# Missing in Action: Embodied Experience and Virtual Reality

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## Introduction

Theatre has always been a space of virtuality. The action on the stage exists as neither what it is actually nor what it is pretending to be; instead, it bridges the actual and the imaginary to create a virtual world in which performers and viewers are complicit. During the twentieth century, as design and projection technologies advanced, theatre developed even greater potential as a place of imagination unfettered by physical restrictions. Two- and three-dimensional images can now represent people, environments, and objects interacting and interlacing with the action onstage, or even replacing the stage altogether. As a researcher working with human bodies and digital avatars, my interest has been piqued by the recent surge in the desire of audiences to enter the performance space in immersive theatre, coupled with the emergence of virtual reality (VR) headsets into the regular commercial and home entertainment markets.[1] These two phenomena are already colliding in productions like Noma Labs' recent *Virtually Dead* (2016) in which participants are taken to a "training facility" to learn how to kill zombies in VR, only to find that the real zombies are coming to get them.[2] What might this new era of VR offer to theatre in the future? Immersive theatre takes the participant into the action, but that action is still limited by the physicality of settings and performers. In VR anything can be done because it is all in the mind—isn't it?

Since its early days, VR has been beleaguered by claims that it has a disembodying effect, with popular culture often following the pattern of William Gibson's seminal writings suggesting that the body will become obsolete.[3] Much research in VR was carried out in the 1980s and '90s with head-mounted display (HMD) units enabling full immersion, often incorporating data-gloves and other haptic interfaces to enable the user to "touch" virtual objects.[4] Scientists examined perceptions of location and presence in virtual worlds, but there was surprisingly little investigation of the embodied experience of the participant.[5] Susan Kozel's early writings on the phenomenology of dance and new technologies during the 1990s stand out as some of the few works in the territory at that time.[6] This was due at least in part to the fact that these early HMDs were expensive, heavy, and cumbersome, with trailing wires and cables that limited freedom of movement.[7] Between the late 1990s and the early 2010s, interest in VR waned in favor of "mixed reality" in digital arts and performance, where virtual and physical elements combine within the artwork or environment. However, contemporary production of relatively low-cost, lightweight HMD units or headsets with limited wiring opens up the potential for immersive VR to emerge into wider usage, including the arts and home computer games. The HMDs on the market currently range from relatively costly full-system headsets like Oculus Rift or HTC Vive that require powerful computers to run high-quality VR experiences to cheap Google

Cardboard or equivalent systems that strap your smartphone into a headset as the source of computing power.[8] In many cases, the headphones can be plugged into the system and worn over the headset to provide some level of surround sound, although the sound quality tends to scale with the price. All of the headsets are fitted using a strap around the back of the head, and some of them include a strap over the top of the head (fig. 1). The effect for the wearer is that she is inside the virtual world, able to look in any direction around, above, below, or behind her as if she was "really there."

Writer and producer Jason Ferguson claimed recently that "virtual reality has a storytelling problem and theater will save it."[9] He explained that the problem is caused by first-person delivery modes, which tend to struggle with linear narratives. Indeed, VR and immersive theatre can assist each other in the storytelling process. In *Virtually Dead* the VR element of the production is a zombie-shooting game in which zombies attack you from every angle out of the dark, creating a sense of pleasurable anxiety akin to being inside a horror movie, which enhances the framing narrative provided by the immersive theatre element.[10] However, VR is not necessarily a storytelling medium, and often it is essentially an experiential medium. While these new technologies are still at an early stage of development, with Oculus Rift launched in April 2016 and HTC Vive a month later, it seems that the primary market is likely to be in the provision of "experiences" for users, much like the "holodeck" in the television and film world of *Star Trek*. What would it be like to be onstage with Madonna, or in a haunted house, or on planet Mars, or in a battle zone? With VR, even more than with theatre alone, we can be anywhere and do anything—the possibilities for theatre are seemingly limitless.

