11	I continued to shop on this website out of curiosity. (NO1)	I would continue to go to this website out of curiosity. (SAz)	I would continue to meditate with Sanctuarium out of curiosity.
12	The content of the shopping website incited my curiosity. (NO2)	The content of the gaming website incited my curiosity. (SAz)	The content of Sanctuarium incited my curiosity.
13	I felt interested in my shopping task. (NO3)	I felt interested in my gaming task. (SAz)	I felt interested in my meditation.
14	Shopping on this website was worthwhile. (EN1)	Playing the game on this website was worthwhile. (SAz)	Meditation with Sanctuarium was worthwhile.
15	I consider my shopping experience a success. (EN2)	Eliminated	
16	This shopping experience did not work out the way I had planned.* (EN3)	This gaming experience did not work out the way I had planned. (PUz)	This meditation experience did not work out the way I had planned.
17	My shopping experience was rewarding. (EN4)	My gaming experience was rewarding. (SAz)	My meditation experience was rewarding.

Number	UES – O'Brien and Toms (2010a)	UESz – Wiebe et al. (2014)	UESz-m – Downey (2015)
18	I would recommend shopping on this website to my friends and family. (EN5)	I would recommend playing the game on the website to my friends and family. (SAz)	I would recommend meditation with Sanctuarium to my friends and family.
19	This shopping website is attractive. (AE1)	The website was attractive.	The virtual world Sanctuarium was attractive.
20	This shopping website was aesthetically appealing. (AE2)	The website was aesthetically appealing.	Sanctuarium was aesthetically appealing.
21	I liked the graphics and images used on this shopping website. (AE3)	I liked the graphics and images used on the website.	I liked the graphics and images used in Sanctuarium.
22	This shopping website appealed to my visual senses. (AE4)	The website appealed to my visual senses.	Sanctuarium appealed to my visual senses.
23	The screen layout of this shopping website was visually pleasing. (AE5)	The screen layout of the website was visually pleasing.	The layout of Sanctuarium was visually pleasing.
24	I felt frustrated while visiting this shopping website.* (PU1)	I felt frustrated while visiting the website.	I felt frustrated while interacting with Sanctuarium.
25	I found this shopping website confusing to use.* (PU2)	I found the website confusing to use.	I found Sanctuarium confusing to use.
26	I felt annoyed while visiting this shopping website.* (PU3)	I felt annoyed while visiting the website.	I felt annoyed while interacting with Sanctuarium.
27	I felt discouraged while shopping on this website.* (PU4)	I felt discouraged while on the website.	I felt discouraged while interacting with Sanctuarium.

Number	UES – O'Brien and Toms (2010a)	UESz – Wiebe et al. (2014)	UESz-m – Downey (2015)
28	Using this shopping website was mentally taxing.* (PU5)	Using the website was mentally taxing.	Interacting with Sanctuarium was mentally taxing.
29	This shopping experience was demanding.* (PU6)	The gaming experience was demanding.	This meditation experience was demanding.
30	I felt in control of my shopping experience. (PU7)	Eliminated	
31	I could not do some of the things I needed to do on this shopping website.* (PU8)	I could not do some of the things I needed to do on the gaming website.	I could not do some of the things I needed to do with Sanctuarium.

Permission to use the scale was obtained from the UES originators. The UESz-m was administered using a five-point scale with "strongly disagree" and "strongly agree" at the respective endpoints. The wording of the questions in the UESz was adjusted for the technology-supported meditation activity (UESz-m). Items with an asterisk (*) indicate reverse-coded items which were maintained from the original UES and the UESz. The UESz retained the UES original subscales of FA, PU, and AE but combined the scales of EN, NO, and FI into a new scale titled Satisfaction (SAz). Question PU7, EN2, and FI2 were eliminated from the UES to the UESz. For the UESz, question FI1 was moved to FAz, and questions EN2 and EN3 were moved to PUz. The UESz-m maintained the UESz scale and question changes. Only the phrasing was adjusted from "gaming" references to "meditation" references. Parenthetical designations indicate the UESz and UESz-m sub-scales as follows:

- Focused Attention (FAz) (retained FA1-7 from original UES with FI1 added)
- Perceived Usability (PUz) (PU1-6 and PU-8 retained from original UES with PU7 eliminated and EN3 added)
- Aesthetics (AEz) (AE1-5 retained from original UES)
- Satisfaction (SAz) (combined FI3, EN1, EN4-5, and NO1-3 from original UES to form new consolidated dimension)

Appendix J

Experience of Meditation During Meditation (EOM-DM) Scale

EOM-DM Questions:

1. My body becomes heavy. (RE)
2. My perceptions are clearer. (CE)
3. I have thoughts or memories which bring an emotional response. (EE)
4. My body awareness changes - as if parts of it were "missing" or expanding in size or becoming distorted. (RE)
5. I experience what are sometimes described as "psychic phenomena." (ME)
6. I feel the desire to cough, sneeze, scratch or swallow. (PD)
7. I am able to let my thoughts go and not get caught up in them. (CE)
8. I feel a sense of awe and wonder. (ME)
9. I observe my thoughts as an impartial observer. (CE)
10. I experience intense emotions. (EE)
11. I observe without judgment any negative thoughts or emotions that arise. (CE)
12. I experience feelings of anger. (EE)
13. I have a new awareness of order in the universe. (ME)
14. My body becomes soft and loose. (RE)
15. I experience feelings of tension and anxiety. (EE)
16. I observe without judgment any positive thoughts or emotions that arise. (CE)
17. I feel my heart rate slow down. (RE)
18. I accept my meditation practice however it is going. (CE)

19. I experience fluctuating emotions. (EE)

20. I feel the desire to smile or laugh. (PD)

21. My mind is alert but still. (CE)

22. I feel my breathing slow down. (RE)

23. I feel restlessness or twitching of parts of my body. (PD)

24. I experience feelings of gratitude and contentment. (CE)

25. I have an experience of contact with a higher power. (ME)

26. I am aware of physical discomfort. (PD)

27. I experience feelings of sadness and depression. (EE)

28. I become aware of tightness in parts of my body. (PD)

29. I have what I describe as a mystical experience. (ME)

Permission to use the EOM-DM scale has been obtained from the creators. The EOM-DM Scale (Reavley & Pallant, 2009) was administered using a six-point scale with "almost never" and "almost always" as the respective endpoints. Parenthetical designations indicate the sub-scale as follows:

- Cognitive Effects (CE)
- Emotional Effects (EE)
- Mystical Experiences (ME)
- Relaxation (RE)
- Physical Discomfort (PD)

Appendix K

Pilot Script

1. *Make sure to have a folder with participant number and all materials.*
2. *Have computers and router set up and already tested and ready to go. (See technical set-up instructions.)*
3. *Make sure signs are on doors indicating that research is being conducted.*
4. Thank you for participating in this study on technology-supported meditation. My name is Laura Downey and I am the researcher who designed the study. The study involves several steps and will take approximately two hours including this introduction.
5. First, I will give you the informed consent form. This will explain the study and all the steps. When you are finished reading the form, please sign and date the form and I will do the same. Please also feel free to ask me any questions. Would you like a copy of the signed form? If so, I'll make one while you are filling out one of the surveys towards the end of our session.
6. *Sign and date informed consent form and place in folder. (If participant wants copy, then make a copy while they are filling out the EOM-DM survey at the end of the session.)*
7. Okay great, here is the short demographic questionnaire.
8. *Collect the demographic questionnaire and place in folder.*

9. Now I would like to conduct a short interview on your regular meditation experience. As mentioned in the consent form this will be recorded so that I can make sure to not miss any of your answers. I may also take some notes. Ready? *Make sure to bracket my own thoughts/feelings on meditation.*
10. *Turn on digital tape recorder and annotate participant number and pre or post activity interview. Begin asking questions.*
11. *When interview is complete, turn off digital tape recorder.*
12. Thank you for sharing your experience. *Hand participant set of avatar pages.* To prepare for interacting with Sanctuarium, please choose an avatar from these pages indicating how you would like to be represented in Sanctuarium. Circle your choice. I will input your selection to the virtual world.
13. *Place page with circled avatar choice in participant folder.*
14. Here is some information about Sanctuarium, please take your time to read this information and let me know when you are ready to begin.
15. *While participant is reading the explanatory information, select the participant's avatar in Sanctuarium and bring up the welcome screen.*
16. When I leave the room, go ahead and begin. The technical programmer and I will be able to see your screen in another room but that is all. You will be alone to experience this meditation journey in Sanctuarium. As mentioned in the explanatory information, there will be a few messages and simple instructions along the way and you only have to touch the screen or touch the message to clear a message and continue. Ready? Okay good, I'll be back when you are done.

17. The next task is a short survey about interacting with Sanctuarium. *Hand UESz-m to participant.*

18. *Place completed engagement scale into participant folder.*

19. Thank you. Here is a short survey about your overall meditation experience with Sanctuarium. *If participant indicated they wanted a copy of the signed informed consent form, then go make copy while they are filling out the EOM-DM.*

20. *Place completed EOM-DM into participant folder. Hand participant copy of informed consent form if they so indicated.*

21. Okay great. Now we are ready for our final activity, an interview about your experience in Sanctuarium. Again, the interview will be recorded. Ready? *Make sure to bracket my own thoughts on meditation and meditation using Sanctuarium.*

22. *Turn on digital tape recorder and annotate participant number and post-activity interview. Set speaker towards Participant. Begin interview. When interview is complete, turn off digital recorder.*

23. We are done. Thank you so much for your participation today.

24. *Walk participant to door. Place participant folder into "completed bag."*

25. *Get new participant folder.*

26. *Reset Sanctuarium on Yoga 2 and SP3 to point where next avatar can be selected for the incoming participant. See technical set-up instructions.*

27. *If end of testing for that day, make sure to upload digital recording to transcription dropbox and send email to transcriptionist that a new recording is in the folder.*

