

Increased Immersion in the Digital Multiverse: Implications for Adult Motivation

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Abstract— People who often virtually enhance their physical context are part of the digital multiverse, which has greatly expanded in scope and depth in the last few decades due to ecommerce, streaming entertainment, videogaming, social media, telehealth services, videoconferencing, and online learning. In recent years, most adults active in the digital multiverse report that their level of virtual activity has risen substantially compared to pre-pandemic life. Spending a high proportion of daily time in virtual environments and simulated experiences may result in social phobia, complexes, or the loss of basic skills to function in the real world. Loneliness may be enhanced by the inability of remote interactions to substitute for the full advantages of face-to-face experiences. People who are co-located in the real world may have their interpersonal connection undercut through their individual patterns of virtual immersion. As advances in AI and XR further increase the scope and depth of the digital multiverse ecosystem through widespread bottom-up authoring of simulated experiences, protecting adults from misinformation and malicious actions may be challenging, but is important to minimize risks and enhance benefits. Research on these problems and strategies for alleviating them is an important frontier for adult wellbeing.

Index Terms—artificial intelligence, augmented reality, immersion, metaverse, mixed reality, online learning, presence, simulation, social media, telehealth, videoconferencing, videogaming, virtual reality

INTRODUCTION

The “digital multiverse” is a virtual ecosystem with many niches in which billions of people daily participate. This multiverse ecosystem includes social media, video games, streaming entertainment, online learning, telehealth consultations, videoconferencing, ecommerce, and many other types of applications that provide information, services, and experiences. In some of the ecosystem niches, people interact with each other in real time irrespective of the physical distance between them. Some niches have interfaces that mix virtual and physical reality; other niches immerse participants in fully digital environments. Overall, people who often virtually enhance their physical context are part of the digital multiverse, which has greatly expanded in scope and depth in the last few decades due in part to ecommerce, streaming entertainment, social media, and mobile devices.

The “metaverse” is a subset of the digital multiverse in which participants are embodied as avatars, virtual representations of themselves by which they can act in digital settings and interact with others who are virtually co-located even though they may be physically distributed throughout the world [1]. Participants have personas that may mirror their real-world appearances and actions, providing an illusion of body ownership, or may have multisensory integration with avatars that have little

resemblance to their real-world characteristics [2]. In contrast to the multiverse, which has organically developed bottom-up, the metaverse is a top-down aspirational vision fostered by the cyberpunk genre of science fiction, notably William Gibson’s *Neuromancer* [3] and Neil Stephenson’s *Snowcrash* [4]. Companies such as Meta (formerly Facebook) have invested billions of dollars trying to foster widespread use of this overarching immersive context but, for reasons beyond the scope of this article, the metaverse has far fewer participants than the digital multiverse.

In the metaverse, “presence” is the basis of immersion, based on XR interfaces (virtual reality, mixed reality, augmented reality) [5]. Participants experience “place illusion” – the feeling that they are located inside their avatar in the virtual setting rather than in their physical bodies in the real world. They also experience “plausibility illusion” – the feeling that what is occurring in the virtual environment is really happening [6]. In multi-participant contexts, they also experience the illusion of co-presence [7]. Fantasy role-play gaming on the internet is often based on these illusions.

While some niches in a person’s virtual ecosystem may involve this type of presence, digital immersion in the multiverse is more diffuse. People move rapidly among digital enhancements to their physical context, as illustrated in the vignette below.

Vignette Depicting Digital Immersion in the Multiverse

Vesper is an adult who currently lives alone and works remotely. One day, she awakened to the sound of her cellphone’s digital alarm app. She propped herself up in bed and spent 15 minutes watching the latest news-streams on her bedroom digital television. Over coffee in the kitchen, she skimmed on her cellphone the email and chat messages that had come in overnight. Her banking app had sent a notification, as had a weather app. After showering and dressing, Vesper logged into her desktop to participate in the daily one-hour workplace agenda-setting Zoom meeting. Then she completed various tasks using apps in her organization’s remote portal, including both synchronous and asynchronous communications.