In the first monograph on the subject, in 2012, Josephine Machon suggests that the rise in popularity of immersive theatre is representative of a desire for real-world, interpersonal communication in physical space, in direct rebellion against the disembodied, distancing effect of VR, social media, and online existence.[11] I will argue, on the contrary, that this emphasis on experiences and interactions in, and with, VR environments can enable us to relocate ourselves as embodied beings rather than distancing us from our bodies. These environments allow us to ask questions about embodiment and humanity through the experiences of our individual bodies in a way that has never been possible before. The nature of action in virtual worlds is such that our bodies are both present and absent, experiencing agency and aspects of sensation even though there is no direct contact between flesh and world. How do we approach the nature of embodied experience in VR when anything can be done, but the body is apparently missing? It becomes possible to explore impossible situations and experiences through the eyes of others. We can begin to learn what it might feel like to be blind, as in Arnaud Colinart's art installation *Notes on Blindness: Into Darkness* (2016) where the participant sees blackness with fleeting outline images appearing only when sounds are heard.[12] Or we might feel something of the terror of a family of refugees as the participant accompanies them in their flight across the sea, as in Daniel Efergan's *We Wait* (2016).[13] The new field of immersive journalism can provide a VR perspective on human experience in relation to news stories, such as Nonny de la Peña's

*Project Syria* (2016), which places the participant alongside frightened children in war-torn Syria.[14] These examples can only give us shades of the genuine experiences that they portray, but for reasons I will explain, they enable us to feel more at an embodied level of the experience of "being there" than television or theatre can offer.

Yet, is it ethically defensible to engage in any experience or action that would not be viable or perhaps condoned in the physical world on the basis that it is not "real"? What if that experience is of the sexual abuse and murder of a virtual child, as in Jennifer Hayley's play *The Nether*?[15] Even within the play's storyline, the event did not "truly" happen and no child was involved, but the adults experienced the sex and violence even though their bodies were technically removed from the action. The image interposes itself between the physical Other and the participant. This begins to raise questions about how we understand the virtual Other. In *We Wait* and *Notes on Blindness* the participant is called on to empathize with the human experience of the Other, but how far is the virtual Other related to the physical Other at an embodied level? By the middle of the present century, will we be uploading our consciousnesses into cyberspace and leaving our obsolete bodies, or "meat," behind us, or will embodied experience connect us across physical and virtual worlds?

In the following pages I examine the nature of embodied experience in VR, both in one-to-one engagements with virtual worlds and in telematic interactions with other people (remotely located while being projected into a shared virtual environment). I will argue that bodies within these contexts may be experienced simultaneously as absent and present, together and separate. This area is still under-researched in the fields of computing, new media, and communications, but it is essential for theatre and performance to understand if we are to approach VR effectively and ethically in artworks. The essay begins by exploring the differences between screen-based VR and the use of a HMD unit or headset. The proprioceptive senses are exposed as playing a crucial role in grounding experience within a body experienced as "missing." These senses include internal connectivity, spatiality, and movement, enabling me, for example, to know the position of my arms without being able to see them. The argument moves on to encompass the nature of perception and presence in VR environments, referencing visual and embodied sensation and bodily memory. Touch is identified as a contributing factor in the establishment of presence, yet it is the action involved in reaching out to touch rather than in the achievement of contact that provides the constituting effect. As a result of these various modes of engagement, the body in VR is experienced as blurred, being both virtual and physical, absent and present, compounded and indivisible, even though body and environment have different materialities. This duality may cause confusion in the ethics of embodiment governing physical interactions between audience and performer—when, and if, to touch or be touched, for example—since the blurred body confounds cognitive separation between the physical and virtual. Such confusion can result in a mismatch between the embodied self and disembodied Other that the gaming world is poorly equipped to negotiate, but that could have profound effects on VR users. Theatre, on the other hand, is well-

versed in the negotiation of the real and the virtual, and as such it can offer a place to explore relationships between embodied experience and ethical engagement in virtual worlds.

I will refer to a number of VR and telematic performances, but my argument draws particularly on my experiences of Gibson/Martelli's *White Island* (2014). In this performance installation, I donned an Oculus Rift headset and drifted alone in a virtual hot-air balloon over a representation of the Arctic landscape. I was surprised at the intensity of the embodied experience in which my body was disrupted, conflicted, and confused. I cowered, muscles tensed and body folded inward protectively, as I hurtled on a collision course toward a vast virtual mountainside. And yet, glancing toward where my senses were screaming that my body should be, I saw nothing. My body was, I will argue, "missing in action." In that moment my embodied self knew that my arms were raised in front of my face, but my empirical perspective on the world presented visual evidence that my arms were not there. Two different ways of knowing the world collided as I crashed into the cliff face.

