Entertainment in Virtual Reality and Beyond

Hartmann, Tilo

published in
The Oxford Handbook of Entertainment Theory
2021

DOI (link to publisher)
10.1093/oxfordhb/9780190072216.013.37

document version
Early version, also known as pre-print

Entertainment in Virtual Reality and Beyond: The Influence of Embodiment, Co-Location, and Cognitive Distancing on Users' Entertainment Experience

Tilo Hartmann & Jesse Fox

This is a draft of a chapter that has been accepted for publication by Oxford University Press in the forthcoming book The Oxford Handbook of Entertainment Theory edited by Peter Vorderer & Christoph Klimmt due for publication in 2020.

Introduction

Virtual reality (VR) technology consists of interactive media systems that track users' movements and responsively render a rich sensory environment designed to replace cues from the physical environment (Biocca, 1997; Fox, Arena, & Bailenson, 2009). Recent advancements have made VR accessible to a broad consumer market and expanded its reach in a number of domains including health, education, and entertainment. Many consider entertainment key to VR's mass adoption given the potential for compelling user experiences. Also, entertainment genres like gaming often attract early technology adopters.

Alongside the development of VR technology, empirical research and theorizing on VR entertainment is also expanding (e.g., Hartmann, Klimmt, & Vorderer, 2010; Klimmt & Vorderer, 2003; Shafer, Carbonara, & Korpi, 2018; Skalski & Tamborini, 2006). Currently missing is an integrative conceptual framework that identifies properties of VR that distinguish it from other currently available entertainment media. In the present chapter we attempt a step in this direction. After reviewing recent trends in VR entertainment, we identify key affordances and characteristics of the VR experience. Subsequently, we discuss how these elements may shape the entertainment experience and how existing entertainment theories may be elaborated or challenged by VR. We offer five guiding propositions for future research. We conclude with a brief discussion of the complexities of creating and studying VR entertainment.

The Rise of VR Entertainment

Early VR technology dates back to the 1960s, an era when color television was the latest breakthrough in mainstream media entertainment. It took several decades of development before the first wave of consumer-oriented VR devices were introduced to the mass market in the mid-1990s by video gaming companies. The equipment was typically expensive, uncomfortable, and prone to technological issues; the available content was

limited in scope and relatively crude. These two factors led to a rather underwhelming consumer experience, and Nintendo's Virtual Boy, Atari's Jaguar, and Sega VR quickly disappeared from shelves.

The hype around consumer-grade VR was revived in 2012 with the introduction of the Oculus Rift. Yet again, the consumer market has focused largely on gaming applications such as Sony PlayStation VR. Several major tech companies have also heavily invested in VR for more diverse applications, including Google, Amazon, Apple, and Facebook. In comparison to the first wave of VR technologies, recent head mounted displays (HMDs) and tracking devices are cheaper, provide an improved VR experience, and are more comfortable to wear. Nevertheless, some problems persist. For example, HMDs like Oculus Rift or HTC Vive still require powerful computers, many users experience headaches or motion sickness, and lengthy sessions can be exhausting. As a consequence, adoption of consumer-grade VR is again slower than initially expected, despite the relative success of PlayStation VR (with 4.2 million HMD units sold; Moon, 2019) and best-selling VR game titles like *Beat Saber* (over 1 million units sold; Jagneaux, 2019) and *VR Skyrim*. This leaves the industry speculating whether VR will soon be widely embraced, possibly driven by next-generation gear like the Oculus Quest (a stand-alone HMD that does not require additional computing or tracking equipment), or remain niche entertainment.

Aside from gaming, entertainment VR applications have successfully emerged in several other arenas. Social VR applications (e.g., VRChat, AltspaceVR, and Facebook Spaces) allow users to meet and interact. Similarly, the popular application Bigscreen enables users to blend traditional mass media experiences, such as watching a movie, with social interaction. Outside of the home, location-based VR has proliferated: sites where the public can participate in a VR experience have popped up as independent businesses or within entertainment complexes, movie theaters, and museums (Sag, 2019). Companies including

VOID and Sandbox VR offer access to technology that is still too exclusive, expensive, and difficult to install for ordinary consumers. Among these technological variations, there are still common elements that define the VR experience.

Conceptualizing the VR Experience

VR provides a distinct user experience compared to other currently available media given its broader array of sensory cues (e.g., visual representations, motion, depth, sound, spatialization, balance) and naturally mapped modes of interaction using head rotation, gestures, and body movement. Given the way VR engages the sensorimotor system, VR can make users feel like they are having "a non-mediated primary experience of the everyday world" (Frey, 2018, p. 495). In short, VR can feel more "real" than other channels.

Here, we clarify some key affordances that define the VR experience. Importantly, these are not exclusive to VR, although experiencing this collective constellation of affordances at high levels is difficult to achieve with other modern media technologies or communication channels. Thus, rather than basing our framework on VR as a monolithic and invariant channel, we use these affordances as a foundation to enable more flexible and durable theorizing (Fox & McEwan, 2017).

Embodiment

Embodiment (related to self-presence, Biocca, 1997, and the body-ownership or body-transfer illusion, Gonzalez-Franco & Lanier, 2017) refers to the extent users experience the body of their virtual representation, or avatar, as their actual body or an extension thereof (Ratan & Dawson, 2016). Embodiment is "the sense that emerges when the virtual body's properties are processed as if they were the properties of one's own biological body" (Kilteni, Groten, & Slater, 2012, p. 373). Users feel ownership of their virtual body and physically located within this body. As such, the virtual body becomes the center of one's actions ("I am really doing this") and the subject of external forces ("This is happening to me.") Compared

to a traditional narrative, VR enables the user not only to observe the character's viewpoint, but to *be* the character and control their actions.