While eating lunch, Vesper entered a virtual world in which she was polishing her French language skills through her avatar’s interacting with chatbots simulating a murder mystery in a Parisian museum [8]. After two more work-related videoconferences, she had a telehealth consultation with her nutritional specialist [9]. At five, she face-timed with a friend about how the day had gone. After fixing dinner, Vesper watched the news again, purchased a couple items via ecommerce, and viewed her favorite sitcom on television. The

evening concluded with catching up on social media, including LinkedIn and Facebook.

That day, Vesper's experiences in the digital multiverse totaled eleven hours, with five waking hours spent non-digitally in the real world. This is a relatively high degree of immersion not typical of all her days, but not unusual. On most days, Vesper spends at least 6 hours digitally, including substantial weekend time as Dread Archmage Vesper in a massively multiplayer role-playing game. Her degree of digital immersion is substantially higher than a decade ago.

Vesper is not unusual [10]. Also, most adults less active in the digital multiverse report that their level of virtual activity has risen substantially in contrast to pre-pandemic life [11]. If the proportion of a person's time spent virtually is high, their degree of presence in the real world is reduced as their various forms of digital experience increase. As a result, people who are co-located in the real world may have their interpersonal connection undercut through their individual patterns of virtual immersion [12].

The digital multiverse provides people around the world with access to resources that transcend geographic constraints and offer educational, occupational, and social opportunities [13]. However, this is more the case for those who are privileged in society than those who are marginalized. The digital divide disproportionately affects people of color, low socioeconomic status groups, people in rural areas, groups whose native language is unusual, individuals who are disabled, indigenous peoples, and older adults [14].

Further, 2.6 billion people are unconnected to the internet and thus have no access to the digital multiverse. Digital inclusion includes five elements: affordable, robust broadband service; access to digital literacy education; quality technical support; internet-enabled devices tailored to the needs of the user; and applications and online content designed to empower self-sufficiency, participation, and collaboration. Recent advances in solar power and cellphone capabilities are enabling increases in access for low-income populations in isolated areas, but much remains to be accomplished before digital equity is achieved.

For adults who do have opportunities for digital inclusion, what are the potential consequences for adult motivation if they progress to substantial immersion in the digital multiverse?

POTENTIAL IMPACTS OF THE DIGITAL MULTIVERSE ON ADULT MOTIVATION

Typically, technological tools, media, and infrastructures are double-edged swords that have both positive and negative impacts inextricably mixed. The following sections describe opportunities and risks associated with various types of adult participation in the digital multiverse.

Opportunities to Communicate and Collaborate across Distance

By leveraging spatial audio, tracking eye movements, interpreting facial expressions, and using realistic avatars, virtual collaboration platforms are evolving to enable more engaging and interactive meetings through increasing a sense of social presence [15]. For example, social XR enables richer

interpretation of nonverbal cues that can reveal others' intentions and engagement [16]. This is important in collaboration through turn-taking and can foster a sense of social co-location [17]. Advances in Generative/Agentive (GenAI) and in XR are making practical use of these capabilities affordable [18]. Although adults typically prefer face-to-face interactions to remote videoconferencing, their motivation for virtual interaction may increase as strategies for reducing "Zoom fatigue" and social disconnection are implemented.

That said, significant challenges in improving remote interaction remain. A discrepancy between an avatar and the real-world entity it represents can cause feelings of distress and even dread: the "uncanny valley" [19]. Overcoming this psychological effect may be important in reducing workplace discrimination through using avatars that reduce the visual stigma associated with an individual (e.g., Downs syndrome).

A second challenge is cybersickness, which stems from neurological stress caused by the staring at a monitor for long periods of time, such as during videoconferencing [20]. While individual susceptibility to cybersickness varies, with prolonged exposure many people experience symptoms similar to motion sickness. Time zones are another human-centric challenge that cannot be resolved with a technological advance.