**Experiencing *White Island***

*White Island* was created by Ruth Gibson, a dancer and somatic-movement practitioner, and Bruno Martelli, a digital artist and programmer. The performance installation incorporates an Oculus Rift headset to take the participant on a journey in a hot-air balloon over the Arctic Circle.[16] The installation was inspired by the doomed Arctic exploration trip led by Salomon August Andrée in 1897. Andrée and two fellow explorers attempted to navigate a specially designed balloon over the ice to the North Pole, but misfortune resulted in a crash and the eventual loss of the lives of all three explorers. Their story was discovered in 1930 when their bodies were found on Kvitøya (White Island), preserved by the cold, along with expedition documentation in the form of diaries and photographs. The isolation of the hot-air balloon flight over the forbidding Arctic landscape seems closely echoed in the design of *White Island* as a VR experience in which the participant drifts completely alone in an alien virtual world. The participant is suspended in a hot-air balloon basket over a vast expanse of icy rivers and snowy mountains, driven and buffeted by the northern gales. The following discussion draws on a thick description of my experiences of this installation written on the next day, notes taken while observing my student Eleanor Gribbin participating in the installation, and a record of my discussion with Gribbin afterwards.

In July 2014, at the Coleman Project Space in East London, Martelli showed us into a small, dark room, the walls hung with heavy black cloth. A thick, rough rope was stretched vertically floor-to-ceiling, attached at the base to a stage weight and at the top to a metal rig. Next to the rope was an Oculus Rift headset, dangling by a wire from the overhead rig. He told us that we could tug down on the rope to gain height and pull up to lose height. I put on the headset and found myself in a hot-air balloon, floating over the icy terrain. Snowflakes were blowing past as I hung suspended in the dark basket with the handrail encircling me at about the level of my waist (fig. 2). Looking upwards I saw

the large balloon with dark sails jutting out of either side. There were black ropes running vertically between the basket and the balloon. My hand was still gripping the physical rope, which helped me to balance as I looked around. Below the basket were white hillsides, glaciers, and valleys, with occasional dark rivers snaking their way along the clefts. At times the basket drifted out over the dark sea edged with broken ice floes. The howling wind heard on the low soundtrack playing in the room was accompanied by horizontal snowflakes flying past my face, and the basket traveled in a relentless motion that could change quite suddenly with the vagaries of the wind. I tugged and hauled on the physical rope to go upwards, lifting the basket so that it scraped over hills, and downwards, dropping into vales to make out smaller features of the landscape. I discovered later that I had some control over the direction by pulling sideways on the rope to direct the sails on the balloon, but I did not realize this at the time, which added to the feeling of isolation and helplessness in the harsh, monochrome environment.

The three-dimensional VR of the Oculus Rift headset immersed me in the experience as I turned and observed the world around me and looked up at the balloon. I felt slightly disorientated when I glanced toward the places where I could feel my hand on the rope and my feet on the floor, but I saw nothing except the basket, ropes, and driving snow. I looked ahead to see the side of a huge mountain looming out of the storm, and I decided, as one does in virtual worlds, to see what would happen if I let the balloon crash into it. The basket careened toward the white slopes, which filled my field of vision. I cowered away instinctively, raising my arms to my head for protection. I felt my arms brush my face, but saw nothing come between my eyes and the enormous rock face. I shut my eyes, and the reassuring visible bulk of my physicality was restored by the dark of my eyelids as I heard a crashing boom on the soundtrack that seemed to reverberate dully through my body. Opening my eyes, I saw the landscape flashing with pale color and then returning to monochrome as somehow the balloon skimmed over the top of the mountain and returned to its endless journey.