Because embodiment enables the user to adopt the perspective of the avatar, this affordance may promote feelings of identification (see Cohen & Klimmt, this volume; Cohen 2001). Klimmt, Hefner, and Vorderer (2009) propose a conceptualization of identification in video games. They define identification as a "temporary alteration of media users' self-concept through adoption of perceived characteristics of a media person" (p. 356). This definition of identification resonates closely with Yee and Bailenson's (2007) description of the Proteus effect, a phenomenon wherein a user's attitudes and behaviors align with the characteristics of their avatar (for a recent meta-analysis see Ratan, Beyea, Li, & Graciano, 2019). The Proteus effect is more pronounced if users perceive the body of their avatar as their actual body (Yee & Bailenson, 2008). Because VR may surpass other existing media in fostering embodiment, it might foster stronger temporary alterations of users' self-concepts and behaviors.

Spatial Presence and Co-Location

Spatial presence refers to users' experience of "being there" in the virtual setting (Lee, 2004). Cues from the real world are suppressed, and users feel surrounded by and immersed within the virtual environment. When spatially present, users feel "as if they could actually take part in the action of the media presentation, rather than merely observing it" (Hartmann et al., 2016, p. 4). Accordingly, embodiment and spatial presence are considered closely linked concepts (Haans & Ijsselstijn, 2012).

Another closely related aspect is *co-location*, which we define as users' subjective perception that displayed entities are physically co-present and seemingly tangible. In VR, co-location is enabled by stereoscopic vision, spatialized audio, and three-dimensional

rendering so that entities seem to possess volume and occupy space. Co-location increases if other entities can be touched or provide haptic feedback (Nam, Shu, & Chung, 2008).

Social presence is commonly defined as users' feeling of being with another sentient entity (Lee, 2004). People can experience social presence by sensing others are near them (e.g., seeing or hearing someone else in a room) or by interacting with them (e.g., talking on the phone). *Co-presence* occurs when sentient entities feel both socially present and co-located: that is, entities appear embodied and share space with the embodied user (e.g., Croes, Antheunis, Schouten, & Krahmer, 2016). Although many media offer sufficient cues for people to experience social presence, most cannot afford co-presence as VR can.

Entities that are physically co-present should seem more consequential and self-relevant to the user than entities that are not embodied or sharing the same space. Entities that appear to be co-located imply imminent threat or opportunity, and thus may have an immediate impact on the embodied self (Hartmann, 2008). Because their immediate wellbeing seems to be at stake, users might approach co-located entities in VR with greater care and caution compared to entities displayed on a screen (Blascovich et al., 2002).

Cognitive Distancing: An Antagonistic Process

Embodiment, spatial presence, and co-presence are mainly automatic, bottom-up, sensory-driven perceptual sensations that together define the typical VR experience. In contrast, cognitive distancing represents an antagonistic process that relies on users' top-down, higher-order cognitive processing. *Cognitive distancing* refers to users' awareness that they are immersed in a media-induced experience (Hartmann, 2011; Quaglia & Holecek, 2018). This awareness might be triggered by several factors including content, such as being confronted with implausible or inconsistent information; medium issues, such as a technological glitch; and individual differences, such as psychological distractions, a critical

perspective, or efforts by the user to remind themselves that the mediated experience is not an authentic one.

Initially, users may forget that the stimulus is mediated either because this information was not cognitively salient or because higher-order cognition was bypassed (LeDoux, 2006). Subsequent cognitive distancing allows users to reappraise the stimulus as safe, benign, or inconsequential. As depicted events become less immediately self-relevant, cognitive distancing should invite a more carefree interpretation and a more playful stance towards the media environment (Frey, 2018; Vorderer, 2001).

Cognitive distancing can facilitate two related processes regarding users' affective responses. First, users should be able to engage in affect regulation more easily (Schramm & Wirth, 2008). Reminding oneself that the experience is not real should help the user regain control over their arousal and emotional responses. Similarly, cognitive distancing can enable *hedonic reversals*, or transformations of the affective experience (Rozin, Guillot, Fincher, Rozin, & Tsukayama, 2013). Some entertainment experiences may evoke negative affect initially, such as a gruesome horror movie in which a leprechaun disembowels humans. A viewer might engage in cognitive distancing by focusing on how poor the special effects are and how unrealistic the corpses appear. Although the viewer originally felt fear and disgust, this realization may yield positive emotions such as amusement. This positive reversal may be due to achieving "mind over body" and feeling satisfaction for surpassing the body's automatic response (Apter, 1992; Rozin et al., 2013). Thus, many fear- or suspense-inducing entertainment offerings are perceived as enjoyable (Andrade & Cohen, 2007).

Although the process of cognitive distancing has rarely been explicitly explored in VR research, many conceptualizations of presence focus on the "illusion of non-mediation" and the acceptance or rejection of the VR world as real (e.g., Lee, 2004; Lombard & Ditton, 1997). A "break in presence" has been defined as an occurrence when a user is immersed in

VR and their attention and responses shift from the virtual world to the real world (Slater & Steed, 2000), effectively a measure of cognitive distancing. The process of cognitive distancing is understudied in VR, although one notable study examined awareness and the potential for hedonic reversals in VR. In a fear-inducing environment, participants with greater awareness that the experience was virtual, not real, reported less fear and more enjoyment (Quaglia & Holecek, 2018). Further research is necessary, however, to determine how the perception of affordances are tied to this awareness as well as the extent to which participants were able to invoke it.

