The Psychological Effects of Immersive Virtual Reality

Exploring Mindfulness in The Age of Information And Communication Technologies

A Thesis Prospectus
In STS 4500
Presented to
The Faculty of the
School of Engineering and Applied Science
University of Virginia
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Computer Science

By
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Fall 2022

On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

"Mindfulness" refers to the quality or state of being aware and conscious—it is a term typically unused in technical contexts given its spiritual connotation. In this paper, we shed light on the concept of mindfulness in a technical setting to understand how the emergence of information and communication technologies (ICT) has caused a shift from engaging to distractive technology practices. ICT is a realm that contrasts traditional media in that it provides access to a vast space of information that rarely has set limits and regulations. This access to vast information has enabled users to fall into long periods of unconscious "screen time" that can be disruptive and evolve into a dependence on ICTs to provide momentary fulfillment.

Though it is up to the user to decide whether to view ICT as distracting or engaging, there are indeed intentions behind its development that make it easy to get absorbed into its limitlessness. Given the nature of this addictive media, our brains are slowly becoming habituated into fragmented, quick satisfaction-demanding interactions that work against conditions that forge a level of awareness (Hadar & Ergas, 2018). For this reason, my STS paper explores the psychological effects of technological media consumption; specifically, how our relationship to this technology has influenced our attention spans, what that means for our everyday practice of mindfulness, and what devices these technologies use to cultivate these effects.

For my technical report, I dive into the subject of mindfulness further with a detailed investigation on a new type of media: virtual reality (VR). As part of UVA's Babylab, I am studying the psychological effects of various fear inducing VR scenarios on fear-prone individuals to better understand how immersive technologies create engaging experiences and what devices they use to do so. With this knowledge, our lab aims to reduce the impact of

immersion on users by creating safer virtual reality experiences, though, I plan on using these findings to understand how VR, an ICT claimed to promote mindfulness, differs from other ICTs in creating experiences far from distractive. On a psychological level, the paper will explore how the more immersive a media becomes, the more similarity there is in brain activity and awareness in parallel to mindfulness (Baumgartner, 2008).

The Psychological Effects of Immersive Virtual Reality

In the age of computers, the term "virtual" has taken on the meaning of something not physically existing, but instead made to appear by software; virtual reality recontextualizes the virtual space through a simulated experience that allows the user to view and interact with a computer-generated environment, currently through headsets and controllers. Though initially developed for the military to allow them to remotely experience hazardous situations, overtime the technology has become more accessible to the public and has found purpose in gaming, education, healthcare, etc.

As VR becomes increasingly widespread, like other forms of technology, there are questions regarding whether its intended usage will align with its marketed appeal. Cell phones, a fair example of this trend, have promoted applications far beyond traditional communication; overtime, they have enabled accessibility to genres such as social media and mobile gaming which, consequently, have constructed addictive uses of smartphones that pose as mindless forms of technology use (Chen et al., 2020). Yildirim and O'Grady (2020) present virtual reality in the contrary; they claim that these 3D interfaces have yet to stray from disengagement and employ distinct sensory tactics that gently force the user to have increased awareness within the environment (p. 3). Using this claim, we can pose the ethical question of whether the new development of virtual reality does indeed enhance our state of mindfulness and, if so, what

devices are being utilized that vary from generally distractive forms of ICT. This discussion is important in the context of future information and communicative technology innovation given that further use of disengaging practices only promote “digital distraction” with consequences that lie on a psychological level (reduced attention span, poor memory, inhibited deep learning) (Chen et al., 2020, p. 2). Though this discussion pushes accountability onto the stakeholder, if we make the assumption that developers are generally aware of “automatic thinking behavior”, or one’s thoughtlessness while pursuing spontaneous and effortless practices—i.e., scrolling through social media longer than intended, according to the responsible research and innovation (RRI) concept we can assume that their motivation behind VR development is one that should promote intentional use (Stilgoe et al., 2013; Bijker, 2017).

I have been working in the UVA Babylab, alongside Computer Science PhD Kunlin Cai and Psychology PhD Kenn Dela Cruz, which studies how the brain processes underpinning social interaction and cognition during infancy. Recently, we introduced a study pertaining to a wider age range in which we monitor how fear prone individuals react to virtual reality environments that target their fears. The study targets four fear scenarios/games—sharp objects, height, confined space, and unsettling textures; individuals experience their respective fear scenario via virtual environment and their motion data and heart rate data are collected through the game console and a smart watch.