Watching Gribbin taking her turn in the installation, I noticed the same instinctive physical bracing prior to a crash and the same involuntary gesture of lifting her arms to her head. At other times, like me, she reached out a hand in an attempt to grasp the basket's handrail in front of her and pawed at the air—an invisible physical hand attempting unsuccessfully to locate the visible virtual rail. Occasionally, Gribbin chose to let go of the physical rope, but she was unable to move out of the virtual basket because the headset tethered her to the overhead grid and prevented stepping beyond that small space. Then her hand sought about for the rope again until it relocated her in the invisible physical world once more. I saw from her gestures that she was experiencing the same confusion as I had felt and we spoke afterwards about it. Our bodies were missing, but we could feel the actions we were doing and experienced physical responses to the visible (virtual) world. How were physical and virtual realities interacting in our experiences, and *where were our bodies?*

**Eyes in the Front of My Head**

One of the reasons why the participant's body appears to be missing in *White Island* is the absence of any form of avatar or representational image of the body in the virtual world. In situations where the avatar is encountered via a separate screen in front of the participant, for example, a desktop computer game, I have previously proposed the Husserlian "nullpoint" as a way of modeling how the participant's visual perception of the virtual world maps to the avatar's "eyes" through the screen interface.[17] The first theorist to introduce phenomenological methods to philosophy, Edmund Husserl argued at the start of the twentieth century that the eyes were the place from which the perceptual field radiated and thus they were a visual nullpoint in themselves. One cannot look at one's own eyes (without using a mirror) because they are the organs of seeing; thus they might be perceived as connecting the interior of the perceiver's body with that which is exterior. Husserl's thinking was grounded in nineteenth-century observational empiricism based on the five then-recognized senses (sight, smell, hearing, touch, and taste) and reliant upon a subject/object binary in the sense of inside/outside the body. Inevitably, it carries an inherent sense of dualism that is at odds with more contemporary perspectives on the body, such as those of philosopher Mark Johnson and neurologist Antonio Damasio.[18] However, this dualism is useful when considering the human/avatar relationship. Indeed, Husserl's visual nullpoint seems to serve particularly well when the participant is working with/through a first-person avatar, where the perspective displayed onscreen represents vision through the avatar's eyes.

This perspective was the case in most performance installations using VR before the advent of contemporary headsets. For example, in Blast Theory's *Desert Rain* (1999), six participants entered a virtual world projected onto a screen of falling water to explore a desert war environment.[19] Standing on a footplate control mechanism and screened off from one another inside cubicles, they each navigated buildings and desert terrains on the water screen in front them to achieve a given task. There is quite literally a separation between body and environment at the interface of the screen in this installation and others like it, with interior/exterior translating readily as flesh/digital world. This separation is further underscored by the mismatch between the avatar's movement in the virtual world and its control by the physical body. In *Desert Rain* the participants had thirty minutes in which to experience the virtual world, so a key aspect of the design had to be an intuitive control mechanism that could be learned quickly. The standard computer-game keyboard controls (for example, pressing "W" to move forward) can take a while for people to learn, although once learned, these controls tend to recede from conscious awareness. There was insufficient time for such a learning process in *Desert Rain*, so instead the team created a footplate that could be tilted by shifts in the participant's body weight, which controlled the perspective on the virtual world and moved it in the direction of tilt. This was a more direct relationship between the movement of the participant and that of the avatar than pressing the "W" key, but there was still a clear separation. In both *Desert Rain* and computer gaming, the participant/player's bodily experience becomes linked to the avatar through the realization of her

physical movement in the actions of the avatar in the virtual world. This loop—the intention to act, the physicalization of that action, and feedback that the avatar has realized the action—creates a connecting membrane between the participant's body and the onscreen avatar. The participant/player may claim the actions of the avatar as her own, even though those actions may not map directly to her own physical movements.

In performance studies theory, Richard Schechner has proposed that initially the actor experiences herself as "me," and the character she will represent onstage as "not-me." However, through the process of rehearsal there is a level of synthesis that results in the actor perceiving her own stage persona as that character being "not-not-me."[20] This modeling can also apply to the participant/player and avatar, where the avatar becomes the "not-not-me" by which I gain presence in the virtual world. In *Desert Rain* the bodily mapping was simple and could be learned quickly, enabling the participant to connect with her avatar to navigate the virtual desert within the installation. More complex mapping takes time, as is usually the case in computer games. Media scholar Jaime Banks has carried out extensive research into the relationships between players and avatars in online games. She noted that extended time playing with one avatar often leads to the establishment of deeply embodied connections between player and avatar. These connections can result in players perceiving their avatars as an extension of themselves, by which they inhabit the virtual environment.[21]