Appendix L
Avatars


Isabella 1


Isabella 2


Isabella 3


Isabella 4

Isabella 5

Isabella 6

Isabella 7

Isabella 8

Isabella 9

Isabella 10

Isabella 11

Isabella 12

Isabella 13

Isabella 14

Isabella 15

Isabella 16

Isabella 17

Isabella 18

Isabella 19

Isabella 20

Isabella 21

Isabella 22

Isabella 23

Isabella 24

Sean 25

Sean 26

Sean 27

Sean 28


Sean 29


Sean 30


Sean 31


Sean 32


Sean 33


Sean 34


Sean 35


Sean 36


Sean 37


Sean 38


Sean 39


Sean 40


Sean 41


Sean 42


Sean 43


Sean 44


Sean 45


Sean 46


Sean 47


Sean 48

Appendix M

Demographic Data

Table M1

Detailed Demographic Data

Question	Pilot	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11
Age	66	75	60	66	61	39	68	54	58	46	58	32
Profession	retired S/W archit	retired	defense contr by day, yogini by night	retired social worker	chose not to answer	comm mgr	IT prof	analyst	yoga instructor	lifestyle coach, healing facilitator	sales	yoga, meditation, instructor, life coach
Gender	F	F	F	F	M	F	F	M	F	F	M	F
Marital Status	M	R	M	S	S	S	W	S	M	M	S	R
Race/ Ethnicity	C	C	C	C	C	B	C	C	C	C	C	C
Years Meditating	18.5	3	44	20	21	4	8	0.67	2	2	8	7
Med Schedule	D	W	Wx2	D	M	D	Dx2	O	Wx2	D	Wx2	D

Question	Pilot	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11
Med Types	M	M	M	M	M	M	M	M	M	M	M	M
Average Med Time (mins)	45	15	20	20	20	20	25	20	30	30	10	20
Med Locaation	M	Y	M	M	M	M	H	H	M	M	M	M
Individual or Group Med	I, G	G	I, G	I, G	I, G	I	I, G	I	I, G	I, G	I, G	I, G
Self-directed or Guided	S	G	G	S	G	G	S, G	S	G	S, G	S, G	S
Avatar Choice	I24	I24	I20	I4	S42	I24	I2	S40	I24	I8	S38	I22
Total Test Time	75	70	75	75	80	75	75	60	62	70	96	57
Time of Day	D	D	D	D	D	N	N	D	D	D	D	D

Legend: Gender - (F)emale, (M)ale; Marital Status – (M)arried, (S)ingle, in (R)elationship, (W)idowed; Race/Ethnicity – (C)aucasian, (B)lack; Schedule – (D)aily, (W)eekly, (M)onthly, (O)ccasional; Types – (M)ultiple; Location – (H)ome, (Y)oga studio, (M)ultiple; Avatar – (I)Sabella, (S)ean; Time of Day – (D)ay, (N)ight

Appendix N

UESz-m Data

Table N1

*Detailed UESz-m Data (*indicates reversed score) (Likert scale of one to five)*

Sub-scale/ Question	Pilot	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	Question Mean
AE-Q17	5	4	5	4	3	5	5	5	4	4	4	4	4.33
AE-Q18	5	4	5	4	4	5	5	5	4	4	4	4	4.42
AE-Q19	4	4	5	4	4	5	5	5	4	4	5	4	4.42
AE-Q20	5	4	5	4	4	5	5	5	4	4	5	4	4.50
AE-Q21	5	4	5	4	4	5	5	5	4	4	4	4	4.42
Participant Sub-scale Score	4.80	4.00	5.00	4.00	3.80	5.00	5.00	5.00	4.00	4.00	4.40	4.00	

Sub-scale/ Question	Pilot	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	Question Mean
FA-Q1	4	4	3	4	4	4	5	5	4	4	4	4	4.08
FA-Q2	4	4	4	4	4	4	4.5	5	4	4	5	4	4.21
FA-Q3	4	5	4	4	4	4	5	5	4	4	3	3	4.08
FA-Q4	3	5	4	4	4	4	5	4	5	4	5	4	4.25
FA-Q5	4	4	5	4	4	5	4	5	5	4	4	4	4.33
FA-Q6	4	5	4	4	5	4	4	5	4	4	5	4	4.33
FA-Q7	3	4	3	3	3	4	5	5	5	4	4	4	3.92
FA-Q8	4	5	3	4	4	4	4	5	4	4	4	3	4.00
Participant Sub-scale Score	3.75	4.50	3.75	3.88	4.00	4.13	4.56	4.88	4.38	4.00	4.25	3.75	
PU*-Q14	3	4	5	4	4	4	5	2	5	5	5	3	4.08
PU*-Q22	4	5	5	5	4	4	5	4	5	5	5	3	4.50
PU*-Q23	4	5	5	5	4	5	5	5	5	5	5	4	4.75
PU*-Q24	4	5	4	5	5	5	5	5	5	5	4	4	4.67
PU*-Q25	4	5	5	5	5	5	5	5	5	5	5	4	4.83
PU*Q26	4	5	5	5	5	3	5	5	5	5	5	4	4.67
PU*-Q27	4	4	5	5	5	4	5	5	5	5	4	4	4.58
PU*-Q28	4	5	5	5	5	5	5	5	4	5	5	5	4.83
Participant Sub-scale Score	3.88	4.75	4.88	4.88	4.63	4.38	5.00	4.50	4.88	5.00	4.75	3.88	

Sub-scale/ Question	Pilot	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	Question Mean
SA-Q9	4	5	5	4	3	4	4	5	5	4	5	4	4.33
SA-Q10	3	4	4	4	4	4	5	5	5	4	5	4	4.25
SA-Q11	4	5	4	4	4	5	5	5	5	4	4	4	4.42
SA-Q12	4	5	4	4	4	5	5	5	5	4	5	4	4.50
SA-Q13	4	5	4	3	3	4	5	5	5	4	5	4	4.25
SA-Q15	4	5	4	4	4	4	5	5	4	4	4	4	4.25
SA-Q16	3	4	4	3	4	4	5	5	4	4	5	3	4.00
Participant Sub-scale Score	3.71	4.71	4.14	3.71	3.71	4.29	4.86	5.00	4.71	4.00	4.71	3.86	

Legend: AE = Aesthetics, FA = Focused Attention, PU = Perceived Usability, SA = Satisfaction

Appendix O

EOM-DM Data

Table O1

Detailed EOM-DM Data (Likert scale of one to six)

Sub-scale/ Question	Pilot	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	Question Mean
CE-Q2	4	5	4	4	4	4	4	5	5	5	6	4	4.50
CE-Q7	5	5	4	6	5	5	5	6	5	4	5	4	4.92
CE-Q9	5	2	5	5	4	5	6	4	5	4	5	4	4.50
CE-Q11	5	6	5	5	5	5	6	5	5	5	3	5	5.00
CE-Q16	5	6	3	5	5	5	5	5	4	4	5	5	4.75
CE-Q18	5	6	5	5	5	5	6	6	5	5	3	5	5.08
CE-Q21	5	6	6	5	5	5	5	6	6	4	5	4	5.17
CE-Q24	4	6	6	5	3	5	6	6	5	5	4	4	4.92
Participant Sub-scale Score	4.75	5.25	4.75	5.00	4.50	4.88	5.38	5.38	5.00	4.50	4.50	4.38	

Sub-scale/ Question	Pilot	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	Question Mean
EE-Q3	4	4	5	4	3	4	5	6	3	4	6	2	4.17
EE-Q10	2	4	2	4	2	3	4	3	2	4	4	1	2.92
EE-Q12	1	1	1	1	1	1	1	1	1	1	1	1	1.00
EE-Q15	3	1	1	1	1	1	1	1	1	1	1	1	1.17
EE-Q19	4	6	3	2	2	3	2	1	2	2	4	4	2.92
EE-Q27	2	1	1	2	1	1	1	1	1	1	5	1	1.50
Participant Sub-scale Score	2.67	2.83	2.17	2.33	1.67	2.17	2.33	2.17	1.67	2.17	3.50	1.67	
ME-Q5	1	1	1	2	4	4	2	2	3	4	4	1	2.42
ME-Q8	4	5	5	5	3	6	4	3	4	4	4	4	4.25
ME-Q13	1	3	3	3	2	4	5	1	4	4	3	1	2.83
ME-Q25	2	3	3	5	4	5	6	1	4	4	5	5	3.92
ME-Q29	1	3	1	3	4	5	4	1	4	4	2	3	2.92
Participant Sub-scale Score	1.80	3.00	2.60	3.60	3.40	4.80	4.20	1.60	3.80	4.00	3.60	2.80	

Sub-scale/ Question	Pilot	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	Question Mean
PD-Q6	1	1	4	1	2	1	1	4	1	3	1	1	1.75
PD-Q20	2	4	5	5	3	3	5	6	3	4	6	2	4.00
PD-Q23	1	1	4	2	2	2	1	4	1	2	1	1	1.83
PD-Q26	3	1	2	2	1	2	1	3	1	2	1	1	1.67
PD-Q28	2	1	4	4	2	2	1	5	1	2	1	1	2.17
Participant Sub-scale Score	1.80	1.60	3.80	2.80	2.00	2.00	1.80	4.40	1.40	2.60	2.00	1.20	
RE-Q1	1	4	4	3	5	2	1	6	4	4	5	5	3.67
RE-Q4	2	2	4	4	4	4	1	5	3	4	5	5	3.58
RE-Q14	2	4	4	4	5	4	5	6	4	4	5	5	4.33
RE-Q17	1	3	5	5	6	3	4	1	5	3	4	6	3.83
RE-Q22	1	4	5	5	6	4	6	6	6	5	4	6	4.83
Participant Sub-scale Score	1.40	3.40	4.40	4.20	5.20	3.40	3.40	4.80	4.40	4.00	4.60	5.40	

Legend: CE = Cognitive Effects, EE = Emotional Effects, ME = Mystical Experiences, PD = Physical Discomfort, RE = Relaxation

Appendix P
Themes and Significant Statements

From Pre-Activity Interview

Definition of Meditation:

1. He's [John Kabat-Zinn] secularized meditation, you know, took it out of the spiritual realm a little bit and he made it into something you can quantify or understand this as a researcher. He made it into the, you know, the 20-minute… what you do with novices and then exactly what you do with them.
2. Well, there's a difference between the motivation for why you're doing the meditation. So when I say secularized it, he's made it accessible to people who are not looking for a spiritual path, who are just looking for stress-relief and a calmer life and so on. They're not necessarily looking to, you know, give their life for the benefit of beings, you know, that would even… They don't believe… My brother is an atheist and he can do mindfulness meditation. It's not a conflict with being a card-carrying atheist.
3. You know, we all have this distraction, you know, and Sogyal Rinpoche's definition of meditation is a state of non-distraction, so you're not off, you know, starring in the Super Bowl or whatever.
4. So when I'm talking about my meditation practice that's not a visualization…
5. And my favorite at the time – and I don't even do it that much anymore – was the candlelight meditation so that you're focused with a drishti; you repeat it in your third eye.