Overall, that remote interaction will ever be "just as good as being there" is unlikely, but the conveniences of scheduling and of avoiding the difficulties and costs of travel are substantial. Life and work are increasingly hybrid, and so finding ways to mitigate negative effects on virtual interaction on adult motivation is important.

Social Connections

For many adults, social media are an important type of participation in the digital multiverse [21]. In 2025, 84% of US adults report using YouTube, 71% Facebook, and 50% Instagram. About half of US adults indicate they visit both Facebook and YouTube at least once per day, with frequency skewed toward adults under 30.

Social media usage offers both benefits and risks for adult motivation [22]. Reasons for usage include sharing personal experiences, including photos and videos; seeking information and news; and staying in touch with friends and loved ones across distance. In addition, online interactions can be easier than face-to-face dialogues for individuals with impaired social functioning and facing symptoms [23]. Also, people who have depressive feelings may prefer communication via social media to in-person interactions.

Risks of social media include exposure to harm (e.g., cyberbullying, hate speech), social isolation and loneliness through lack of face-to-face interactions, social abuse and exclusion, and social comparison pressure with concomitant depressive symptoms [24]. Participants may be exposed to misinformation, biases, and even online radicalization [25]. Privacy and confidentiality of one's interactions are a concern, as are identity theft and invasive advertising. Pornography and sexual harassment are additional risks.

This is not to imply that all adults using social media experience these negative effects. Rather, an analogy can be

made to driving a motor vehicle. Accidents are rare (although more often if one is careless) and driving is an important prerequisite for many societal opportunities. However, the algorithms that underlie both social media and video games are designed to create digital addiction [26], so constant vigilance is important in realizing the positive effects of these niches in the digital multiverse ecosystem while minimizing potential negative consequences that can adversely impact motivation.

Entertainment and Gaming

Many forms of entertainment are available in the digital multiverse. 64% of the US population reports playing video games more than 1 hour per week; the average age for players is 36 and the average number of years they have played is 18 [27]. For reasons of space, this discussion will focus on internet gaming as an example that incorporates positive and negative aspects of adult motivation.

Done in moderation, video games can have a positive effect on mental health, particularly depression and anxiety [28]. Benefits to those playing regularly include enhanced attention control, cognitive flexibility, and information processing. Video games also can aid in emotion regulation [29]. Randomized clinical trials have shown positive effects of video gaming on clinical depression [30] and on reducing symptoms of anxiety [31]. Players who find little value in their everyday lives can experience various types of self-affirmation through assuming a successful role in a video game and may increase their ability to collaborate with others in a digital community [32].

That said, as with social media, addiction to gaming is a risk, as are various types of potential harms from incautious use. Kowert [33] describes possible negative consequences of video gaming, including hate speech, (sexual) harassment, trolling, grieving, doxxing, fake news, cheating, trash talking, contrary play, and inappropriate roleplaying as forms of “dark participation.” Because video games have many characteristics of the metaverse, such as the participant inhabiting an avatar, players may experience the Proteus effect, in which the individual’s behavior in the virtual environment—and potentially in the real world—is influenced by the positive and negative characteristics of their avatar [34]. Thus, videogames and other forms of online entertainment may affect adult motivation in complex ways that mix benefits and deleterious effects.

Healthcare and Similar Services

Virtual consultation and telemedicine became more common during the COVID-19 pandemic and, enhanced by remote sensors, have expanded as a complement to face-to-face interactions with healthcare professionals [35]. In addition, telerehabilitation is emerging as a form of therapy at home [36]. Participants who particularly benefit include people with limited mobility, those living in rural areas with acute shortages of medical specialists, and patients in remote areas who are compelled to travel long distances to access public health resources.