In summary, VR provides greater bandwidth and promotes fuller sensorimotor engagement than most existing entertainment technologies while simultaneously suppressing cues from the external environment. Immersed in VR, users can feel embodied in an avatar that seems physically co-located in a shared spatial environment with objects and social beings. Collectively, VR's affordances may lead users to experience VR stimuli similar to real world stimuli, making events in VR seem highly self-relevant and consequential. Cognitive distancing, however, may enable users to contextualize and make attributions regarding their VR experience, perhaps triggering a reappraisal or reinterpretation of events and their current state. These factors are key to understanding the nature and effects of VR entertainment.

The Entertaining Quality of the VR Experience

According to Vorderer and Hartmann (2009), "feeling entertained by a media offering means meta-level appreciation of the dynamic chain of rather autonomic affective states on the primary level" (p. 542). Entertaining media offerings generally represent a condensed (e.g., from fast-paced action to rapidly developing plots and changing scenery), exaggerated or pointed (e.g., from staggering explosions to the grimace of a comedian), or novel (e.g., from fantastic medieval or science-fiction scenery) reality (Frey, 2018; Vorderer &

Hartmann, 2009). Being immersed in this "hyper-reality" triggers a chain of automatically evoked primary physiological and emotional responses in users, from joy to sadness, and from hope and fear to suspense. According to Vorderer and Hartmann (2009), if experiencing these primary responses remains playful and safe, and if their occurrence does not violate but even promote salient mood-regulation (e.g., "I want to be sad at a funeral") and self-realization goals ("I want to become an intellectual person"), users will appreciate what the stimulus is doing to them and feel entertained.

Proposition 1: The VR experience can evoke relatively intense primary responses given its realistic sensorimotor cues. Media that more closely resemble natural stimuli can evoke automatic, and sometimes intense, physiological and emotional responses (Lang, 1990; Reeves & Nass, 1996). Although entertaining media like books, movies, and video games can trigger the experiential mode (e.g., narrative engagement, Busselle & Bilandzic, 2008; transportation, Green & Brock, 2000; involvement, Klimmt & Vorderer, 2003; narrative enjoyment, Tamborini, this volume), the VR experience might feel even more real given its affordances of embodiment, spatial presence, and co-location.

VR may feel more real and evoke stronger primary responses because objects, people, and the environment can be represented in a way that more closely resembles the real world (Biocca, 1997). Unlike textual media, objects have rich sensory representations. Unlike static media, objects have motion. Unlike two-dimensional media, objects have volume, occupy space, and vary in distance and location relative to the user. Thus, reading a description, seeing a picture, or watching a video of a peaceful lake differs from a VR experience in which the user can look down and see the water lapping at the shore, turn around and see mountains in the distance behind them, and hear the wind rustling the leaves in the tree overhead. Feeling present within the VR environment and close to objects within it should

evoke stronger primary responses than media that portray similar content but do not afford these sensations (Marowski et al., 2019).

Additionally, VR may feel more real because it enables users to interact naturally with the environment. Unlike non-interactive media, objects have action potential and can respond in natural ways to the user's actions. In VR, users have a body they control and can perform natural behaviors, such as leaning, walking, or grasping, to engage with co-located objects. Natural mapping of user actions in VR means that motor actions are similar to those enacted in the real world (Biocca, 1997), and thus similar physiological responses may follow. Having a body within VR should evoke a more intense response to threats. The view from a cliff's edge may seem dizzying on a movie screen, but in VR, users are present and embodied on the cliff. They can tilt their head to look down, use their feet to step closer, and watch as their body nears the treacherous edge. Moving naturally within a realistically rendered, highly threatening environment can trigger an automatic and intense physiological response (Lin, 2017).

In summary, the VR experience might evoke intense primary responses given its realistic sensorimotor cues. Displayed entities seem to exist in physical space, not simply as symbolic depictions that need to be imagined, as in books, or flat simulations that inevitably reveal themselves to be inauthentic, as in movies and video games. Users potentially perceive these entities as co-present and hence significant to their wellbeing as they imply immediate threat or opportunity. Because users' perceptions and sensory experiences within the environment shape their interactions with content and narrative, they are fundamental to the study of VR entertainment.

Proposition 2: The VR experience results in potentially difficult hedonic reversals and regulation of primary responses. According to Vorderer and Hartmann (2009), entertainment results from a positive reappraisal of arousal and affect as primary psychological states. For

example, users can appreciate that a series of good jokes in a comedy makes them laugh, that they are brought to the edge of their seat by a suspenseful TV series or sports match, that they feel competent and effective while playing a video game, or that reading a dramatic novel makes them feel sad. Users adopt an active role in this reappraisal process. They appraise, manage, and regulate their primary psychological states based on an active choice of reference frames (Schramm & Wirth, 2008). If primary responses are unpleasant, users engage in cognitive distancing or other coping strategies.