6. And as a younger person my imagination was really wild and uncensored so I really would get deep visualizations from that. So much so that I started to get nervous about it and then I backed off.
7. I used to go to Notre Dame and I'd just sit and reflect at the rose window. I mean, that was my meditation. So, you know, some people might think it's prayer but I don't think I was praying; I think it was more meditative.
8. Really introduced me to the guided meditations and that just, you know, took off.
9. Really, really, really got into the visualization meditation.
10. I guess all of the training I had was by doing except when I moved here I did take the MBSR training that they offered at the studio.
11. But I have found that if you are working with the general population and they haven't been exposed to meditation, having something to ease them into total quiet is a good way to go.
12. And part of that was for myself I found when I was the most stressed at work if you asked me to sit, my mind was goofy. If I could visualize something or a take a little voyage in a calm place I was able to get to a place of peace quicker.
13. So I know that, you know, real true yogis would say that's cheating, but, you know, as far as I'm concerned whatever works for you.
14. [Definition of centered]: Knowing that whatever's going to happen will be okay. Knowing that yes I can control some things but there's a lot of things that I can't, and recognizing what I can and can't. And sometimes it's hard, especially if you're Type A, not to try to…I liken it to instead of being in the situation you're kind of watching the situation unfold. And in a way it gives you a better control

because you're not reacting. And that's because you're here in yourself saying, 'Okay, let's let this unfold and see what's going to happen.

15. A connection to me would be just a… I guess you would say happy satisfaction, feeling… I guess feeling clarity of just who I am and what I'm… you know, my surroundings.
16. A lot of people don't realize that a lot of these techniques are pointless because we all have the innate power to tap into this and it's an inward journey. And that's what meditation is – it's an inward journey…you really don't need to be looking outside of yourself to, you know, tap into your creative and intuitive power. I mean, it's there. The idea is by taking that journey inward you can watch the boundaries disappear. Alright? So it's a path to oneness.
17. So I don't sit around all day meditating, but taking the Jon Kabat-Zinn approach I do find myself slipping into meditative states all the time. It's nothing like, you know, blocking out an hour a day every day at a specific time. It's like getting into the zone and…
18. Just finding a state of peace - you know, like catch-as-catch-can
19. I do yoga a lot and you slip into a meditative state without stressing about it or working towards it.
20. You're simply focused on the breath. So it becomes a moving meditation. So I wrote down like maybe I'll meditate once a month. But the fact is if I do twenty yoga classes a month I'm meditating a lot more than just once a month, because when you're, you know, like ten minutes, fifteen minutes into that class…

21. When I say ‘get centered’ I take those few steps to take the depth breath, think about what might have really triggered my feeling at that time, and then bring myself back to the calm. Because I know I can’t control… Like what can I control? It basically almost goes to serenity prayer for me…
22. Focused and intentional.
23. Well, the chakras… I can do it when I’m lying down, but it’s more of that inner connectedness. you know, take in a deep breath to calm your physical body, to calm your emotional body, to calm your mental body.
24. Sometimes I'll call on guides – who are you? Okay, so if I’m divinely guided what does that mean? Who are you?
25. Achieving an inner calm and sense of focus, and ability to shut out the distractions of the outside world; to elevate one’s consciousness beyond the mundane day-to-day concerns of life and to sort of free flow and do some creative sort of subconscious thinking.
26. I believe meditation’s very different from prayer but I think that just the general overall mindfulness and attitude about spirituality has enabled me to learn more about myself through prayer and meditation, which are very different things now.

Motivations for Meditation:

1. So the reason that you meditate is to get in touch with the nature of mind, you know. And eventually you can drop, you can let go of all your thoughts, your emotions, your habits, your… all these things that are in the way of being in touch with the nature of mind.
2. In order to make progress on the path.

3. …basically just to develop my spirituality and to just expand, you know, some experiences that I felt were important to me. Just that self-reflection. (example of experience LLD) Participate to the fullest.
4. Basically to reduce anxiety and stress level and later it blossomed into more of a spiritual exploration. So clearly in both cases it was really to come to an inner sense of calm or peace.
5. And I did. I did meditation fairly regularly. But my job was much more stressful. So what would happen is I didn't have a regular practice per se, but because we lived in such a setting, if I would start into work and I would feel the stress I'd turn around, I'd come home, I'd get on my deck and I'd look out over the mountains and I'd just breathe.
6. Just as a way of giving me a grounding… foundation. Just a connection. Just a connecting…To a higher power, to the divine. So meditation is a good way for me to stay present and in my body, that type of thing.
7. And because I do spiritual healing work… the context of doing my work it's also a very meditative practice as a practitioner. So again it's more an active meditative state that I get into when I'm actually interacting with clients.
8. And in terms of tapping into your higher power, higher self, meditation is highly recommended for that purpose.
9. And it also was a… more recently I would say it's been a… As my religious views have changed in some drastic ways in the last year, I find it to be almost like a transitory type of thing. Like maybe like it's my prayer now more

than it was before – even though before I would say I incorporated both anyway and I probably still do.

10. Mainly because I read a lot of articles about the psychological and physiological changes that it can have on your body. It has helped me to stay centered even as I work out the other types of belief systems and whatnot, because it's the one thing that's sort of constant, no matter.
11. You know, there's always the need to quiet your mind and to really see things, and so it helps me to be more open to the spirit world, I guess, and to spiritual awakening overall.
12. Just a sense of calm. And like one of the other reasons I think I kind of really started to pursue it is because when I would start to feel a sense of anxiety - and maybe not in a really official sense but just feeling, okay, I'm stressed, I'm whatever – the mindfulness thing really came to be something I learned about and I started to say, okay, that's something I can do at any given time and just start to take a breath and figure out why do I feel what I feel now. You know, sometimes it could be somebody cut you off in traffic…
13. Not that I have experienced this, but I've experienced friends and family who maybe were ill. And I feel like your mind is so strong. And like even if my body were to start to give out at some point, if I can have the mind control in terms of being able to unleash whatever powers or whatever…there's a lot there that we can do with our mind.

14. I was looking to connect at a higher level with my soul. And I was in a group of people who meditated together for like 25 years, and they're sitting around and I'm thinking, 'What the heck?' You know? So that's when I started.
15. For peace of mind and ability to focus in the moment and to become more centered and less being caught in the past or in the future; trying to stay in the moment.
16. Well, I really started pursuing it in more sincerity, I guess you could say, when I became a yoga instructor and during my teacher training. Before then I had just done it on sort of a limited basis, maybe during a class or taking a couple of classes.
17. I actually sort of fell into it. I, if you will, had a sort of an awakening, I think, years ago and I realized… I took a yoga class and I realized that all of these years that I had been running away from myself. What I really needed was to go within.
18. Not to say in the beginning I meditated every day or anything like that, but I became more and more drawn to it and would try a little bit by myself - not very successfully, but just do breathing work in the beginning and try to visualize, and then I got into the guided. Then I found a few groups to participate in. So I decided to see, you know, what it's like to be in a group and meditate.
19. You know, alcohol caused problems in my life. I have not consumed any alcohol in more than seven years. And so I started going to 12-step meetings and meditation and prayer and group therapy, and all sorts of things were helpful to

me first to stop drinking alcohol, and about maybe two years later – I think I was on March 15th actually that…

20. I had a spiritual experience of God consciousness that was really like very dramatic and I believe it would be called a photism in the literature, in which I seen the light. I saw standing in one place… what I was looking at became hyper-illuminated in a unique way and I heard a sound and I…And it was dark and grey and then all of a sudden it lit up as if, you know, these lights came on. And the way that the light came through the trees and the leaves moved was… with brilliant colors like I'd never seen before. And it lasted… I do believe that it was my higher power or God reassuring me. But that I would say is a life-changing experience in that it convinced me that… From that point I believed that each of us have an ability to connect with that divine
21. Well, my meditation was part of a spiritual practice. … I mean, the meditation I'm doing now is very different than the meditation I came from before. It was very much a form of prayer for me – which it is now but it's very different, I started pursuing it much more intentionally from a Buddhist perspective for both devotional purposes but then also like to really kind of rebalance things out, because I was under extreme stress and experiencing a lot of severe health conditions at the time, including a potential diagnosis with lupus…
22. Yeah. So it felt to me like basically I needed to do something about it. And I had been on a really intense spiritual path at that time and the way that things worked this teacher that was brought into my life who was a former Buddhist monk and then that's how I started getting into meditation.

23. Very much when I connected to him still meditation was also part of like stress but then also for me it was something that I thought would kind of deepen that path for me.

Learning Meditation:

1. Well, I read a book in 1996 called The Tibetan Book of Living and Dying by Sogyal Rinpoche and it's the first kind of… I used to read everything - you know, all kinds of spiritual literature and nonspiritual literature – and it was the first thing that really made me think, 'Ah, this makes sense.'
2. Though meditation itself can be difficult sometimes, you know, because you find that your mind's wandering and you can give yourself a hard time about, you know, being lost in thought.
3. So my mind still wanders, you know, but I have learned that when you recognize that you simply come back. So of course I would certainly wish that my mind wouldn't wander, but that it is what it is - that's what minds do.
4. Well, I think I'm still learning.
5. I think mostly guided, but I think that also some self-direction, some ways to focus. I mean, I guess it depends.
6. So I got into a regular guided meditation practice with that woman and this course the whole time it was going.
7. And so I got my initial yoga teacher training in 2011 and have incorporated meditation into my practice, because I've taken additional courses where meditation is part of it.
8. I was just part of a meditation group. The leader guiding us, I guess.