To create these games, we have to understand what devices are being employed to instill these psychological responses so that they can either be removed or altered. According to previous research, it was said that sometimes it was as simple as adding in anxiety inducing scenarios to elicit anxious reactions, and this is simply because the same parts of the brain were activated in instances that felt so intensely inescapable (Riva et al., 2007). Our hope is that we

can pinpoint these devices using the data collected and explain how they are affecting the brain to somehow unveil what causes this technology to elicit such intense reactions. The study is reliant on the idea that virtual environments are immersive and engaging to the point that they can simulate reality—another way to rephrase the question of whether VR has the ability to bring about total awareness, possibly to the extent of mindfulness. The physical data collected will be compared with the individual's self-report regarding the extent of their fear and a numerical convention, inspired by Yildirim and O'Grady's State Mindfulness Scale (SMS), will be utilized to quantify how well VR itself can be used as an immersive tool to encourage mindfulness as well as how the scenarios themselves do so (Yildirim & O'Grady, 2020).

Exploring Mindfulness in The Age of Information and Communication Technologies

The accessibility to information and communication technologies (ICT) has reconstructed how we prioritize where we shift our attention. Given the vast pool of information the internet has made accessible, it is easy to misuse what was initially created as a gateway of knowledge now as a quick way to feed into temporary distraction. Chen et al. attributes this phenomenon to "automatic thinking behavior" which the authors describe as "an information processing approach involving four features: (1) unplanned, (2) effortless, (3) without a thoughtful consideration of the reasons and consequences, and (4) difficult to stop or modify" (Chen et al., 2020, p. 2).

In the paper, they conduct a study on 400 college students in which each student self-reports their in-class technology use; findings concluded individuals with high levels of attentional and motor impulsiveness were more likely to also experience internet addiction. With this claim, Chen et al. tackles the topic of digital distraction with the implication that one's existing psychological habits are the root of the cause; however, Koessmeier and Büttner

acknowledge this human tendency, yet introduce the stance that developers are aware of such behavior, thereby shifting blame from the user to a shared fault in both the developer and user alike (Koessmeier & Büttner, 2021).

From there we can pose questions from both sides: (1) what causes individuals to stray from engaging practices of ICT and (2) how does the technology itself promote positive or negative engagement? Provided that advancements in ICT development are inevitable given the current "age of the internet", it is imperative that the momentum of these advancements aligns with intentional uses of ICTs; Wilmer et al. explain that over time, one's absent-mindedness and reliance on smartphones and related technologies have "a negative impact on our ability to think, remember, pay attention, and regulate emotion"—they even go as far as saying that "modern connectedness is rewiring our brains to constantly crave instant gratification" (Wilmer et al., 2017, p. 1).

Sun et al. break down the characteristics between contemplative and non-contemplative technology devices with the use of a "Mindfulness of Technology Adoption" model that explains this relationship between the user and the engineer. The model depicts the adoption of ICTs in two phases: (1) finding a perceived usefulness and intention for the technology and then (2) a post-adoptive perception that will influence one's intention to continue (Sun et al., 2016). During phase one of the adoption model, the user will, in some sense, find the technology intriguing; this intrigue is dependent not only on the user's needs and inclinations, but also, how well the developer is able to "sell" the technology to the user. Later in phase two, the user will make a decision whether to become dependent on the technology based on how fulfilling its role is in accomplishing its "perceived usefulness" from phase one. Sliwinski et al. explain that, typically, the content and human computer interaction (HCI) components are a main predictor in whether a

user will fall into the "trap" of phase two (Sliwinski et al., 2015, p. 168). In the example of mobile applications, he explains genres like social media and phone games will incorporate easy navigation tools like scrolling and swiping to get the user "hooked" onto the excitement of "moving in the direction of new information" whereas applications that prioritize mindfulness practices, such as weather, clock, and reading applications, will shift the control back on to the user by avoiding deep plunges into vast information pools and rely on just a few screen taps to get to the heart of the information (Sliwinski et al., 2015, p. 169).

To correctly investigate the shared role of this effort in mindfulness, I will be using the Actor Network Theory (ANT) framework to portray technologies and human behaviors as players alongside the engineers and the users (Rodger et al., 2009; Peine et al., 2017; Law, 1992). However, as opposed to all players sharing equal accountability, I plan on gearing the argument towards the devices engineers utilize to obtain their intended contemplative or non-contemplative reactions with some emphasis on human behavioral vulnerabilities, but a majority of the emphasis being on the psychological effects of these devices after dependence. Using the responsible research and innovation (RRI) concept mentioned earlier, I plan to deconstruct the intentions behind the earlier mentioned engineering practices and create a comparison between those that are mindful and mindless; this will be done by following the history of uses of ICTs and tracking their level of distraction and engagement based on the developer's intent and devices.

Conclusion

Potential findings in this research include greater knowledge regarding the psychological effects of ICTs on its users and what devices are employed in order to attain those reactions. With these findings, we can continue our expansion of new media by utilizing methods that

assist individuals in the effort to stay clear of unworldly distractions but stay true to our never-ending consumption of knowledge and learning. This could mean rethinking how we use ICTs in ways that are not addictive in nature to optimize intentional uses, as we are hopefully seeing with virtual reality. All these small changes will alter our experience with new media and the hope is that this research can pinpoint certain techniques to provide us with direction on how to do that.

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