One possible goal of these strategies is a hedonic reversal. There is some early evidence that users may undergo hedonic reversals in VR (e.g., Quaglia & Holecek, 2018); however, they may be more difficult to achieve in VR than other media for at least four reasons. First, as elaborated in Proposition 1, VR provides a continuous stream of vivid sensory cues. Users may automatically process their surroundings as real, and it might require relatively high cognitive effort to reinterpret co-located, sensory-rich entities as not real (Zeimbekis, 2016). Second, VR's layers of sensorimotor involvement and interactivity might tax attentional and cognitive resources (Shapiro & McDonald, 1992), limiting the amount of resources available for such reappraisal as well as affect regulation. Third, being immersed in a compelling and persistent sensory illusion that is designed to minimize cues from the real world may make cognitive distancing more challenging. For example, when watching a scary movie, a viewer can redirect their attention away from the screen and focus instead on the bucket of popcorn they are holding. In VR, the user is surrounded by the virtual simulation and thus it is more difficult to shift attention to a non-mediated cue. Finally, the high levels of interactivity in VR can make users' experiences less predictable; in turn, affect regulation may be more taxing and less effective. In summary, if embodied VR users feel threatened by a rapidly approaching and seemingly real monster, cognitive distancing and reappraisal might

be harder to achieve than if the monster were encountered while reading a book, watching a movie, or playing a typical video game.

In line with this assumption, despite knowing that "this is not real," VR users appear to be severely stressed by walking over a narrow wooden plank over a high virtual pit (Meehan, Insko, Whitton, & Brooks, 2002), chopping off the head of another user's avatar in a medieval sword-fighting VR game (Rundle, 2015), and being sexually harassed by other users in Social VR (The Extended Mind, 2018). Although effective dismantling or reinterpretation of the sensory illusions provided by VR and their affective consequences like fear can serve entertainment, they potentially require substantial cognitive skills (Quaglia & Holecek, 2018). Accordingly, the VR experience might easily become too intense for users and turn unenjoyable, because users fail to hedonically reverse distressful or unpleasant primary responses. Note that while we focused on inherently unpleasant primary responses such as fear or distress in our discussion so far, the same might be said over the regulation of any primary response triggered in VR, including pleasant ones (e.g., awe, joy, sexual arousal). Although entertainment-seeking users usually would not be prone to regulate positive primary responses, at times they might be deemed inappropriate, maybe because users' feel pushed by a VR stimulus to respond in a certain way or the positive primary response violates personal norms or standards. In line with the above discussion, we believe that regulating unwanted positive primary responses in VR might also be relatively difficult.

In summary, the first two propositions describe the VR entertainment experience as a high-risk, high-gain scenario. Given VR's affordances, the VR experience can result in powerful primary responses, including intense arousal levels. The risk is that users find it difficult to regulate these primary responses, if they turn too intense or are otherwise at odds with the experience users seek. However, for those users who are able to appreciate their powerful primary responses, perhaps by successfully employing cognitive distancing to

hedonically reverse distress into excitement, the VR experience might be intensively enjoyable.

Proposition 3: The VR experience allows for enjoyable expansions of the self, even in non-narrative formats. Engagement in media entertainment offerings can be enjoyable because they distract users from their everyday problems and provide vicarious experiences that momentarily expand users' selves beyond the constraints encountered in everyday life (Slater, Johnson, Cohen, Comello, & Ewoldsen, 2014). This reasoning lies at the heart of the temporary expansion of the boundaries of the self (TEBOTS) model by Slater and colleagues (2014, this volume).

According to TEBOTS, maintaining the personal and social self in daily life is a demanding process. Individual experiences are also constrained by a person's abilities, social roles, and environmental factors. By transporting into stories and identifying with story characters, however, users can find relief from demanding self-maintenance through distraction. Further, they may experience an expansion of their personal selves by vicariously entering scenarios, adopting abilities, and representing values that are out of reach in their everyday life.

Becoming somebody else for a while might be also be an important aspect of VR's entertainment quality, but this process might work differently in VR than other media narratives. In VR, users can become somebody else even without narrative context: The VR experience is centered on the self and incorporates the physical self. If embodied, users adopt the virtual body as their own and behave in a way consistent with this representation (Yee, 2014). It is plausible that through embodiment in a rich environment, VR provides a new type of expansion not possible through existing media: an expansion of the sensorimotor self. When embodied in VR, users are not merely observing or imagining the expanded self; they are enacting and practicing it. For example, studies have shown how users can exceed the

capabilities of their physical bodies and learn to control a third arm in VR (Won, Bailenson, Lee, & Lanier, 2015).

Embodiment may facilitate easier and more direct expansion of the self, given the ability to be present within, and in control of, the virtual self. VR thus indicates a potential enhancement of TEBOTS as vicarious experiences become virtual ones that require physiological engagement and bodily enactment. Indeed, many VR studies have observed effects on the self even when users are only performing mundane tasks such as looking in a mirror or touching virtual objects. In summary, the VR experience might be entertaining because it provides a powerful distraction from users' actual selves and profound self-expanding experiences even in non-narrative formats.

Under certain conditions, however, the VR experience might also constrain a temporary expansion of the self by triggering a less carefree and less exploratory behavioral stance. For example, if the VR experience feels too real, users might refrain from engaging in risky behavior like jumping off a cliff or in antisocial behavior like virtual violence even if such behavior would imply enjoyable expansions of the self. Further, the nature of the embodied self may constrain the possibilities for self-expansion. If the user's avatar is highly self-similar or characterized in a way that evokes other personal or sociocultural inhibitions (such as being overly sexualized; Fox, Bailenson, & Tricase, 2013), high levels of embodiment may limit the potential for self-expansion. A final issue concerns the accessibility of VR platforms. Because VR requires higher sensorimotor engagement, users with sensorimotor limitations may be less able to expand the self in a VR setting compared to other media.