9. Well, it was a recommendation on the part of a mentor, and I actually joined the group in New York City that met on a monthly basis and it was guided meditation. And in between monthly events I did individual meditation. Guided meditation involved visualizing, learning the chakra colors in sequence through the body.
10. Mentor recommendation plus books. Like I already mentioned Jon Kabat-Zinn's work. I have explored Buddhism. So I've been to Buddhist functions. Of course I was exposed… I went to my first yoga class in 2001. And a lot of the metaphysical material that I was involved with recommended meditation and gave instructions D115– you know, like this is what you do; you focus on the breath; let go of the thought, you know.
11. Well, the biggest influence, I guess, would be through reading a couple of articles – like I said, one or two in particular on mindfulness, with examples of how to do certain things.
12. But I would say that those things all influence it – you know, reading about it, doing the series through the Institute that they do, and then through yoga, just seeing like, well, I can take a mantra and just focus on that or just, you know, that type of stuff.
13. And then also when Oprah Winfrey and Deepak Chopra started doing those meditation series… Each series follows a theme and each day you have a mantra or you have a centering thought. And so what I try to do… With those two I do it in the morning usually, so kind of get the day started, even if it meant waking up

a little earlier. And then I would usually write down in my planner for the day whatever the centering thought is or try to go back to it later in the day and…

14. I tried a lot of different yoga. But Kundalini yoga really resonated with me and I was actually able to do it, you know. It's not like vinyasa where the body… I mean, my body just doesn't work like that. But Kundalini yoga I could do almost everything. And breathing. A lot of the postures or the kriyas are seated, and…
15. And so then when I took the yoga teacher training I did learn more about it. I had two very good teachers and a lot of other outside influences during that training and I began to get comfortable with it and learn that I could do it. So during those nine months of the teacher training I learned a lot and tried to begin on a regular basis and I have managed to continue fairly well since then.
16. It was mostly from my teacher training, but I've also learned from attending various meditation groups and had been fortunate to have been exposed to different teachers and to learn different methodologies and different foundations for the meditation.
17. And I've also sort of gotten into the online versions; mainly like through podcasts…
18. I took a course at Duke Integrated Medicine and it was for therapeutic yoga for seniors. And so part of that was devoted to some meditation and it was nice because it was in a different location. They use some different venues. It was more of a group setting. And I love the way they use different sort of goals and objectives through that meditation. So that was a whole different sort of exposure from another side. Yes, this was much more secular. One of the reasons they do

it… And it was actually involved in the time when… This was a program for seniors. So there is a big section of that training on end-of-life and palliative care.

19. I think another good thing is that I learn something different each time. Sometimes it's personal feelings or personal thoughts that maybe you can guide yourself in a certain direction that you have not taken yourself before, sometimes because you just haven't taken the time to do so or been directed to do so.
20. I'd like to expand my repertoire so to speak a little bit so I learn a little bit more about again different foundations, different methodologies. I'm very interested in the breathing part of it.
21. And then in the group. And then from reading some books, you know. So just various different ways.
22. So that led to me experimenting more with just trying to find a place at home to be still and quiet and personal meditation, which wasn't necessarily guided or anything really more than just trying to be still and quiet.
23. And it was three or four years of specifically like Buddhist mindfulness meditation practices and then also learning different yoga meditation practices too…

Teaching Meditation/Serving Others:

1. So now that's complete and I've been stamped on the head as an instructor, so now I'm holding classes in meditation
2. But all of it's motivated by this wish to benefit beings and to… You know, Buddha chitta is to become enlightened for the benefit of beings and that's what

my motivation is. So all the classes, the meditation itself, all of that comes from that fundamental motivation.

3. You know, this is crazy. I have all the training. What am I going to do?' So I decided to study to become a yoga teacher.
4. But in terms of being an active co-creator of your experience, alright, we're using meditation to actually cement in or focus people on their intentionality.
5. Over the years, though, I've been actively involved in a course in miracle study and other studies and what it's really come down to for me is that what I teach – what I call trinity healing – is a practice that's focused on personal empowerment. It's non-dogmatic. It's for everyone. And if you really do want to help the planet you really have to shift the vibration of everybody on the planet, which means you want to make these types of practices accessible.
6. Also for my teaching… And I also teach some other groups. I teach seniors. I teach rehab groups. I teach some substance abuse groups. So it's important for me to learn…
7. So for me that's another good reason to continue to learn: continue to share it - which I love.
8. But I never expected to end up teaching it, and that's what ended up happening.
9. But I feel called through teaching to serve and so then I keep saying yes to that rather than protecting multiple hours in the day.

Effects of Meditation:

1. Always better, but usually I'm almost always by the time I finish the meditation I feel more settled, more calm, and have more clarity.

2. I always feel better. I feel calmer maybe, you know, able to do some self-reflection that I don't take time for.
3. I feel really centered and calm.
4. I feel very relaxed, connecting to what's around me, connected to people around me. I feel very present.
5. I feel peaceful. Sometimes I think, especially at first, I didn't really feel like there was a huge difference. You know, sometimes it's kind of like, oh well, maybe it's me; maybe I messed up…
6. Sometimes I feel like wobbly - like phew! - and I just have to sit. And I've learned the importance of grounding myself after meditation, drinking water, you know, eating raw chocolate. My two favorites things: drinking water and eating raw chocolate.
7. Well, usually the way I feel after meditation is complete. Sometimes, meditation only lasts like 11 minutes and then I know, okay, it's time to stop, it's okay, and other times maybe it's going to be 45 minutes, maybe it's going to be longer, and it's no big deal. It doesn't even matter.
8. I usually feel very good, just like I usually feel very good after yoga or after a workout. , there seems to be a sort of a residual cleansing effect, like a lightness almost, light', 'unencumbered', 'supple'…'Strong' and 'alive'.
9. I think just a chance to calm down, find a bit of quiet both externally and internally.
10. So when I do it I always come away – so far – with a good feeling; but in the end I always feel… I feel calmed by it. I feel also awakened by it a little bit and I feel

like I need to do this every day. A stillness'; I think maybe 'self-care' or 'self-compassion'…

11. That's another thing I like - just sort of clearing out and maybe bringing things later to the fore that I probably should have brought in.
12. I mean, it has been very effective for me. On many, many levels it just makes me very happy, puts me in a wonderful state, and I feel sort of elevated after I do that even if it's for a little bit.
13. I feel as though I've come into balance not only within myself but with what's around me. I feel a sense of harmony. I feel peace. It's funny; sometimes I feel like I'm floating, you know, when I do that and it's going to this blissful state. It kind of makes me feel good about being me at the time. You know, I feel like I'm a better person now that I've meditated, because it takes away so much of the nonsense that we usually have on our minds during the day, and the chatter and, in my opinion, insignificant thoughts, you know. So it suddenly shifts everything into another perspective. So I feel more at one, if you will, more at one with nature and myself and everything around me.
14. I really feel when I go within that I connect with my source; that I tap into – at least that's my intention every time – but, you know, I feel even having tried to connect to the source within it puts me in touch with something grander than myself, something more vibrant, more powerful than myself, and I feel joy with that.
15. Well, I usually feel more peaceful. I feel more serene. Oftentimes, I feel as if I know what my purpose is, at least for that day, just in terms of specific activities.

So often when I begin meditation there's not much clarity in my mind, I would say. My mind is moving and, you know, active, but it's not focused. So I'd say I feel more focused and I feel more directed.

16. I feel much myself. I don't know how to explain it. It's like grounded and present and just there's a lot of clarity. There's a lot of clarity. I can just like see things a lot more clearly. And, yeah, I would say and peaceful, tranquil. Sometimes I experience a lot of joy afterwards. Sometimes it's just a very quiet like steadiness. I get a sense of like deep contentment.

Realizations of Meditation:

1. So you may enter into this, but if nothing was working you probably wouldn't continue. And I do continue because I find I have more… When I start my day with my 45 minutes of meditation I end up with more focus, I have insight, things go smoother. You know, it's not really anything you can put your finger on but it's a better day.
2. Maybe doing some changes or making some decisions. I mean, I think it can be helpful… yeah… doing…
3. Well, because I think it's helpful to me as a person. I think it helps me be a better person. It helps me. And I just simply want to improve. I think it's an important part of my life now, Well, being a better person, being more directed – I feel like it. Sometimes in my lifetime it seems like I should be more sure of direction, one that does no harm; that strives to make the world a better place for everybody; is kind.

4. You know, this isn't about me.' And I credit the meditation for enabling me to get to that spot. But when I was able to center with my breathing and say, 'Hey, I have compassion for you. You know, it was just being able to breathe and contain my center made what could have been a really ugly situation something that could be resolved. So I would say that because of the meditation – and I didn't start out that way – I could directly see benefits to what I was doing on the side in my practice to how I changed as an individual, especially in the work environment.
5. Because I still have a lot of emotions that come up and that's how I deal with them. And there's more relationships in my life that are more emotional than others and, you know, just trying to get there. And I think the other piece of it is too I think as we age… I'm not a religious person.
6. But I'm a spiritual person. And I think as you slow down and have time to contemplate more it's a good way to kind of go within and sort through next phases of your life. The spirituality part kind of came after the calm for me and again it was probably at Kripalu. I was somebody that wrestled with self-esteem for no apparent reason and it was in one of those meditative sessions in Kripalu where – and this sounds really hinky, I know - I felt like I met my inner self, who said, 'It's okay. Give yourself a break.'
7. But when I'm doing a lot of meditation, that intuition, that person, that being – whatever it is – that energy… I don't know what to call it but that's what speaks to me and says it's okay. She doesn't surface all the time.

8. Just that it gives me, you know, a feeling of being present, being connected to the divine or to, you know… Just being connected to the source or whoever you want to put it. For relaxation. It's a way that I can get clear as to who I am and whose I am and… I use meditation just to sort of, you know, just be clear and connected.
9. I find it very relaxing. And I will tell you that over the last three decades I went from being a fairly stressed out individual to being much more Zen. I've been described as being very Zen. And I just am less at the effect of the stresses of the world, mainly because I don't give a crap! But I think the spiritual discipline of meditation, yoga… Like I've let go of a number of vices – alcohol, cigarettes – you know, I've had challenges with over the years, but it's all part of a multifaceted lifestyle shift, and meditative and healing arts have certainly been important in that.
10. Meditation is now like breathing. It's… well, you breathe in meditation, right? But a lot of what I do fosters a meditative state, alright. It's like second nature.
11. Or maybe I didn't do anything. But then I started to just like not judge it quite as much and realize that it was beneficial maybe even in ways I wasn't aware of. But I definitely feel like it adds something, because even if it's not like every day where I'm conscious of it, there were moments throughout that time where, when stressors would come that might have normally upset me, I was able to just again kind of go back to 'this is not my situation or my mess…
12. I just think now it's something that I want to have as part of my life, like exercise or anything else, like, you know, healthy eating, exercise… So it's a self-care type of thing… Just like I want to go to the spa regularly or …

13. But I've come to understand that I've been meditating off and on my whole life - so the contemplation and the, you know, meditative walks and all that - but I did not understand that that was actually meditation .
14. Sometimes it emerges but sometimes it's very specific. Sometimes what I'm seeking is I need help with this right now. Not in three hours - I need it right now. And those times I will just sit until help comes. And what I've learned is that when I ask, if I'm really specific like that, it's there.
15. So learning to ask for help has been a big learning for me. I mean, it's... Because growing up as a child we just didn't ask for help. In the service of others, to others, your needs are met.
16. What I learned was that in meditation there's an alignment that takes place. When I'm in alignment with my soul and not like out of balance or something then I'm open. But I have learned now to put myself into alignment without having to spend a lot of time to get there.
17. It's like food. And if I find myself snarky, in a bad mood, feeling bad about… starting to judge other people, then I know I'm way out of alignment with myself. And if I keep a meditation practice then I'm able to more stay with the mindset of just observe and not judge, and stop complaining. In fact, I don't have much to complain about, I really don't, and I'm fine with that.
18. Because I feel that it has benefits and I feel that I'm such a novice that I could probably get a lot better. Just like yoga or anything, I don't feel like I've achieved expert level.