*White Island* offers a different kind of experience from either *Desert Rain* or computer gaming. The Oculus Rift headset provides the participant with the visual impression of being physically located within the virtual environment. When the participant turns or looks up or down, she sees the virtual environment all around her. The body and the avatar appear to inhabit the same space because their eyes/perspectives occupy the same nullpoint and thus coincide spatially. The headset presents a three-dimensional stereoscopic image on two screens directly in front of the participant's eyes, which results in visual perception similar to the way in which the eyes and brain perceive the physical world. This impression is underscored by the way in which the movement of the participant's head and body is reflected in the perspective displayed on the screens, which adjusts her view of the virtual world to match her positioning in a manner that corresponds to physical-world expectations.[22] In *White Island*, without an avatar to represent my body, I see, but I cannot be seen even by my own eyes. Instead, I experience a kind of missing or phantom body that exists only proprioceptively, perhaps similar to the sensation of a phantom limb that is sometimes experienced by amputees.[23] Neurophysiologist Oliver Sacks explains that the term *proprioception* was first coined in the 1890s by a doctor named Charles Scott Sherrington, who referred to it as "our secret sense, our sixth sense."[24] Sacks describes it as "that continuous but unconscious sensory flow from the movable parts of our body (muscles, tendons, joints), by which their position and tone and motion is continually monitored and adjusted, but in a way which is hidden from us because it is automatic and unconscious."[25] This "sixth sense," encompassing internal connectivity, spatiality, and movement, was a late addition to the

five primarily externally facing senses on which empiricism was based, bringing with it new ways of knowing (in) the world.

Writing over a century ago, Sherrington considered proprioception as indispensable for "our sense of *ourselves*" and named it after its importance in defining the "body proper" to (or owned by) the self.[26] My own physicality was strongly present in *White Island*, as my proprioceptive senses felt the interconnectivity and movement of my muscles, tendons, and joints. Yet, the absence of an avatar onto which I could map these sensations created a focus on bodily interiority that seemed fundamentally at odds with the emphasis on visual representations of the body in most screen-based virtual environments.[27] It felt particularly out of kilter against the relatively naturalistic representations of the Arctic ice floes and the hot-air balloon, which simulated a "normal" physical relationship with the world in other respects. My body was highlighted by its visual absence, causing me to pay particular attention to my internal senses in order to locate myself in the virtual environment. The notion of avatar becomes obsolete in *White Island,* and with it the Husserlian nullpoint, because there is no direct representation of the body; there is no sense of "not-not-me," but just "me," breathing, moving, feeling. The experiential absence-presence of my body in that space simultaneously identified my proprioceptive senses as defining my physicality and highlighted the awareness of my whole bodily interface with the virtual world. The visual absence of my body, missing as object, focused all of my attention on my action as subject. The narrative of *White Island* is an internal one; nothing happens on the journey apart from my own navigation through the virtual world. I am performer and spectator conjoined, and the performance takes place in my missing, yet acting body. The performance is one-on-one in the most extreme fashion, as I perform my own embodied subjectivity for myself.

**Visual and Proprioceptive Perception**

There was a marked contrast between my experiences of body and world in *White Island*. My body I felt somatically, internally, as a subject with no objective visual perception of it externally. Conversely, I experienced the virtual representation of the Arctic world visually, apart from the rough physical rope in my hand, which I associated vaguely with the vertical ropes of the hot-air balloon. Coming from the dual perspectives of dance and philosophy, Deirdre Sklar contrasts visual and proprioceptive perceptions:

> Seeing implies an object, something to see. And in order to see an object, one must be separate from it, at enough distance to bring it into focus. . . . The objectification implicit in seeing is associated with the objectivity of the mind, while the somatic sensation implicit in touch is associated with nearness and the subjectivity of proprioception. Kinesthesia, even more proprioceptive than touch, has been entirely omitted from the western sensorium.[28]