Immersive teleclinics provide opportunities for integrated diagnosis, follow-up, group meetings, and exercise [37]. Virtually recreating for the patient simulated situations that

cause anxiety (e.g., flying in a plane) can aid with increased ability to cope with similar activities in real life [38]). In treatment of mental health, interacting with avatars in simulated social activities may facilitate transfer to prosocial behaviors in the real world [39]

However, spending substantial time in virtual environments and simulated experiences may result in social phobia, complexes, or the loss of basic skills to function in the real world. Loneliness may be enhanced by the inability of remote interactions to substitute for the full advantages of face-to-face experiences. Issues of privacy, ethics, and security are particularly important in healthcare because the data is so sensitive. More research is needed on the balance between benefits and downsides of virtual healthcare, as well as strategies for maximizing potential positive effects on adult motivation.

Learning, Training, and Education

For reasons of space, this discussion will focus on aspects of education closely related to adult motivation. The metaverse provides a good illustration of activities that can increase participants’ engagement. Experiential learning designed to foster increased involvement can center on adventure worlds (narrative-driven quests that build self-regulation and self-efficacy), immersive authentic simulations (modeling real-world phenomena and activities for mastery and transfer), creative spaces (facilitation of imaginative design to enhance initiative and growth mindset), role-playing worlds (developing perspective taking, empathy, resilience, tenacity), and digital collaboration supports that foster teamwork [40]. As an example of the last, the Jigsaw Agent is an AI-enhanced tool for collaboration support in a mixed reality setting [41].

Digital XR that enable learning often combine these types of experiences. Bailenson [42] highlights the value of the metaverse in DICE learning (dangerous, impossible, counterproductive, or expensive and rare). XR can interactively immerse learners in the context that is well suited to deliver a situated learning experience to increase motivation and transfer. An example is the EcoLearn series of curricula based on immersive virtual ecosystems [43]. Participants learned ecosystem science, inquiry skills, teamwork, and empathy for natural species and environments. The challenges encountered fostered initiative, resilience, and tenacity in learners.

High quality instruction is essential for realizing the full value of immersive experiences. An overreliance on surface learning can diminish long-term skill retention [44]. Focusing on knowledge acquisition at the expense of critical thinking and metacognition can undercut transfer and behavioral change [45]. Relying on gamification and novelty for engagement is a short-lived strategy [46]. Too complex an experience may result in excessive cognitive load that undercuts motivation and learning [47]. Research is needed to deepen our knowledge about effective strategies in immersive experiential learning for adults.

Overall, this section of the chapter has summarized opportunities and risks associated with various types of adult participation in the digital multiverse: collaboration across distance, social interaction and connections, entertainment and

gaming, healthcare, and learning and education. The next section focuses on advances in AI and XR over the next few years that may enhance both the opportunities and the risks for adult motivation and learning.

COMING ADVANCES IN AI AND XR

GenAI has capabilities that are altering the lives of all adults, for better or for worse. Intelligence Augmentation (IA) is a framework for describing complementary partnerships between humans and AI agents to which each brings their strengths [48]. The many ways in which IA affects adult motivation are beyond the scope of this chapter. Rather, this section focuses on how coming advances in AI and XR may alter the digital multiverse. In particular, GenAI applied to XR is increasingly enabling content generation by people with no expertise in computer science and is also aiding the creation of lifelike virtual-human agents.

Through “vibe coding,” any participant in the digital multiverse can automatically convert textual or verbal descriptions (prompts) into complex 3d digital scenes, both static and animated. People with no special training can use multimodal GenAI models to produce interactive scenarios related to any of the niches in the digital multiverse discussed above [49]. Beyond textual or verbal descriptions, anyone who has conventional images and videos can convert those to 3d content using GenAI; this is already being used to create “deep fake” pornographic material defaming real people.

A related emerging capability of GenAI applied to XR is synthesizing believable, context-aware virtual-human agents that respond adaptively to user inputs. These agents can engage in adaptive realistic dialogues [50], empowering non-linear storytelling to aid education [51]. In a few years these agents may add convincing non-verbal behaviors [52]. Believable human-like agents are now developed top-down by technical experts, but in the future could be developed by anyone, as well as placed in 3d virtual contexts developed without special expertise. If history is any guide, the majority of what is added will be of questionable quality.

