Walking the "New World": The Mental Health Repercussions of an Alternate Reality
(STS Research Paper)

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Introduction

Over the last decade, virtual reality (VR) has emerged from the periphery of technological advancements to become a novelty in the digital age, shaping industries such as entertainment, education, and medicine (Jahn 2021; Kassutto 2021; Hayes 2022; Hawes 2023). VR continues to blur the lines between the natural reality and newly imagined world. Compounded with growing sentiments of loneliness and isolation, adolescents may struggle with their identity, and dissociate from our existing reality (Aardema 2010; Hayes 2022). This detachment might culminate in the adoption of a fully immersive alternate reality, also termed as "deep-dive virtual reality" (DDVR), where identities are completely reimagined.

We will define DDVR as "a perceived virtual environment entirely indistinguishable from the natural world across all 5 human senses" combining definitions and effects of both fully immersive VR and alternate reality from previous literature (Kassutto 2021; Martirosov 2022). The "natural world" is the environment on Earth we associate to be true existence or genuine, as opposed to anything artificially created or simulated. While fully immersive alternate reality is highly futuristic in nature and thereby lacks empirical support, we can attempt to examine how DDVR will shape society by understanding psychosocial effects of recent technological advancements from prior literature. This research paper draws parallels from the rise of mental health concerns due to the internet as well as technological advancements from previous literature, proposing psychosocial consequences that an alternate, DDVR would pose in new generations. Furthermore, by analyzing enhancements to VR immersiveness, this paper proposes how similar trends might manifest in the adoption and impact of DDVR.

The Internet: A Digital Genesis and Societal Paradigm Shift

One key assumption we will make is that DDVR is online, and people will interact with one another in fully immersive alternate reality. Thus, we explore how internet usage has been an outlet for escapism, since we may see a similar phenomenon in DDVR.

In the span of the last few decades, the internet has revolutionized the fabric of society. It has touched many aspects of our lives, from casual communication to work life, and serves as an accessible, centralized knowledgebase. By 2007, digital media overtook traditional forms as the primary repository of information, storing over 94% of human information (Hilbert & Lopez, 2011). With the constant flow of digital content and easily accessible knowledge at our fingertips, the internet can serve as a treasure trove of content. For adolescents and our future generations, the internet houses vast educational content, facilitating novel learning methods and expanding intellectual horizons. Such learning resources are important for the direction of our future generation because the content they learn directly affects their mental-wellbeing and sense of belonging in our reality, since their identity is shaped by the content they learn (Verhoeven 2019). However, adolescents are prone to an environment of magnified stress, often comparing their own academic performance with their peers and online exemplars (Marciano 2021). With such stress in mind, the younger generation looks to the internet to solve their problems quicker, thus produce content quicker to get ahead, making more people feel behind and thereby creating a feedback loop of recurring, amplifying the pressure to keep up.

Adolescents' growing susceptibility to the commonly termed "internet addiction" — problematic, excessive, or compulsive usage of the internet — raises pressing concerns about its

effects on their mental health and development (Restrepo et al. 2020). A Korean study on a nationwide sample of adolescents between 12-19 years of age (n = 74,980) conducted by Nursing Doctorates saw potential internet addiction in 14.8% of participants, and 25.3% suicidal ideation in potential internet addicts (Yoo 2014). In adolescents, frequent usage of the internet on screens can significantly hinder the efficacy of cognitive control regions, and is often coupled with symptoms of substance dependence, including tolerance and withdrawal (Jo 2019; Marciano 2021). This arousal of destructive behavior can lead to internet use being a coping mechanism in stressful situations, further increasing usage of the internet in adolescents and thus facilitating more repetitive, addictive internet use patterns.

Moreover, the excessive screen time associated with such internet use, particularly during nocturnal hours, is linked to sleep disruption. This reduced sleep quality can have detrimental effects on cognitive function and, consequently, academic performance (Hale and Guan, 2015; Carter et al., 2016). The implications of this are two-fold: not only may it result in immediate academic strain, but also in longer-term mental health issues, as poor sleep is a recognized risk factor for developing mood disorders.

In addition to competition in the educational realm, adolescents continue to feel the negative mental effects of the internet with social media. These negative health effects present complications in the development of teenagers' self-identity and their capacity to develop meaningful relationships (Karamehic-Muratovic 2022). With a lack of social grounding, social media use in teenagers has been positively correlated with generally risky and sexually risky behaviors (Vannucci 2020). Social media also encourages active online checking by sending notifications to the user, which may be detrimental to cognitive development and academic

achievement in adolescents (Camerini 2020; Marciano 2021). Diminishing academic achievement in addition to increased academic competition as a result of the internet imbues compounding stress onto teenagers and can further prompt internet use as a coping strategy.