Proposition 4: The VR experience enhances the moral or normative significance of action. The VR experience implies that embodied users encounter seemingly co-located, physically existing, sentient others, and it might be relatively difficult for users to cognitively

distance themselves from this impression. According to the model of social influence in virtual environments (Blascovich et al., 2002), human-controlled avatars and realistically displayed computer-controlled agents evoke social considerations and influence similar to humans in face-to-face interactions. Similarly, Hartmann (2018) argues that avatars and agents are capable of evoking automatic mind perception in users. Thus, avatars and agents may be automatically perceived as moral entities that deserve consideration, and social interactions within more immersive environments may be perceived as more morally significant.

The realism afforded by VR may enhance morally relevant experiences. For instance, a recent VR study by Dzardanova, Kasapakis, and Gavalas (2018) showed that participants embodied into a virtual self that undressed in front of a virtual salesman felt uncomfortable and embarrassed. Embodiment may also enhance feelings of responsibility for one's moral actions, which should intensify self-conscious emotions such as pride or guilt. For example, within an interactive entertainment narrative, a user may be given the option to stab a threatening character. The decision-making process and the effects of the action may be different if one is pushing buttons in a video game (see Melzer & Holl, this volume; see also MIME, Tamborini, this volume) compared to being in immersive VR, where the user must pick up a virtual knife with one's hand, get close to the other person, lift one's arm, and engage the physical body in a stabbing motion. It seems plausible that moral decisions in VR are more closely aligned with users' values and norms than moral decisions taken in traditional video game environments.

Whether or not the enhanced moral significance of action and strong self-conscious emotions in VR enhance or impede the entertainment experience depends on reappraisals. Negative primary responses like guilt or embarrassment, for example, could fuel the entertainment experience if they can be hedonically reversed. For instance, some users might

find it exciting to “be bad” in VR and experience a rush of shame or guilt that is then positively reappraised.

Proposition 5: Users may remember parts of their VR entertainment experience as something that they actually experienced. Different forms of media are recalled differently and form qualitatively different types of memory. Memories of text-based media more closely resemble memories of imagined events, whereas memories of screen-based media more closely resemble memories of real events (Gordon, Gerrig, & Franklin, 2009). Further, people can confuse sources of mediated information and mistakenly recall fiction as fact (e.g., Appel & Richter, 2007; Mares, 1996). Given VR’s affordances, researchers have expressed concern that VR may be more likely to be falsely remembered as a real, rather than virtual, experience (Gordon et al., 2009; Shapiro & McDonald, 1992).

According to the source monitoring framework (SMF), an extension of the reality monitoring framework (Johnson & Raye, 1981), people must distinguish the origin of remembered events (Johnson, Hastroudi, & Lindsay, 1993). Reality monitoring entails determining whether an event was real (external and perceived through the senses) or imagined (internal). Source monitoring involves a more discriminating determination, such as recalling whether an event was observed on the news or firsthand.

SMF has been applied to remembering media events (e.g., Johnson, 2007; Shapiro & Lang, 1991) and specifically VR. VR events are an interesting case for the SMF because they are perceived externally through the senses and thus conceived as “real” within the framework. Although the process of the event is real—the user did indeed experience VR—the content of the event is not objectively real, because it is only a digital simulation and not something that actually happened. If a VR user feels highly present and loses sight of the medium itself when encoding the event, it may be more difficult to recall the experience as a mediated one and source monitoring errors may be more likely.

For these reasons, scholars have argued for the need to examine "virtual reality monitoring," or how people make reality judgments about virtual events (Hoffman, Hullfish, & Houston, 1995; Shapiro & McDonald, 1992). In studies by Hoffman and colleagues, adults were exposed to objects in reality or in VR and later asked to recall where they had encountered the objects. Although there were some source monitoring errors, generally they found that people were able to remember what was virtual and what was real (Hoffman et al., 1995; Hoffman, Garcia-Palacios, Thomas, & Schmidt, 2001). Notably, however, these studies did not examine some crucial factors elaborated by SMF researchers. First, age is important; children and older adults are more prone to error than college-aged individuals. Second, from an entertainment perspective, it is worth noting that these initial studies involved simple object recognition tasks rather than a narrative or other engaging experience. Finally, from a technological perspective, the VR graphics and systems were quite crude at the time; it may have been easy to remember objects as virtual because they looked pixelated, lacked natural shading, or otherwise appeared unrealistic.

Thus far only a handful of studies have begun to probe source monitoring and VR experiences, particularly in entertainment contexts. One exploratory study examined how a fictional narrative accompanied with self-oriented VR content could promote false memories in elementary-aged children (Segovia & Bailenson, 2009). At this time, additional research is direly needed, particularly given the rise in immersive journalism applications and related infotainment.

Concluding Remarks

To take a step towards more systematic research and theorizing on VR entertainment, the present chapter aimed to conceptualize the typical VR experience and offered five propositions about entertainment experiences in VR. These propositions and the underlying thinking could guide empirical research in the future, for example by comparing users'

entertainment experience of environments and encounters displayed in VR compared to other channels.