19. Again I think it's important. I think it's important because I do… Because of my family situation - I have girls that are teenagers and it's sort of a vulnerable, susceptible time in their lives - I'm trying to share things like this with them a little bit, although… difficult for teens to sort of pick up on that.
20. Well, primarily I'd say it's connected to my program of recovery, which is one day at a time and trying to live in the moment. And I feel like every day I kind of need to reset.
21. I continue to meditate for that reason, but also, I mean, mainly now I continue to meditate because it gives me deep insight. Like I would say two things: (1) it keeps me in balance. I'm a pretty intense person. My partner describes me as like driving the motorcycle 100 miles an hour all the time.
22. Yeah, so I needed to keep myself in balance because my mind is naturally very intense and very extreme. And so it's to keep myself in check. (2) It's also connecting me to something deeper for me. It's a very spiritual practice. So it's connecting me with source. And it's taking time for that. And then (3) by connecting with source and balance like I also get a lot of deep insight into like just the nature of life and most importantly the nature of what's happening with me, like how are things happening and just like a lot of clarity of seeing how things are, how I'm showing up in the world, how I may be getting triggered by certain things, how I can start to shift patterns. Yeah.

Challenges and Changes to Meditation:

1. The only thing I can think of is that I wish I were doing more of it. So I don't think there's anything about the experience itself that I have any difficulty with.

So that keeps you going, even though the motivation is something greater than that. It does keep you going.

2. So the only thing is I wish, you know, I wish I could arrange my life to build in a couple of sessions a day rather than just one and have more time for the other practices that we do, which are with mantra and visualization and so on.
3. Well, definitely doing more on a more regular basis and more self-directed; being able to do it on my own.
4. I think I have the time. It's just making that a priority as opposed to maybe something else…
5. If I'm sitting in a traffic jam I breathe more now. So it's more like throughout the day I pull the techniques rather than sitting solidly for 30 minutes. So when I'm feeling disciplined I will say, 'Okay, I'm only going to do 10 minutes a day and I'll do that.' But that usually only lasts for so long, because my schedule's such that it's hard for me to commit to a specific time to just say I'm going to do it.
6. I just wish I was more diligent, because it is sporadic. I find that it's the place I return to when I need it versus something that I do out of habit.
7. Well, I mean, it's really funny, because I look at this little app I have that three times a day it just says 'be mindful'. I can't tell you how many times I just skip it because I'm on a task.
8. I think the only thing that I would like to do is have a more designated place in my home, you know, than I do. It would be a place where I would have, you know, my cushion and candles and incense and where I could just let nothing else happen there except sitting and meditating. totally dedicated space.

9. And I feel that if I focus a bit more on it and put a little bit more structure into it I think I might get more out of it, as opposed to the unstructured second nature thing which has sustained me for quite a while now. Now, getting back into it as a regular practice is something that's been on my mind a bit and…, that getting into a little bit more structured meditative work would be beneficial to me getting to the next level.
10. I just see that meditation could play a bigger role.
11. I wish I could be more consistent and not necessarily as reliant on a series to do it more consistently. You know, again I do certain things daily and I practice yoga a lot, but to really…
12. The hardest thing for me is to really relax and quieten my mind. It really is difficult. It's so hard for me to just be still because I am sort of that Type A. So that would definitely help me be better at meditation if I could just really start to let go. And I think that's a vulnerability thing, you know.
13. And sometimes it's not easy to focus, but if there's no intention it's impossible. It's just... I just… okay, I'm not able to do this. I'm not able to do this. I mean, I'll sit and, you know, it just isn't happening. You know, the thoughts are coming in at 500 miles an hour.
14. Well, I've thought I'd like to have a nice little room, [scarlet] Buddha here and some nice plants and a water feature and all that.
15. I wish I could probably change the regularity and the frequency. I wish I could get into more of a routine where I would do it, you know, at a certain time of day or every day for, you know, 20 minutes or something like that.

16. But it's one of those things where, you know, with a full-time job and kids and everything it's difficulty to squeeze everything in.
17. I have a busy life and two teenage girls, so sometimes I found that I wasn't very good… I was never very good at taking time for myself. And as much as you think you can do it you can't. So I had to literally learn to do it. And so I wanted to find a way…
18. It's sort of a regular space. I know I keep telling myself I'm going to, you know, kind of create a space that's more conducive to it in my home, but again that hasn't happened yet. So there are things I know I can improve. I can improve consistency of time, consistency of space or landscape, if you will.
19. I get distracted very easily and it's hard to quiet my mind. So I use guided meditation a little more than other things just because it helps me focus.
20. Oh dear, that's an easy one to answer. I wish I could just tap into it as soon as I… I wish it wouldn't take me so long to sort of get to the state that my mind is still. It takes me a long time to do that.
21. What I would change is that I want to be more advanced as I progress in life. As I become older I want to become wiser. And I think I still feel like that I'm very inexperienced and many more things will be revealed to me. However, I'm not impatient for that.

Appendix Q

Themes and Significant Statements

from Post-Activity Interview

Previous Technology Use:

1. We use technology quite a bit to watch teachings from Sogyal Rinpoche. So they're on… you know, they're videos. And he's just sitting still and you're sitting there with a video. He is able to kind of project this sense of spaciousness that helps take you into that feeling of non-distraction – even on video.
2. CDs.
3. Most of what I have done has been either timers or reminders.
4. iPhone app, Insight Timer, Dharmaseed, That's a lot of talks and guided meditation.And I use that as regularly… For meditation I might put in my earphones and listen to the talks. I use this pretty much every morning just because it helps me to stay… you know, helps me stay focused.
5. Tapes; guided.
6. The guided meditation with The Chopra Center.
7. Guided meditations, they're very effective … And I had no idea they would be effective, because it was very different from the other meditations that I've done, you know, whether they're chanting meditations or visualize, because there's a speaking but there's also an intention of the meditation. Maybe the intention is to

experience joy, or maybe the intention is to manifest, or maybe the intention is a multidimensional reality.

8. There was a CD. It was like a Steven Halpern CD with just music, but not with any sort of instructions or words.
9. I do a lot of walking and I love to listen to podcasts while I'm walking, and I thought it would be a good way to just continue my education. ...And then I've actually done meditation through some of these online… I guess you could call it service or online.
10. Just listening to some meditations on YouTube.
11. I have like an app on it that's a timer that will sound like a gong. guided meditation tracks at times.

Design-driven Experience of TSM:

1. When we first started out from the porch thing and walked across, it seemed to me that the avatar was walking too fast. You know, like if I were doing a labyrinth I probably wouldn't walk that fast. And then I kind of got into it. I'm not saying you should slow it down; I'm just telling you what my experience was… was it was like oh wait, we're going too fast…
2. And then the sound was quite relaxing. It was, you know, jungle noises and water and… You know, it was quite nice. And I could really relax into, you know, and just imagine I was walking along and see the bamboo go by. And the butterflies were a nice touch.
3. And then when I got to the center and sat down that was very settling. To sit and have the noise of the water was very settling and it was a beautiful spot.

4. Didn’t want to leave. And then coming back was the same, and then when we actually went to the beach I wanted to stay longer.
5. You know, there were some things that came up like that that I could let go. But basically I think it's a beautiful environment and quite… very nicely done really.
6. I don’t know that I have ever meditated on anything that was moving. In my tradition we have visualizations and thangkas and these things, but they’re not moving; they’re still. So I don't think… I can’t think of any other visual experience where there was kind of a sense of movement, so I don't think I can think of anything else like it.
7. it was just intriguing. I mean, I just didn’t have any problem at all. Just experiencing it with… Yeah. I didn’t know what to expect. I mean, I guess there was a description and I thought, ‘Gosh, I…’ I don’t know what I thought. Maybe I thought there’d be more I had to do, I suppose, but I thought it was… I mean, I enjoyed it.
8. I think it was very easy to navigate
9. I enjoyed it. Oh, I think I perceived it all together. I was fascinated by the whole thing. And I did close my eyes during the meditation.
10. Oh, all of it. I love the water, and I know it was a waterfall and I suspected the other sound was the wind, although I didn’t see anything, you know… Actually nothing’s moving, so I pretended it was the ocean, you know…
11. [nothing comparative] Oh, no. Certainly not, no. Not really.
12. Well, as far as meditation it almost always involves the ocean and water, you know, the sounds. I mean, I could visualize that. … art…dance

13. Well, I'd just say it was sort of technologically new to me in many ways. So I got to choose my own avatar and then in a comfortable seating position began to walk behind, you know, Isabelle, and we walked and walked on a path. Well, you know, there were lots of trees. They were more like tall reeds, I guess.
14. And walked, you know, steadily along a path. A bit of a… it wasn't really winding but there were a few little twists in the path. And then came to a waterfall and sat and meditated for five minutes and then walked back. And - oh - along the path there were gongs… sounds… the sounds. The first two going were just the sound and then I think the third one was green, fluttery. But they looked more like… sort of like leaves, but I was following her and I… And then the next three were purple. Four and six looked like certain… pretty much like butterflies, but the one in the middle was more of a little flowery thing....And then coming back there were some extra ones
15. as far as any physical connection it's hard for me to make that because it doesn't look real.
16. I found myself drawn into the visuals. So rather than going inside it was more of an 'oh, what's going to happen next?' I found the background noises very soothing. I found myself looking forward to the butterflies popping up. And I really liked the setting of the inner labyrinth. I thought that was very relaxing.
17. Deepak Chopra came out with a computer-generated imagery meditation, which I don't know whether we actually bought or we had a sample of and I just thought it was interesting. But that would be the closest thing to it. ...I like this better. I don't remember enough of the particulars of the Deepak one but I think there

were too many things to do, whereas this was... you had the luxury of just being to meditate in this one.