In dominant Western modes of knowledge—for example, rationalism and empiricism—the distance of objectivity is an essential element of knowing the world. In *White Island* everything is distanced, except the hot-air balloon itself, by the height at which one travels over the landscape. Yet, the objectivity of that distance is challenged by the nature of the representation. The landscape is unknowable in its immeasurability, uninhabited, often partially obscured by snowflakes, sometimes glitching, flickering, or shifting between low and high resolution, passing below the basket on its never-ending journey. This is not the distance of objectivity from which one can contemplate and observe; instead, it functions as a visual, alien counterfoil to the immediate and constant subjectivity of the proprioceptive senses by which I experience being in this installation. The limitations of language, with its separatist consequences, force me to describe my body as if it were an object that belonged to "me" (which Sherrington's early definition of proprioception also implied). Yet, as Sklar indicates, it is partly the ability to see the body that leads to this objectification, since the body can be observed as if from the outside via the eyes (returning us to Husserl's nullpoint). Sacks explains that our proprioceptive senses do not require any conscious attention and continue to define our being, regardless of anything else that we might be thinking or doing. If visual perception of the body is missing, then the only immediate awareness of physical being is via the proprioceptive senses (including touch), and thus those senses tend to be foregrounded where normally they might recede from conscious attention.[29]

Critical to the experience of bodily presence is the perception of the space in which the body exists, as it is intimately connected to the kinesthetic sense of being a moving body in space. In VR the space exists virtually, so how can it be perceived as being inhabited? Maxine Sheets-Johnstone, an anthropologist with a strong interest in movement, critiques Merleau-Ponty's examination of George Stratton's experiments with inverted vision to highlight the body's role in spatial perception. Stratton's researchers put on glasses that inverted their vision, but after a few days their brains re-inverted the images so that everything appeared normal to them again. Merleau-Ponty proposed this as evidence that space is essentially visually constructed, and that understandings of spatial concepts may be achieved through the disruption or distortion of normal modes of perception.[30] This approach would seem to be effective for VR, as it is seen through the eyes as an image. Sheets-Johnstone points out, however, that it was bodily experience that caused Stratton's researchers' brains to correct the visual anomaly. While it is possible to invert vision and thus temporarily confuse spatial orientation, it is not possible to undertake such an inversion of proprioceptive perception, and therefore the brain re-inverts the images to match the body's experience. She explains that "the tactile-kinesthetic body cannot be fooled. . . . *Space at its source is a corporeal space defined by the intrinsic spatiality of animate form and the inherent spatial possibilities of the tactile-kinesthetic body*."[31] This fundamental corporeal space arising from proprioceptive sensation is the basis by which I inhabit the virtual environment, whether an avatar is visible or not. In the virtual hot-air balloon basket, I perceived the physical rope in my hand and the occasional tug on my head from the cable connecting the headset to the overhead

rig if I attempted to move beyond the space of the basket. However, the greater portion of my spatial-locative experience came from my proprioceptive senses, and those senses gave me presence in the virtual environment because my body was moving in the world. My body always knows where I am in corporeal space, and I make cognitive sense of that corporeal space in relation to the world that I see around me, folding physical and virtual together rather than experiencing a binary division. My body cannot be missing because my corporeal space is "here," engaging in action.

## The Doing of Action

The argument for the primacy of proprioception and corporeal space suggests that VR might coincide with the physical environment, but that it should have limited power for transcendence because the body "cannot be fooled." Yet, I cowered instinctively away from the crash into a virtual mountainside in *White Island*, aware of a small rush of adrenalin coursing through my body even though I knew the mountain did not exist.

Mel Slater has been researching the experience of presence in VR since the early 1990s.[32] He and his colleagues have noted that people in immersive VR environments "tend to respond realistically to virtual situations and events even though they know that these are not real."[33] This "response-as-if-real" remains constant even if the visual representation is "severely reduced" in terms of verisimilitude, resolution, physics, and so forth. Slater's explanation is that this is related to "place illusion" and "the brain's high degree of plasticity in the representation of the body."[34] He describes "place illusion" as being a "strong illusion of being in a place in spite of the sure knowledge that you are not there."[35] He claims that this experience of place is further enhanced by the "plausibility illusion," which is brought about by the direct relationship between the participant's physical movement and the uncontrolled, yet direct responses of the virtual world. For example, as the participant moves her head, her perspective on the world adjusts accordingly. Movement is fundamental to this illusion, as it is only by moving the head that the correlating response of the virtual environment can be mapped and evaluated against the physical experience of moving. Thus proprioceptive sensation corresponds to visual representation, confirming the user's corporeal space as being consistent with having presence in the virtual world. This correlation is sufficient to establish the plausibility of presence in VR and thus to engage the user in the dramatic illusion as if it were real. Where then might the theatre-maker take the participant, if the correlation between corporeal space and dramatic world can place her at the heart of the experience?