Going forward, researchers should attempt to systematically manipulate and measure affordances to clarify their role within VR and other entertainment media experiences. Although we focused on VR in the present approach, channel-, medium-, or modality-based labels become increasingly meaningless as traditional media and platform boundaries blur. In this light, it is necessary to identify and elaborate psychological underpinnings, principal affordances, or core mechanisms that qualify experiences across media. Despite of our focus on VR, the present approach should be understood as an attempt to turn away from explicit media labels and an encouragement to explore the role of these core mechanisms on users' entertainment experiences.

Last but not least, two potential caveats of the present attempt to discuss users' entertainment experience need to be noted. First, as with many emerging technologies, the novelty of VR may be a draw initially, but the initial "wow effect" might be strongest among first-time users and gradually diminish with further usage (Shapiro & McDonald, 1992). It is possible that primary responses such as fear become less intense as users grow accustomed to VR. This desensitization could undermine VR's entertainment quality in the future. Second, the present approach focused primarily on the form and psychological experience of the VR experience rather than delving too deeply into primarily content-based elements, such as narrative embedding. However, narratives profoundly affect entertainment experiences (Tamborini, this volume, on narrative enjoyment), and the VR experience and narrative experience likely influence each other (e.g., Riva, Mantovani, Gorini, De Leo, & Capideville, 2010; Schneider, Lang, Shin, & Bradley, 2006). Producers and scholars are currently tackling the challenge of learning how to tell engaging stories in VR. Accordingly, a full account of VR entertainment should integrate both medium and the message in the future.

References

Andrade, E. B. & Cohen, J. B. (2007). On the consumption of negative feelings. *Journal of Consumer Research, 34,* 283-300. doi: 10.1086/519498

Appel, M. & Richter, T. (2007). Persuasive effects of fictional narratives increase over time. *Media Psychology, 10*(1), 113-134.

Apter, M. J. (1992). *The dangerous edge: The psychology of excitement*. New York, NY: The Free Press.

Biocca, F. (1997). The cyborg's dilemma: Progressive embodiment in virtual environments. *Journal of Computer-Mediated Communication, 3*(2). doi: j.1083-6101.1997.tb00070.x

Blascovich, J., Loomis, J., Beall, A., Swinth, K., Hoyt, C., & Bailenson, J .N. (2002). Immersive virtual environment technology as a methodological tool for social psychology. *Psychological Inquiry, 13*(2), 103-124. doi: 10.1207/S15327965PLI1302_01

Busselle, R., & Bilandzic, H. (2008). Fictionality and perceived realism in experiencing stories: A model of narrative comprehension and engagement. *Communication Theory, 18,* 255–280. doi: 10.1111/j.1468-2885.2008.00322.x

Cohen, J. (2001). Defining identification: A theoretical look at the identification of audiences with media characters. *Mass Communication & Society, 4,* 245-264. doi: 10.1207/S15327825MCS0403_01

Croes, E. A. J., Antheunis, M. L., Schouten, A. P., & Krahmer, E. J. (2016). Teasing apart the effect of visibility and physical co-presence to examine the effect of CMC on interpersonal attraction. *Computers in Human Behavior, 55,* 468-476. doi: 10.1016/j/chb/2015.09.037

Dzardanova, E., Kasapakis, V., & Gavalas, D. (2018). On the effect of social context in virtual reality: An examination of the determinants of human behavior in shared immersive virtual environments. *IEEE Consumer Electronics Magazine, 7*(4), 44 – 52. doi: 10.1109/MCE.2018.2816204

Fox, J., Arena, D., & Bailenson, J. N. (2009). Virtual reality: A survival guide for the social scientist. *Journal of Media Psychology, 21*(3), 95-113. doi: 10.1027/1864-1105.21.3.9

Fox, J., Bailenson, J. N., & Tricase, L. (2013). The embodiment of sexualized virtual selves: The Proteus effect and experiences of self-objectification via avatars. *Computers in Human Behavior, 29,* 930-938. doi: 10.1016/j.chb.2012.12.027

Fox, J., & McEwan, B. (2017). Distinguishing technologies for social interaction: The perceived social affordances of communication channels scale. Communication Monographs, 84, 298-318. doi: 10.1080/03637751.2017.1332418

Frey, F. (2018). The experiential mode of media reception: A holistic framework concept. *Communication Theory, 28,* 487-510. doi: 10.1093/ct/qty010

Gonzalez-Franco, M., & Lanier, J. (2017). Model of illusions and virtual reality. *Frontiers in Psychology, 8,* article 1125. doi: 10.3389/fpsyg.2017.01125

Gordon, R., Gerrig, R. J., & Franklin, N. (2009). Qualitative characteristics of memories for real, imagined, and media-based events. *Discourse Processes, 46,* 70-91. doi: 10.1080/01638530802629117

Green, M. C., & Brock, T. C. (2000). The role of transportation in the persuasiveness of public narratives. *Journal of Personality & Social Psychology, 79,* 701-721. doi: 10.1037/0022-3514.79.5.701

Haans, A., & Ijsselsteijn, W. A. (2012). Embodiment and telepresence: Toward a comprehensive theoretical framework. *Interacting with Computers, 24*(4), 211–218. doi: 10.1016/j.intcom.2012.04.010

Hartmann, T. (2008). Parasocial interactions and paracommunication with new media characters. In E. A. Konijn, S. Utz, & M. Tanis (Eds.), *Mediated interpersonal communication* (pp. 177–199). New York, NY: Routledge. doi: 10.4324/9780203926864

Hartmann, T. (2011). Players' experiential and rational processing of virtual violence. In S. Malliet & K. Poels (Eds.), *Vice city virtue: Moral issues in digital game play* (pp. 135–150). Leuven, Belgium: ACCO.