18. I love being by the shore, so it really hit home in a meditative environment that I liked. It would be interesting if somebody was not a shore person or a coastal person how they would react. So maybe if there were multiple labyrinth walks in different environments, that might be an interesting way to go going forward.
19. I would tell them, hey, there's a really neat RPG out there that could really help you to slow down and remember to breathe. It might be a really neat way for them to connect to that. Or even kids that are playing the games that are very, very fast, to help them slow down.
20. No. I was actually pleasantly surprised, because what I was really concerned about is that it would take you out of yourself. And this was a nice way to first expose you to a different environment, slow you down, and then allow you to go in. I thought that was a nice blend.
21. Like the altar and the bells?... I loved it. ...the bells chiming and the butterflies coming out, I was looking for the next one. I love Tibetan bells.
22. I found it different from what I've done before. So it was a total new experience. I was totally fascinated by all the visuals that were there as she was walking the path. To be honest I got really taken… I mean, you know, I picked up on the bamboo beside her and looking at her path and, and, you know, when you went by wherever the Tibetan bells chimed, you know, the butterflies that came out.
23. It was a nice journey. It was nice, you know, to relax and just go where she was taking you or where she was walking.

24. I loved the middle part where she sat at the altar, and knowing that I want to put an altar into my condo I looked closely at what was around… what they had incorporated, which is the water and the candles. And I even said it to myself - remember that that's what you need to be part of yours.
25. I loved at the very beginning going across the bridge, and at the end. So the beginning and the end were not… And the end, going through the gate and coming out and sitting down at the edge of the ocean… I love to meditate at the ocean anyway.
26. So then there were the dolphins and that was just great. I just, you know, this was great. I kept waiting for the parrot on the side to do something but he didn't do anything. He just sat there.
27. I didn't see anything I'd really want to change in it. It had the Tibetan bells, which I like. I mean, it had all the things that I love – the Tibetan bells…. I love the bamboo along the side. So it's very visual. I love the dolphins. So I don't know to be honest that I'd really change or add anything.
28. I didn't think it needed something. It flowed nicely.
29. The onscreen instructions were fine. The fact that they told you that you either can close your eyes or not doing that center part, was, you know, it's good instruction.
30. Yeah, but the periodic gonging of course for people who were more susceptible to the sleep reaction or response… I know it was definitely useful. Having the gongs allowed you to, you know, like let go and not worry about falling asleep, whatever.

31. Because I was so relaxed and it was still so soothing. But then I'm thinking, 'Oh, I'm walking. I need to walk with my eyes open.' So that was something I experienced.
32. The meditation part itself flew by. Like it felt like a minute ...It was so short to me this time – which is good, because a lot of times I find it hard to stay for a full 20 minutes or 10 minutes or whatever I may try to do. So even though five is not that long in and of itself, it was very easy to stay focused for that amount of time.
33. But like I love the beach. I love certain… And I've traveled a lot. So, yes, there are times when I'm like, oh… go back to a place when I've been where I've had a great memory. ..Okay. I really like this one, you know, a lot. I would think mine would probably be similar because I like the beach…I love water. I love nature. So I like a lot of those elements.
34. I thought it was awesome.
35. Probably along the lines of video game sort of technology and avatars.
36. But the meditation part wasn't really guided. So that part I think, like you said, somebody would have to have some meditation experience the way it is now…
37. Like I really liked at the end how it said we're all islands of excellence and it gave that principle. But, you know, depending on expanding it, that theme could follow through but they could have more than one theme at the end…
38. I tend to be… I'm open but I'm skeptical too ….., I did kind of go in kind of skeptical about it. I'm not really sure. I've never done anything like that before.
39. And I'm glad that you didn't say, 'Oh, you're going to experience this and you're going to experience that.' People do that sometimes and then I don't and I'm

saying, ‘What’s going on with that? Is that false advertising?’ So then that starts that whole judgement thing and…

40. I would be interested in learning more about it.
41. Well, I would ask them to keep an open mind first and to put aside any judgments, preconceived ideas of what their experience was going to be about…
42. … I love those dolphins at the end. That was so cool.
43. I’ve never had any meditation experiences like that.
44. Well, I would say that I stand in front of a computer screen and an avatar - a cartoon me - that I had picked out walked down this long path to get to a little meditation spot and he’s sat down in front of a fountain with some candles around it and just kind of chilled out for five minutes, then you walk back out. And it’s quiet and you can hear the ocean in the background and you can hear some birds, and it’s just very calming and it’s all right there in front of you. Sometimes you close your eyes because the walk in and out sort of takes a long time. So sometimes you close your eyes, and then you’d hear the gong and then you'd know that you were passing these little pots with the butterflies, and so I’d open my eyes for that …And then it’s over. And it took about – I don't know – 20 minutes and it was calm and relaxing.
45. So I really liked it. I like the graphics. I like the color. I like the focus that it brought. Loved the sounds.
46. I like the way it worked. I think the sounds are so important, and the colors, and, like I said, the things that make you aware, and that things are a little bit changing in it. I think you want to avoid in a virtual thing... Like on this one there was a

time that I almost thought I was walking in a circle, and that's a little bit uncomfortable. But then the path changes. So just when you think that you're maybe taking off in a circle and that's a little bit… er… where you don't want to be, you kind of come out of it and go forward.

47. I liked about this were the changing things that you notice, the changing colors of the butterflies. The flowers stayed the same color. The bird stays the same. The butterflies changes. The clouds enter and exit. The sounds enter and exit.
48. But I will say that I was uncertain how I would be able to adapt to it or fit in, and I thought it was easy. I thought it was easy to make that jump into that.
49. I noticed the butterflies as I was walking and just noticed the clouds towards the center. You know, you could see clouds in the sky – those puffy white ones. And I hadn't noticed the bird flying. Coming back I noticed the bird, which was interesting.
50. Nothing you've experienced before. It's like being dipped into this peaceful world and your senses are stimulated. To just keep yourself open to the experience and just go with it because it's really beautiful.
51. I would like to thank you…
52. But the path was great. And I felt a little uncomfortable when I was going in a counterclockwise direction to the left. It seemed like half the time I was going to the left and half the time to the right, and I just felt better going to the right.
53. But the vegetation on the path and the green was beautiful and really made me feel like I was in nature. The color of the sky, the color of the water and the sound of the water was very realistic, and I loved the little tableau with the candles. And

the waterfall – I love waterfalls. The butterflies to me were almost kind of a distraction . They didn't look like they were colors found in nature. And, you know, I love butterflies but they were almost like…

54. This was very good for me because of the consistency and also the alternation . . . There was enough repetition and, you know, enough of the same but also enough of the different that I didn't feel like when are we ever going to get out of here, you know?
55. This was just more of a natural progression and it kind of slowed down. It was almost like walking downhill to a different level. I loved going over the bridge and going through the gate that opened. That was awesome.
56. You know, I really like the simplicity of this. Again I really like the candles. You don't often see candles outdoors in a setting like that. And I like the sound of the water.
57. Laura Downey's beta testing this video game app that's going to go viral.' So I would talk about it like that.
58. So that's what I did like in the seated meditation part. where it said on the screen you could close your eyes if you wanted.
59. No. I would say the only experience that's kind of similar in the middle part where I close my eyes.
60. Definitely the sounds. Yeah, definitely sounds. Sounds for me are huge. I think they can aid a lot in practices for people. I feel a strong connection to the beach. So the fact that I heard water felt very connected to me, because I've done several retreats close to water before, because any time I'm by the beach I feel very

connected to meditation practice. So definitely sounds. And then visualization. If you're doing visualization I would say like something that's not too… like that's not too much. Like there's a visualization whatever that is that it's not overpowering…

61. I would tell them, okay, I sat down in front of a chair, in front of a screen, and there were speakers with, you know, tranquil sounds of the beach in the background and birds and every once in a while… Pretty simple instructions around just, you know, touch the screen to start moving through. And the screen pulled me in on…
62. There was an avatar and we went walking through a labyrinth with bamboo and every once in a while we would reach an area where there's a fountain and so I would hear the sound of the fountain. And the fountain, depending on where we were passing, it would change from the right to the left ear, whatever, wherever we were turning corners until we got to the center point where we took a seated meditation in front of a fountain. And then came back out and ended at the beach. And then it was all this… Yeah, there was like a virtualization like as if you were in a game.
63. And I think it's very different because my meditation experiences are always just internally, and outside of just work I generally don't interact with a screen a lot because I don't have TV at home.

Design Suggestions for TSM:

1. When I have walked a labyrinth in the past I've been able to see the pattern, and in this one you can't see the pattern. It's more like a maze, you know, than what

I've had an experience in a labyrinth before. So it was more like a walk in nature for me than having some sense of going in and out in the pattern of the labyrinth.

2. but mostly in my tradition we meditate in silence. So the sounds of nature, you know, was helpful and not districting....I would keep the sound, I would probably have it be a labyrinth where you can see the pattern somehow. Maybe you make the trees lower or… You know, I've seen them when they're in the woods and they have like walks running in between the pattern and stuff. I'm not sure that I would… You know, I would probably try that. I'm not saying you should change it, you know. It's just it would be interesting to see if there's more of a different effect.
3. Flowing [clothing], sort of, and a little bit slower. I've already said that. A little bit more deliberate walk.
4. A mountain hike; maybe just sitting watching a scene, so that you sit; maybe the option of…
5. Like what I really liked about this is that you could close your eyes, because, as I said, when we were doing the labyrinth walk unless I concentrated on the flowers, the butterflies and the birds overhead, I was getting a sense of distortion as we were walking through the bamboo. It's kind of like her pace and my pace weren't in sync. So I didn't feel like I had - and again this is me - I didn't feel like I had control of the walk or the pace of the walk.
6. Or just have the avatar start with leading them into their breath….And then just go into it so that the avatar's not directing their breath. So they get into their breath before they actually start on the journey.