Immersed in the installation, the place and plausibility illusions felt strong to Gribbin and me as we traveled, each alone, in the hot-air balloon. We knew conceptually that it was an illusion, but the physical and the virtual were conflated in our embodied responses to the environment. I raised my arms before my face for protection from the oncoming crash against the white cliff face, as adrenalin flowed and my muscles braced for impact. While cognitively I was aware that the impact would not affect me physically, my body only partially acknowledged that fact. The adrenalin rush was nowhere

near as overwhelming as if I had believed myself genuinely about to crash into a mountainside, but it was still noticeably present in my system. Yet, my raised arms did not come into view and block my field of vision as subconsciously I expected them to do. Their proprioceptive presence combined with their visual absence to disrupt the plausibility of the illusion, emphasizing the relationship between my fleshy body and the digital environment. My body was in action, but the lack of a visible avatar meant that it was still apparently missing, thus drawing attention not so much to the act of doing as to the *doing of action*—action missing a perceivable bodily outcome and yet re-found in a corporeal sense: absent-present.[36] I could undertake actions in that environment and it could respond to my positioning in a recognizable manner to give me a sense of reality, but my decision to crash into the mountainside demonstrates my absolute cognitive belief that I was not in physical danger, even though my embodied reactions were not so readily reductive.

I knew that this was a constructed environment, and that this particular instantiation of it was for me, and me alone, to explore and experience. In 1977 psychologist James Gibson introduced the idea of "affordances" when considering the relationship between animal and environment in terms of perception.[37] Bearing some striking resemblances to the earlier work of Henri Bergson, Gibson's theory was that the animal perceives the environment in relation to the affordances for particular actions that the environment offers to that animal. These affordances result from the combination of animal and environment rather than being specific to one or the other. For example, a mouse being chased by a cat might perceive a small hole in the skirting board as offering the affordance of a hiding place, whereas the cat would not perceive the same affordance because it would not fit into the hole and would not need a hiding place if no other predators were present. Gibson explains that "[n]o animal can exist without an environment surrounding it. Equally, although not so obvious, an environment implies an animal (or at least an organism) to be surrounded."[38] Evolving slightly after the philosophical idea of phenomenology though out of similar sociocultural trends, Gibson's theory applies to all animals, including humans. The environment is defined by the presence of a living being, and it is perceived by that being in relation to what it/she/he might need or want to do there. For him, it is the potential for the doing of action that defines the environment. As such, it seems to apply remarkably effectively to VR, where the environment has been designed and created solely for humans to do actions in it.

Bergson had reached similar conclusions some six decades earlier in *Matter and Memory*, writing that "[m]y body, an object destined to move other objects, is, then, a centre of action."[39] He described how the world could not be explained rationally as being defined by a series of signs, images, and representations because world and body (and consequently brain) were of the same material. Instead, he prioritized the body's action as the route from which to receive and give back to the material world. Bergson's nonrepresentational position contrasts starkly with the virtual environment, where the world is constructed entirely from signs, images, and representations, and it has none of the materiality of the body. The confusion of that inconsistent materiality impacted on the

experiences of Gribbin and me in *White Island*. We both chose to keep hold of the physical rope for the majority of the time that we wore the headset, and we agreed afterward that there were various reasons for our reticence to release it. First, it was the only method of controlling the height of the hot-air balloon in which we were drifting among steep mountains and valleys. While crashing was an irresistible temptation, it was also interesting to explore the virtual world, so we chose to maintain what control we could for much of the time (fig. 3). However, my choice not to let go was also related to an innate desire to maintain grounding in the physical world. The roughness of the rope in my hand and its resistance to free movement (attached at top and bottom) gave me a physical reference point that I found psychologically comforting and physically stabilizing.[40] In Bergson's terms, it permitted an exchange between the materiality of my body and the world. This was important to me because the mismatch between my proprioceptive and visual perceptions of my body caused me to feel unstable. When I reached out to grip the basket railing, my invisible hand groped about in the air, searching for the railing that I could see in front of me. This small action was brought to my attention sharply as I felt a momentary loss of balance caused by my subconscious anticipation of grasping the rail. Much contemporary philosophy defines the "real" by lived experience rather than by definitions of *physical* and *virtual*, yet which was more real to me—my proprioceptively present, visually absent hand or the visually present, proprioceptively absent railing? Without feeling the roughness of the rope in my other hand, I found that I was not always certain.