Hartmann, T. (2018). The "moral disengagement in violent videogames" model. *Game Studies: The International Journal of Computer Game Research, 17*(2). http://gamestudies.org/1702/articles/hartmann

Hartmann, T., Klimmt, C., & Vorderer, P. (2010). Telepresence and media entertainment. In C. Bracken & P. Skalski (Eds.), *Immersed in media. Telepresence in everyday life* (pp. 137–157). New York, NY: Routledge.

Hoffman, H. G., Garcia-Palacios, A., Thomas, A. K., & Schmidt, A. (2001). Virtual reality monitoring: Phenomenal characteristics of real, virtual, and false memories. *CyberPsychology & Behavior*, *4*, 565-572. doi: 10.1089/109493101753235151

Hoffman, H. G., Hullfish, K. C., & Houston, S. J. (1995, March). Virtual-reality monitoring. In *Proceedings of Virtual Reality Annual International Symposium* (pp. 48-54). IEEE. doi: 10.1109/VRAIS.1995.512479

Jagneaux, D. (2019). Beat Saber officially surpasses one million copies sold. Retrieved online from https://uploadvr.com/beat-saber-one-million-copies

Johnson, M. K. (2007). Reality monitoring and the media. *Applied Cognitive Psychology, 21*, 981-993. doi: 10.1002/acp.1393

Johnson, M. K., & Raye, C. L. (1981). Reality monitoring. *Psychological Review, 88*, 67-85. doi: 10.1037/0033-295X.88.1.67

Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological Bulletin, 114(1),* 3-28. doi: http://dx.doi.org/10.1037/0033-2909.114.1.3

Kilteni, K., Groten, R., & Slater, M. (2012). The sense of embodiment in virtual reality. *Presence: Teleoperators and Virtual Environments, 21*, 373–387. doi: 10.1162/PRES_a_00124

Klimmt, C., & Vorderer, P. (2003). Media psychology “is not yet there”: Introducing theories on media entertainment to the presence debate. *Presence: Teleoperators and Virtual Environments, 12*, 346–359. doi: 10.1162/105474603322391596

Klimmt, C., Hefner, D., & Vorderer, P. (2009). The video game experience as “true” identification: A theory of enjoyable alterations of players' self-perception. *Communication Theory, 19*, 351–373. doi: 10.1111/j.1468-2885.2009.01347.x

Lang, A. (1990). Involuntary attention and physiological arousal evoked by structural features and emotional content in TV commercials. *Communication Research, 17,* 275-299. doi: 10.1177/009365090017003001

LeDoux, J. E. (2006). The amygdala and emotion: A view through fear. In J. P. Aggleton (Ed.), *The amygdala: A functional analysis* (pp. 289-310). Oxford, UK: Oxford University Press.

Lee, K. M. (2004). Presence, explicated. *Communication Theory, 14,* 27–50. doi: 10.1111/j.1468-2885.2004.tb00302.x

Lin, J. H. T. (2017). Fear in virtual reality (VR): Fear elements, coping reactions, immediate and next-day fright responses toward a survival horror zombie virtual reality game. *Computers in Human Behavior, 72*, 350–361. doi: 10.1016/j.chb.2017.02.057

Lindsay, D. S. (2008). Source monitoring. In H. L. Roediger, III (Ed.), *Cognitive psychology of memory* (Vol. 2, pp. 325-347). Oxford, UK: Elsevier.

Lombard, M., & Ditton, T. (1997). At the heart of it all: The concept of presence. *Journal of Computer-Mediated Communication, 3*(2). doi: 10.1111/j.1083-6101.1997.tb00072.x

Makowski, D., Sperduti, M., Pelletier, J., Blondé, P., La Corte, V., Arcangeli, M., ... & Piolino, P. (2019). Phenomenal, bodily and brain correlates of fictional reappraisal as an implicit emotion regulation strategy. *Cognitive, Affective, & Behavioral Neuroscience,* 1-21. doi: 10.3758/s13415-018-00681-0.

Mares, M. L. (1996). The role of source confusions in television's cultivation of social reality judgments. *Human Communication Research, 23,* 278-297. doi: 10.1111/j.1468-2958.1996.tb00395.x

Meehan, M., Insko, B., Whitton, M. C., & Brooks, F. P. (2002). Physiological measures of presence in stressful virtual environments. *Proceedings of the 29th Annual Conference on Computer Graphics and Interactive Technique* (pp. 645–652). San Antonio, TX.

Moon, M. (2019). Sony has sold 4.2 million PlayStation VR headsets. Retrieved online from https://www.engadget.com/2019/03/26/sony-4-2-million-playstation-vr-headset-sales (8.5.2019).

Nam, C. S., Shu, J., & Chung, D. (2008). The roles of sensory modalities in collaborative virtual environments (CVEs). *Computers in Human Behaviour, 24,* 1404–1417. doi: 10.1016/j.chb.2007.07.014

Quaglia, J. T., & Holecek, A. (2018). Lucid virtual dreaming: Antecedents and consequents of virtual lucidity during virtual threat. *Proceedings of the 25th IEEE Conference on Virtual Reality and 3D User Interfaces* (pp. 65–72). doi: 10.1109/VR.2018.8446546

Ratan, R., Beyea, D., Li, B. J., & Graciano, L. (2019). Avatar characteristics induce users' behavioral conformity with small-to-medium effect sizes: A meta-analysis of the Proteus effect. *Media Psychology.* doi: 10.1080/15213269.2019.1623698

Ratan, R. A., & Dawson, M. (2015). When mii is me: A psychophysiological examination of avatar self-relevance. *Communication Research, 43,* 1065-1093. doi: 10.1177/0093650215570652

Reeves, B., & Nass, C. (1996). *The media equation: How people treat computers, television, and new media like real people and places.* New York, NY: Cambridge.