7. Well, I wouldn't have done this necessarily, not the whole avatar thing, although it worked. I would stand more towards color and sound as opposed necessarily to the avatar approach. But, I mean, it's nice to know how it worked. I mean, it did work.
8. ... I'm a child of the sixties, right. More of moving color...Patterns. I'm talking about random geometric patterns. You know, like color sequences. And why I think about that… Like when I meditate with my eyes closed I do tend to visualize color - not directed color, but colors tend to spontaneously come up in the visual field...So for me that seems like a more natural stimulus.
9. Also maybe like in terms of the different senses. So kind of we have the sight, the sounds. That could potentially be the touch or whatever. But also smell might be something interesting…
10. If there was a way that you could get that, that would be incredible, you know. Maybe some time in the future that will be possible. Or someone who wants to go for a walk in the woods, the same kind of thing. But the woods, the forest, it has a whole different smell…sit on top of a rock on the top of a mountain overlooking – I don't know – you know, the Shenandoah Valley or something?
11. I would have liked to have seen a little bit more of the water. You know when she's sitting in front of these little things that are going like this? Most of it is blocked off by her body, so I didn't get to see that. Yes, I would have liked to have seen that because to me that's like the prize.
12. Maybe just to give people different choices, like, okay, if you're a beach person, that's great….You might hike up to an alpine lake. And so if you were given a

menu of like six different scenarios you would say, ‘Oh, that’s the one for me.’...An underwater one for someone who’s into scuba; that they would, you know, swim down to some, you know, great coral reef and look at the fish and all that....Another one might be like someone who’s into flying; that they would actually fly up through clouds and, you know, sort of just glide around over a nice green earth.

13. Oh my! It’s kind of hard to say now that I’ve seen yours! It would have to be something, you know, visually very, very pleasing. For me a very wooded area would do. Like maybe by a brook or something that has a lot of greenery in it sort of to… Similar idea of coming into a sort of a clearing in the midst of a forest, if you will, by a babbling brook. Something like that would be very pleasing to me personally.
14. What made me think of it is I’d love to see a little hike where you'd look up and you’d hear that sound, the roar… Have you ever been to Niagara Falls?
15. So the waterfall would definitely be one.... A shady… Also the other thing was that I felt like time was passing in a way that I was aware of in a different way than I would feel or experience. But I definitely had the feeling that time was elapsing. However, the sun never changed position. The shadow was always directly beneath the avatar and the shadows of the folds in the garment didn’t change at all, and yet I felt… So I know I was trying to synchronize this in my mind – why are the shadows and light not changing when I feel that…? I mean, I felt like hours could have passed.

16. That if I had seen visually the same thing it might have made me think that. I was sort of at a distance and I knew that hours hadn't passed, but in some way it felt that way. So I'd like to see more visual evidence of the passing of time. ...And so shade… You know, just the… Also it seemed like the sun was very high in the sky and yet it wasn't hot. I didn't feel hot at all and so that didn't really ring true.
17. So I would also enjoy, you know, a little bit more altitude and the sense of climbing - you know, making progress on an uphill path. So very much trying to replicate being in the mountains of North Carolina in the Sapphire Valley where I've been.
18. So designing something like that might be interesting if there are like different tracks where there's like one… whether it has the walking that goes to sitting, or you could set how long you would want the track to be…And how long you'd want to sit. Or if you want to do more sitting and more walking. Also maybe choosing which kind of atmosphere you want to be in. Another one that I would think of is like either maybe even like walking on the beach, hiking in mountains…
19. … If this was a program for people who were newer for meditating, at the beginning, where you have people take a couple of breaths, it might be interesting to… like if there was also a couple of statements on there like 'you may choose to continue looking at the screen or at some point you may if you wish close your eyes – it can be helpful' and then you could say like, you know, 'It can be helpful to focus on the avatar. It can be helpful to focus on the trees,' – whatever it is. Giving people a visualization point.

20. The other thing that might be interesting with visualization with the technology is, you know, this one is like moving through something and visualization. It might be interesting to have also places where it's like steady. You know, like in one of the practices that I had to do for yoga training was we had a candle and we had to meditate with a candle. It might be interesting having different options like that where people like go and they sit and there's like a candle and that's like the whole of it – the whole screen is like that…

Effects of TSM:

1. I think I told you before that I have a slight leg wound. I try to do virtual reality things I get sick to my stomach. I had a little bit of that reaction by the time I got to the center…And coming back out, where it's just a little bit on the edge and it's the visual slight jumpiness, you know, in the movement, because I was trying really hard to keep my… you know, to keep my visual open
2. Good. I mean, I felt undistracted, okay. So, I mean, I felt that I was fully meditated; I wasn't distracted, and that the environment sort of helped you to let go of other thoughts and emotions that might have come in.
3. I felt relaxing.
4. Calm and relaxed. The time passed quickly. So in terms of having an awareness of this being a set period of time it went quickly.
5. it was really very peaceful both the beginning and the end, and I loved the altar in the middle and the time that it had me spend there.

6. I felt energized, I think because it was so different an experience that maybe I was a little bit more charged than perhaps...it was a little bit more novelty-wise. But I think if I did it again and therefore knew what to expect...
7. this reminded me very much of going to the beach and being at the beach and meditating there. So it reminded me of that. I think the beach much more so than the mountains or whatever I just relate to more. So this reminded me of how much I enjoy being on the water, and the ocean.
8. But I found it very relaxing. In the absence of an actual guided voice it did provide a relaxing context for it. Very calm, very zoned out. Good, yeah.
9. Well, very peaceful. I felt almost like I had to… On the way back I almost felt like it was hard to keep my eyes open…
10. Ready to go take a bath; get in the bath! Like, oh, I might be asleep at night tonight.
11. And I had a very, very similar experience to where I have like a tingling all over. Sometimes I feel… If I'm laying down, I feel almost like I'm levitating. And I thought, 'Well, this is very interesting, to be able to have this physical sensation in this environment.' And I thought that was pretty cool, because usually it's a very private, quiet… And so I like that.
12. Actually I feel a lot calmer than when I came in here…Yeah, I'm a lot calmer. And actually I have a sweet taste in my mouth . I don't know… Sometimes when I meditate I'll have nice… beautiful fragrances will show up, and sometimes I'll hear music. Sometimes I'll have a nice taste in my mouth. And there's actually kind of a sweet… like I've had some sweet water.

13. Very enjoyable. I didn't know what to expect but I kind of just went with it. And enjoyed watching the display and the calming flora and fauna and the butterflies flying up, and the sounds. I thought the visual and the sounds was a good combination, very relaxing. And I felt very relaxed and I noticed that my limbs got heavy and I just felt very calm and relaxed.
14. Kind of a little tired, I think, like maybe I'll go take a nap.
15. I really liked it. One thing I liked about it was that it did provide the stillness but it also was great and it made me notice things, and I like that. It kept me focused. It kept me noticing. It kept me with a still mind but an alert mind and things took me out of my… Sometimes when you meditate you get to your monkey mind. And if I got to my monkey mind it was able to bring me back to where I needed to be.
16. Good. Relaxed. Still; calm…...positive emotions and sort of a feeling of accomplishment…
17. That I had, you know, focus, and again noticed and brought myself into a state where I thought I needed to be, and I was able to accomplish that. So, good.
18. And it was a walking meditation. And it was a silent walking meditation and it was through a lot of growth and sort of a labyrinth and all that. And I kept thinking about that.
19. Life is a garden not a road; we enter and exit through the same gate; wondering where we go matters less than what we notice.' So they had told us that day to notice – just notice.

20. So I use that now in a lot of things that I do and I tell my classes that. And so here I was just… I tried to notice.
21. Like being in a great environment without actually physically being there; that you can literally transport yourself there.
22. I was able to achieve the quiet stillness. I didn't have any urge to move or, you know… It's that thing with knowing that you can move but you don't really want to...And I loved getting to that place….And I was able to do that through this.
23. I wasn't distracted.
24. I felt at peace, happy. And actually on the walk back, for a good part of it, I kept my eyes closed - sort of wanted to stay with the experience.
25. Oh, I see what you mean. Yes, I mean, in that regard it was just as real, just as peaceful, just as effective
26. However, I felt the sense of clarity after the meditation, so I kind of feel like I heard more sounds coming back, noticed more plants and flowers that I hadn't noticed in the beginning. I did notice some but not in more detail. There were more details as I was done coming back.
27. Well, I felt like it was a very positive… it was a very good experience and it was surprising to me in a lot of ways. But I felt that it achieved all of what I typically would achieve in a period of meditation - meaning calmness, serenity - and I was surprised how much I felt like I really was in that place. And I noticed several things about it. I really enjoyed the path to the destination and then I really enjoyed being in the destination and I enjoyed the path out. And I thought the time spent getting there and being there was just about perfect…

28. And I chose the avatar without thinking whether he looked like me or not, but I felt specifically connected to my father [cries]. I'm sorry . But that avatar reminded me of him but it also reminded me of my son, and I felt like sometimes I was the avatar and sometimes he was the avatar and it was just very emotional for me.
29. But I remembered how many times I walked following my father and then it seemed like I was the avatar and my father was behind me. I could feel his hand on my shoulder. And it looked like my father the way it walked. And he and I walked a lot. He loved to be in nature and he would have enjoyed that. I thought it was very realistic. We grew up in Florida, so the beginning scene with the thatched roof hut with no walls is typical Seminole Indian. And we camped among the Indians, and the palm trees and the dolphins and the beach were very much scenes that I saw every day growing up and it really reminded me of home.
30. ...And I felt very calm and very relaxed and closed my eyes most of the time and would open from time to time.
31. I smelled water today. It was around the time I first heard the sound of running water and I thought, 'Wow that is wild.' So I've never had that kind of an olfactory reaction to a video screen.
32. I feel really tired actually and I don't know if that's just because like it relaxed me a lot. Like definitely my breathing slowed down significantly. I felt like I was moving to the place where I normally get to meditation, but at the end I was kind of getting close to dripping to the place of like almost feeling safe in coming back.
33. Calm but I also feel a little groggy.