These advances have the potential to deepen and diversify all the niches in the digital multiverse ecosystem described earlier. For better or for worse, the spectrum of digital experiences will likely widen in terms of quality, content, and believability. What this means for adult motivation is unclear but will likely be impactful. For example, imagine agents in each niche above sharing the information they have about a particular participant’s behaviors and preferences with agents in other niches [53]. This would create opportunities for personalization of experiences but also would enable many types of abuse.

DISCUSSION

Each type of participation in the digital multiverse has opportunities and risks for adult motivation. This discussion centers on the impact of one’s entire digital multiverse experience on some adults who, like Vesper in the earlier vignette, are very active participants. As an analogy, movies depend on how human perception works: a series of still images, presented 25 or more times in a second, becomes fluid

motion in the mind of the viewer. Similarly, adults who are above some threshold of daily experience moving in rapid succession from niche to niche in the digital multiverse with only occasional intervals in the real world may experience high-dosage effects of this exposure.

Adults are incentivized to heavily utilize digital experiences because of the “attention economy”: Human attention is now a central factor in economic commodification [54], leading to the use of additive algorithms to capture and sustain interaction. Also, people are driven to ever increasing digital participation by fear of missing out [55]. Given the likely advances in AI and XR discussed earlier, a profusion of bottom-up content and experiences across the multiverse ecosystem may intensify these accelerants for digital involvement.

Rapidly and pervasively shifting attention across multiple digital experiences can lead to social interaction overload [56]. This may result in negative effects on wellbeing, such as reduced self-efficacy and increased anxiety. As discussed earlier, spending substantial time in virtual environments and simulated experiences may lead to social phobia, complexes, or the loss of basic skills to function in the real world. Loneliness may be enhanced by the inability of remote interactions to substitute for the full advantages of face-to-face experiences. One’s identity may fragment due to the challenges of integrating multiple roles/experiences that may diverge in their characteristics [57] [58].

The umbrella concept of adult motivation can be parsed into at least four dimensions: engagement and flow, self-regulation, beliefs about oneself and others, and dispositions towards using one’s knowledge and skills. For high-dosage adult participants in the digital metaverse, strong self-regulation may be needed to avoid digital addiction and identity fragmentation, particularly with experiences that induce emotional executive function responses. Also, negative beliefs about oneself (e.g., fixed mindset, imposter syndrome, stereotype threat) may be reinforced by excessive participation in social media and gaming. On the other hand, educational and healthcare services can bolster important dispositions such as resilience, tenacity, self-direction, and initiative [59].

As advances in AI and XR increase the scope and depth of the digital multiverse ecosystem through bottom-up authoring of simulated experiences, protecting adults from malicious or erroneous misinformation about the real world and about themselves may be challenging, but is important to minimize risks and enhance benefits. Wikipedia has shown that bottom-up standards, curation, and voluntary expert participation can aid with misinformation. Similar strategies across the niches in the digital multiverse ecosystem may help with highlighting content and experience that can be trusted in their quality.

Ultimately, educating participants in digital literacy may be the most powerful defense against the negative effects described in this paper [60]. To accomplish this, embedding learning at teachable moments in virtual experiences will likely be more effective than relying on adults to make time in their busy schedules for formal training sessions. Also, AI agents can help learners reflect on missteps they have made to develop better strategies for safety in their pervasive digital lifestyles [61].

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Conducting research on these strategies for adult flourishing in the digital multiverse will require developing measures more sophisticated and detailed than total screen-time per day. Stealth assessments of the types of interaction, their momentary effects, and their cumulative impacts may yield important insights [62], but will require participants' consent and strong protections for security and privacy.

CONCLUSION

Paying attention to the advantages and risks of each niche in the digital multiverse ecosystem is important. However, we need to monitor the forest as well as the individual trees. Negative impacts from high-dosage digital lifestyles may affect adult motivation and learning. Research on these problems and strategies for alleviating them is an important frontier for adult wellbeing.

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