Despite many sources associating excessive internet use and internet addiction with negative mental health effects, some have found mixed beliefs, thus hindering the formal classification of internet addiction itself as a mental health disorder in manuals like the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (Kraut et al. 1998, 2002; Thom et al., 2018; Yao and Zhong, 2014). Though we know the internet shines as a powerhouse of information and there are mixed views on internet use, we have seen that the internet has mentally adverse effects in adolescents both directly through internet addiction, and indirectly through increased academic competition and sleep disruption. Moreover, the internet has marked a new beginning of human isolation that carries into our current society. Increased use of the internet encourages distancing and hinders the development of intimate relationships (Sanders 2000; Kirmayer 2013), perpetuated by the recent COVID-19 pandemic and continued technological development.

Our Society Now: The Digital Continuum

As the 21st century progresses, new advancements to technology continue to shake psychosocial paradigms. However, despite growing concerns with increased technology's use and advancements, technology has often been used as a modality for treatment of mental disorders. Psychologists and psychiatrists determined that cognitive training in immersive virtual reality can enhance working memory and executive brain function (Jahn 2021).

Furthermore, new challenges such as the Corona Virus Disease (COVID-19) have seen increased rates of mental illness in adolescents. Health experts found stress-related disorders, suicidal behavior, sleep disorders, anxiety, and depression pervasive in the younger generation (Hossain 2022). In a global sample of 52,797 children and adolescents ages 6 to 19, a meta-analysis found that 49.5% had anxiety, 20.5% had severe anxiety ($p<0.0001$), and 16% had depression among the adolescents (Sanjana 2021). Some critical factors of such mental health conditions included internet overuse, sedentary lifestyle, spending more time at home, social media addiction, and knowledge about the pandemic, which are all caused by increases in use of the internet. With the rise of social distancing and quarantines across the globe, we have seen disruptions in previous societal norms, with adolescents having increased rates of anxiety and depression and are at further risk when paired with negative coping strategies such as internet overuse (Jones 2021; Mucci 2023). Furthermore, COVID-19 resulted in many spending more time connecting through technological means and interacting with current technology, resulting in more severe and greater numbers of both technological and internet addictions (Zara 2021). Thus, technology continues to be a coping medium, furthered by COVID-19.

Although the pandemic has significantly declined in kills, its impact remains strong: COVID-19 has set a precedent of distancing and isolation, perpetuated by current technological developments. In order to cope with isolation and lack of social ties, people turn to escapism (Gabbiadini 2021). Thus, we may see increasing numbers of our future generations turn to virtual environments to alleviate the emotional pains attributed with loneliness. Social isolation is also a snowballing effect: as there are less people to develop friendly relations or social ties with, more people will sink into isolation and further dissociate from the natural world devoid

of relationships, which will increasingly be found on online networks. As immersion into virtual spaces increases, we will likely see individuals absorbed into such spaces, with their identities synonymous with the selves they create in said virtual environment.

Discussion: Bridging Realities and the Pursuit of Full Immersion with Redirected Walking

Many ideas in research attempt to amplify immersive virtual environments by engaging tactile sensory systems. Previous literature in haptic technologies demonstrate wearable devices are able to improve immersion in virtual environments (Wang 2019).

Another frontier in literature that has improved immersive experience in virtual reality is through redirected walking, a locomotion technique that rotates the view of the player by an indiscernible amount, known as a redirection factor, in order to artificially increase the size of the user's virtual environment (Razzaque 2005). Such redirection can be expanded to infinite walking, where the user can perform real walking to traverse a virtual environment infinitely. Due to the dependency of redirected walking to feel natural to a user, a minimum of 6m x 6m is previously known in literature as a requirement, with drastic improvement in immersiveness up to 100% at 31 m x 31m with multiple redirection algorithms (Azmandian 2015).

Redirection techniques include both discrete and continuous methodologies. Discrete redirection affects the user's view at fixed points in time usually dependent on some stateful variable, while continuous redirection affects the user's view along with their movement in their real-world space. Three common continuous redirection algorithms in literature include steer-to-center (STC), steer-to-orbit (STO), and curvature gains. STO is an algorithm that redirects users based on a point of interest. As the user deviates farther from said point, their redirection factor increases in order to keep them from physically veering too far away, while perceiving

infinite movement. STC is similar to STO, but instead utilizes the center of a user's physical space to redirect and has greater relative effectiveness in smaller spaces (Azmandian 2015). Curvature gains is a more effective methodology than STO in STC in creating multidimensional movement – rather than rotating based upon an origin point, it instead aims to redirect the user as they approach obstacles or walls in their physical space (Grechkin 2016, Bolling 2018).

Given that discrete redirection methodologies are not as prevalent in prior literature, only blink redirection will be outlined, which is necessary to understand combined redirection referenced by the technical report. Blink redirection applies an imperceptible rotation to the user's view every time the user blinks to increase size of the virtual environment space in a limited physical space (Nguyen 2018, Davis 2022).