Facilitation of Meditation:

1. So it was very relaxing and absorbing. It was visually beautiful and interesting but not so interesting that it was a distraction. And after a while the movement of the avatar was almost, you know, like mesmerizing.
2. and that the environment sort of helped you to let go of other thoughts and emotions that might have come in
3. I probably wouldn't go online. You know, like I can't imagine I'd use this, but I can imagine that there are people for whom that it would be useful to kind of have an environment that blocks the, you know, the city noise or whatever and brings them into a more natural environment, you know.
4. I would say that it's an environment that you can immerse yourself in that includes sound and a path through the woods, through the bamboo forest, and of time in the, you know, in the middle with a fountain and water sounds and a time at the end, you know, on the beach that is visually interesting and helpful for bringing the…. kind of bringing you to a certain place, you know, like making you be where you are; that it's not distracting from… As an experienced meditator I didn't find it distracting – and there are things that could be.
5. Well, it was quite easy for me to concentrate on the walk with Isabelle. I mean, I got right into it. I do think there was just a little bit of distraction at the beginning because I think the lights…
6. [sound] that was as effective for me as the visual part.
7. I mean, when I was working… I mean, I think this would be incredibly wonderful for people to have on their computer in the office.

8. And closing my eyes I found that I could go within. On the walk itself I was more… It was kind of like I would do a walk in nature and I kind of wanted to deviate from the path and go smell the flowers and watch the birds and stuff like that. So I was definitely outer focused versus inner focused, but that would be very typical for a labyrinth walk for me.
9. But I liked the way everything combined because it did allow me to calm down whereas a typical RPG I get very frustrated with. So the fact that it was all automated was pretty good.
10. First time or an early meditator combining it with this could really help them get the focus a little bit better.
11. So it was very… It sort of took me to like another place, because it's just like it was totally different from normal.
12. I probably would settle in more than I feel like I did. And I think I settled in just fine. And I didn't have any trouble meditating, but I think I was so fascinated by the program that I was just trying to pick up every little nuance.
13. I think it's a wonderful tool for somebody that's new to meditation . Because it really very discretely has all the components that, you know, that are important...somehow I knew it would be a good non-threatening way to get them started.
14. Because it's real clear what you need to do. There are no questions of what's going to happen, what you're going to experience, or how to manage it. It explains… like in the middle when it explained that, you know, you'll be… It starts off telling you about taking the breaths and then in the middle it tells you –

or reminds you – about that again...It tells you that you can even have your eyes closed or not. These are the questions I hear people ask in groups. So I just think it's real non-threatening to somebody. It'd be a wonderful way to… non-threatening way to get them into…[especially if PTSD].

15. Yeah, it was relaxing once I, you know, like let go and just did the walk. I did get into the zone pretty quickly. At first I didn't notice the color of the bowls with the butterflies the first time. I mean, I recognized they're doing a progression of colors – which were in the wrong order, by the way.
16. Yeah, it's in that twilight state that you get into when you fall asleep watching TV. And actually that's what occurred to me while doing this. You do get into that kind of hypnotic suggestible I guess alpha state. And so it was supportive of getting into the zone that way. Initially, at the very, very beginning, I had to let go of the idea that it might be entertaining somehow, but it did definitely help change the vibe.
17. I already made the allusion to the effect of watching TV. It's obviously very simple but what it does is important. It helps you get into a zone that you may not otherwise be able to get into. The distraction of focusing your attention on the avatar helps you let go of those other distracting thoughts that might… While you're watching this guy's back it's kind of like it helps you let go. ...Yeah, I'd recommend it in that sense.
18. Also when we walked through, I walked through . . . or the colors of the butterflies and those types of things, just to be aware of the nature around me. So like I didn't really consider that part of the meditation part, because I thought like

the official meditation was the five minutes, but it was all part of like… I didn't want to miss it either, because I felt like that was maybe part of getting grounded and centered and to be ready to meditate later.

19. So it kind of brought that in with me in terms of being like a blissful life. And one of the things I try to meditate to a lot is to find bliss in chaos. And so just thinking about, okay… You know, the future and the present and that type of thing kind of was the theme, I guess, or the intention of gratitude for whatever I have at whatever moment and whatnot....So that helped me to get, I guess, something out of it, like carrying that through the whole experience and realizing even though it's a virtual world it's like there's so much beauty in the world.
20. To me it's easier, especially when you are trying to get started. I mean, it could also be a crutch, I'm sure. It depends on how you look at it…But for me it's helpful because I don't necessarily know where to start. I mean, I'm better at it now because even with this I could decide, okay, I'm going to set an intention, I'm going to do this…
21. But I think for starting for sure it does; the technology helps. And it also… I know personally I'm very visual. So whether you close your eyes or not, but certainly… And then also the sound …
22. Well, I was surprised that I was able to get right into it. And I think coming from behind helped with that because then I was not distracted.
23. I found myself, as a technology person myself, checking out how often are there flowers, what about this; what about that? But then I let that go. I thought, 'Oh, what's the point of that?'

24. And I did feel a sense of deep connection that initially surprised me and that I just was grateful for and went with it. I believe, though, sound helped a lot, because when I've done guided meditations using recorded guided meditations, the ones that I have the most success with always have some kind of sound, either toning or some music, or water, or air, or something. And I'm pretty sure that what that does is it helps to keep those channels of the right brain, left brain open. So I think that was very beneficial.
25. I didn't get bored – because, you know, she's walking like this and she's turning right, she's turning left. I thought that was pretty cool. Thinking I'd really like to have a body shape like that!
26. And I like getting to the destination, and I found myself wondering... I've heard about these places that have labyrinths and how you walk through the labyrinth and then you get to the middle. I'm thinking, 'How long is this labyrinth, really? I don't know. Is that what a labyrinth looks like? I thought it was kind of…' But then, like I said, I let those kind of questions go. But every now and then something would just pop in.
27. I liked the little bird that flew by every now and then. That actually helped me to focus back on what I'm doing. So I found it really pleasant, very pleasant, and, like I say, surprisingly gratifying.
28. It's different and yet it has many of the same effects. Like I said, I was surprised that I had this elevation, a sense of deep connectedness because of the technology. So I've been taught to sort of eliminate technology from the whole meditative practice…

29. And I think it’s very effective.
30. Well, for someone who has no idea of what meditation is, what does it feel like, this would be, I think, an incredible way to get them introduced, because a lot of things happen.
31. There’s a center; there’s so many things. ...are all designed to help bring you back, bring you back to the minute. Just about the time you're thinking, ‘Oh, she’s going to keep on going,’ you’ve got to take a turn and… So it would be the importance of keeping your eyes open in this meditation, which is almost 100% opposite of what people who are teaching other people how to meditate - close your eyes, take a deep breath, close your eyes, close your eyes, visualize in your mind.
32. I wonder if she would send me like a link or something where I could put this on my computer and do it,’ – because I might very well do it. Or, like, you know, if you sell it or whatever, I mean, I would probably buy it because it’s… I like it.
33. I thought it was very directional. I thought it was a good guide and it really continued to bring me back . So I liked it.
34. So you don’t really have that sense of reality there, but you do through the walking and the sounds and the movement and the sense of… The one thing I loved about it was the sense of going in and coming out. I thought you really got that sense, because the butterflies came in the same order when you came out....I felt like I was going toward something and that I definitely felt like I had been there and I was coming back.

35. And I would describe it to someone as a way of following, a way of sort of being brought into an experience that really assists you . Then you're not trying to create everything yourself; that this is a guide. It's creating the environment that you're looking for without (1) having to do it yourself and (2) without actually being there.
36. It was surprisingly pleasant and effective.
37. I wasn't sure what to expect. So I felt actually the whole experience to be somewhat meditative. Even the walk to the center of the labyrinth to me was very meditative. I found myself very engaged and sort of followed the avatar almost like being the avatar. I just kind of like enjoyed everything that… It was visually very beautiful and I noticed myself being completely engaged in it.
38. I just experienced virtual meditation which to my amazement was every bit as effective as if we were being guided by a voice . And it's multidimensional when you experience it. It's a new experience really…
39. Really cannot wait for this to go like viral ! Yes – to take off, because I really believe it's very well done. It's very well designed. You've taken into consideration everything that's important about meditation in my opinion . . .
40. First of all it's the feeling that it gives you by the design you've chosen. Elements that are peaceful to most people – the sound of the water, the greenery – it's not overly done. The walk itself is a process in the meditation in my opinion. It's long enough that it gets you into… I guess now I can describe it better. The amount of time that it takes you to enter the center, reach the center of the labyrinth puts you in mind for what you're about to experience. And then you sit there, you have that

little fountain in front of you, some candles - although I had my eyes closed when I got there. The sound of the water was extremely peaceful, very, very pleasant. It wasn't splashy. It wasn't loud. It wasn't anything that was distracting. It completely pulled me in …

41. Which doesn't happen that often with me. And the sound of the singing bowls, you know, that indicated the different times, I thought were very well chosen; resonated well with wherever I was at least. And again the walk back sort of gave you a chance to kind of review what you had experienced and to just slowly sort of come back to the present, you know, like reality ....It was a beautiful exit out. So it was very well designed, I thought.
42. I meditated in honor of my father, which I didn't really think of until the question was asked if you want to focus on something today. I mean, I really felt his presence with me today and it's funny because I think of him at times when things happen in nature that I think he's connected with.
43. Well, I'm very gratitude to be a participant; that I think you can do a lot with this and your journey is going to take you a lot farther than just… This is the beginning for you, I think, and I think it's something you're excited about. But I think it's really important.
44. So at first it took time to get used to like focusing on a screen and getting absorbed in that. But the sounds… like the sounds around helped a lot to kind of like draw me in. And it was helpful picking out the avatar, because the avatar that was walking in front of me, funnily enough, the way that her… had it shaped and everything is shaped like one of the nuns that I stayed with.

45. I kept connecting that as like she was leading the way and I was walking in meditation with her.
46. And I had moments on and off at the beginning where I was like… I was like, you know, when I was trying to like connect with it, I was like, okay, focus on her walking; don't worry about… It was like I was trying to center myself, because it was a new experience. And then by the time we were part through, before we got to seated meditation, then I had felt like I was more settled in. The seated meditation in the middle helped a lot to deepen the experience. And then at the end when we reached the beach I kind of wished we could of like hung out there for a while too.
47. Like there was the scene with the fountain. I just recreated my own scene of like a fountain and that took me really deep.
48. Which I think was something nice here. It was like consistent, but every once in a while you would pass by those like fountains that would gong and you would have butterflies that would come out, which was interesting. And I like the process of kind of having seated meditation in the middle. I mean, it might be helpful for people who are… I think what's nice about it is for people who are new the visualization, it can give them something to concentrate on and then by the time they reach the seated point, then when you invite them to keep their eyes open or closed, they're in a place where they might be able to settle more versus if you had them kind of be more settled at the beginning it could be challenging for beginners.

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