Riva, G., Mantovani, F., Gorini, A., De Leo, G., & Capideville, C. S. (2010). The role of immersion and narrative in mediated presence: The virtual hospital experience. *Cyberpsychology, Behavior, & Social Networking, 14*, 99–105. doi: 10.1089/cyber.2010.0100

Rozin, P., Guillot, L., Fincher, K., Rozin, A., & Tsukayama, E. (2013). Glad to be sad, and other examples of benign masochism. *Judgment and Decision Making, 8,* 439-447.

Rundle, M. (2015). Death and violence 'too intense' in VR, developers admit. Retrieved online from https://www.wired.co.uk/article/virtual-reality-death-violence

Sag, A. (2019). Location-based VR: The next phase of immersive entertainment. Retrieved online from https://www.forbes.com/sites/moorinsights/2019/01/04/ location-based-vr-the-next-phase-of-immersive-entertainment

Schneider, E. F., Lang, A., Shin, M., & Bradley, S. D. (2004). Death with a story. *Human Communication Research, 30,* 361–375. doi: 10.1111/j.1468-2958.2004.tb00736.x

Schramm, H., & Wirth, W. (2008). A case for an integrative view on affect regulation through media usage. *Communications: The European Journal of Communication Research, 33*(1), 27-46. doi: 10.1515/COMMUN.2008.002

Segovia, K. Y., & Bailenson, J. N. (2009). Virtually true: Children's acquisition of false memories in virtual reality. *Media Psychology, 12,* 371–393. doi: 10.1080/15213260903287267

Shafer, D. M., Carbonara, C. P., & Korpi, M. F. (2018). Factors affecting enjoyment of virtual reality games: A comparison involving consumer-grade virtual reality technology. *Games for Health Journal, 8,* 15–23. doi: 10.1089/g4h.2017.0190

Shapiro, M. A., & Lang, A. (1991). Making television reality: Unconscious processes in the construction of social reality. *Communication Research, 18,* 685-705. doi: 10.1177/009365091018005007

Shapiro, M. A., & McDonald, D. G. (1992). I'm not a real doctor, but I play one in virtual reality: Implications of virtual reality for judgments about reality. *Journal of Communication, 42,* 94–114. doi: 10.1111/j.1460-2466.1992.tb00813.x

Skalski, P., & Tamborini, R. (2006). The role of presence in the experience of electronic games. In P. Vorderer & J. Bryant (Eds.), *Playing video games: Motives, responses, and consequences* (pp. 225–240). Mahwah, NJ: Erlbaum.

Slater, M., & Steed, A. (2000). A virtual presence counter. *Presence: Teleoperators & Virtual Environments, 9,* 413-434. doi: 10.1162/105474600566925

Slater, M. D., Johnson, B. K., Cohen, J., Comello, M. L. G., & Ewoldsen, D. R. (2014). Temporarily expanding the boundaries of the self: Motivations for entering the story world and implications for narrative effects. *Journal of Communication, 64,* 439–455. doi: 10.1111/jcom.12100

The Extended Mind. (2018). Virtual harassment. Retrieved online from https://extendedmind.io/blog/2018/4/4/virtual-harassment-the-social-experience-of-600-regular-virtual-reality-vrusers

Vorderer, P. (2001). It's all entertainment—sure. But what exactly is entertainment? *Poetics, 29*(4–5), 247-261. doi: 10.1016/S0304-422X(01)00037-7

Vorderer, P., & Hartmann, T. (2009). Entertainment as media effect. In J. Bryant & M. B. Oliver (Eds.), *Media effects* (3rd ed., pp. 532-550). New York, NY: Routledge.

Wilcox, L. M., Allison, R. S., Elfassy, S., & Grelik, C. (2006). Personal space in virtual reality. *ACM Transactions on Applied Perception, 3,* 412-428. doi: 10.1145/1190036.1190041

Won, A. S., Bailenson, J., Lee, J., & Lanier, J. (2015). Homuncular flexibility in virtual reality. *Journal of Computer-Mediated Communication, 20*, 241–259. doi: 10.1111/jcc4.12107

Yee, N. & Bailenson, J. N. (2007). The Proteus effect: The effect of transformed self-representation on behavior. *Human Communication Research, 33,* 271–290. doi: 10.1111/j.1468-2958.2007.00299.x

Yee, N. & Bailenson, J. N. (2009). The difference between being and seeing: The relative contribution of self-perception and priming to behavioral changes via digital self-representation. *Media Psychology, 12*, 195-209, doi: 10.1080/15213260902849943

Yee, N. (2014). *The Proteus paradox: How online games and virtual worlds change us--and how they don't*. New Haven, CT: Yale University Press.

Zeimbekis, J. (2016). Seeing, visualizing, and believing: Pictures and cognitive penetration. In J. Zeimbekis & A. Raftopoulos (Eds.), *The cognitive penetrability of perception: New philosophical perspectives* (pp. 298-328). Oxford, UK: Oxford University Press. doi: 10.1093/acprof:oso/9780198738916.003.0013