In the technical research proposed, both continuous redirection (STO) and discrete redirection (blink redirection) methodologies were combined in a pilot study on 8 individuals (3 female, 5 male) to limited avail. Participants experienced continuous redirection at a lessened factor when combining both redirection modals further outlined in the technical report, which may be useful in decreasing play size required in future research – the discrete redirection through blinks in the pilot study did not rotate the virtual environment enough and thus, does not directly demonstrate combined redirection can reduce the physical space requirement for redirected walking. Additionally, STC and curvature gains are known to have greater relative effectiveness in smaller spaces by being less perceptible, and thus could be used in future research in combination with blink redirection. However, the redirection was less observable by the participants and as a result may be promising for decreasing required and optimal room size

for redirected waking. As immersion techniques continue to develop for virtual environments, we may see the development of fully immersive DDVR that engages all 5 human senses.

Conclusion: Understanding the Next Dimension

As seen with the growing correlation of societal loneliness and isolation with the rise of the internet and new technologies, as well as our ability to socially distance and quarantine as seen from the pandemic, we have set the precedent of alternate reality. Interconnectedness in our communities is one measure of how connected we are to the natural world, and our continual dissociation from quality relationships and social interaction further pushes away the association of our identity to the physical world. Already, we have seen dissociation from the physical world with substantial amounts of time spent in the digital world, which is on the rise. Psychiatry and medical professionals found that in a sample of 1,856 adolescents, the mean total daily screen time of 10h in pre-, peak- , and post-peak COVID-19, which is up from a 2010 US sample that revealed a mean total daily screen time of 7.5h (Wiguna 2023). To demonstrate the sheer amount of time that is, 7.5 hours a day is the equivalent of dedicating roughly 3 and a half months of straight time per year or a little over 16 weeks and 10h per day is the equivalent of roughly 5 months straight or a little over 21 weeks. Moreover, in a sample of 165,000 adolescents mostly from European countries, it was found that the lowest average sleep time was Poland with 7.47 hours on school nights and in a sample of 5,064 US adolescents this was found to be 7.4 hours (Gariepy 2020; De Moraes 2024). Calculating based on the minimum average sleep time and average sleep time, we can determine that on average adolescents spend at least 60% of their waking hours on screens, detached from the natural world. With such astounding prevalence of the digital world, our future generations are spending longer

amount of time in an artificial, digital world than the natural world. A transition to a digitally rendered, fully immersive alternate world may attract more use time because it combines elements of the digital space our future generation is already using significantly, and elements left in the real world. Blurring the lines between our reality with an alternate reality, we effectively replace our natural world. Additionally, since more people engage in digital spaces, or in the future immersive alternate reality, there will be less availability of peoples to develop social ties within the natural world. Thereby, individuals tend to socially isolate and detach, decreasing the time people spend in the natural world and the desire to spend time to be in the natural world.

DDVR may have a precedent in society, due to societal distancing and the rise of mental illness. Nonetheless, it may potentially be an avenue to improve our mental health and learning capabilities, promoting its usage. Previous literature has seen virtual environments to reduce distractions to support learning (Patel 2006). In fact, alternate virtual worlds can be practical for medical training as well, specifically with resuscitation, communication, and bronchoscopy training (Kassutto 2021). Additionally, technology can prime adolescents in ways that may reduce anxiety by focusing attention positively (Hawes 2023). DDVR can do as well since such behaviors can be primed by “an immersive environment that creates feelings of presence” or “simulated worlds that are believable and immersive enabling autonomy and escapism” (Hawes 2023).

In literature, we have seen growing rates of mental health concerns such as anxiety and depression in correlation with the development of technology. Ironically, being highly connected informationally by the internet and social media has distanced humans both socially and

emotionally in the natural world. However, many may better express their personality and thoughts with ease in alternate worlds (Marriot 2014). Emotional bonds in the digital world are sometimes beyond what the natural world can offer and can be perceived to be more intimate than the natural world (Ben-Ze'ev 2004). In contrast, digital worlds may not see this phenomenon in men – communication scientists from the University of Amsterdam found that the perceived norm of text communication from males saw less emotion (Waterloo 2017). Additionally, another phenomenon mentioned in the study was perceived privacy, which may be the leading factor of increased emotional intimacy expressed in the digital space instead of the factor being the alternate world. However, males from the study may deviate emotionally in actuality from their perceived status. Nonetheless, the emotion can be conveyed much more easily online without any stigma, and such may also be seen in DDVR.

Although DDVR or fully immersive alternate reality is dependent on futuristic technologies that would fully immerse all 5 human senses, we can still observe that society would smoothly adopt it due to our existing dissociation. Moreover, even though DDVR could improve learning and lessen mental health concerns, we still have a lot of other considerations to make ethically and morally if detaching completely from our natural world is warranted. Furthermore, fully immersive alternate reality, like existing technology, can be used as a form of escapism. However, as we further turn to full use of digital worlds or DDVR, we lack something to escape from, altogether redefining true reality and escapism.

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