In *Virtual Art*, his seminal book on the subject, Oliver Grau expressed concerns about this lack of common materiality from which to experience being in the world: "virtual reality stands for the complete divorce of the human sensorium from nature and matter."[41] The world of the immersive virtual environment is created by humans for humans; the human creator stands in the shoes of God, as it were, but humans cannot create matter. Despite the awe-inspiring nature of the Arctic that is represented, there is nothing that can hurt me, since the environment has no materiality to match my own. Precisely because of this, there are affordances that do not exist in the material world, which is why my first impulse is to crash into a mountain. It is a space in which to do the undoable, to rehearse the unrehearsable. In this space we might begin to access alternative embodied experiences to expand our individual perspectives. We might begin to experience something of blindness, or travel with Syrian refugees across the sea, or shoot zombies in London. My body remains the center of action, as Bergson posits, but the consequences of those actions are disrupted by the fundamental difference in materiality between body and world so that I can experience these things without going blind, drowning, or dying.

Grau was alarmed by the challenge that VR posed to "the human senses and their relationship with the environment, which produces, sustains and permeates them."[42] Yet, it is the very fact of the body's inescapable materiality that causes slippages between material and immaterial in VR, which allows the undoable to be done. It is precisely this doing of the undoable that Hayley explores in *The Nether*, where a virtual world called the Hideaway has been created as a place for visitors to take their

avatars to engage in acts of pedophilia and child murder, experiencing it as if it were real. Is it a crime, the play asks, if the visitor achieves the bodily experience, but no child is abused or hurt? Should all undoable actions be able to be done in virtual worlds? The play explores this question generally, but its challenge is particularly relevant to theatre-makers. Theatre is used to dealing with dramatic illusion, but what happens if any dramatic illusion can be experienced as if it were physically real and the viewer is taking part in it? Hayley's play is set in the near future, but the blurring of physical and virtual is already happening in our bodies.

**The Blurred Body**

Throughout this essay I have been using hyphenated terms such as "absent-present" to indicate more than just an apparent duality of experience as being both visually absent and proprioceptively present at the same time. There is an inevitable blurring of modalities of knowledge when visual and proprioceptive sensory perceptions do not correspond; body schema and body image are misaligned and phenomena appear familiar yet confusing, uncanny. The physical and the metaphysical have long been bracketed off to support the Western dualism of body/mind and subsequently physical/virtual. The knowledge stemming from these modalities builds limited subjectivities from fixed perspectives, constructing static frames of reference.[43] But the nature of my experience in *White Island* was neither bodily nor metabodily anchored; instead, it was shifting and slipping, simultaneously both and neither. Rather than the experience of a doubled subject, such as body/avatar relationships in which body and avatar are experienced as connected though in separate spaces, this was the experience of a single subject with blurring boundaries and definitions.

Physical/virtual is not the only binary to become indistinct in the blurred body. Sensory perceptions and bodily memories are also deeply implicated. Bergson argued that "the zone of indetermination" surrounds every living being, with its amplitude depending on the relations of that being to other things.[44] These relations are manifested in memory, "impregnated with our past." Bergson asserted that this indetermination "constitutes the principal share of individual consciousness" in our perception. It provides complexity to the otherwise simple immediacy of direct contact, as in the perception of lower-level organisms. Gilles Deleuze takes this idea further to propose humans as "living matter or centres of indetermination" where subject and object coincide.[45] In these centers, there is in-between-ness where conceptual dialectics dissolve—for example, physical/virtual, visible/invisible. Nicolas Salazar Sutil applies this concept to the philosophy of movement: "It is only by being in between that the knowledge of both subject and object, of both here and there, of self and other, of myself and that which is not myself can be integrated."[46] I carry with me all my experiences of being a material body in the material world, and of taking action in that world. As a center of indeterminacy, my perception is impregnated with embodied, kinetic memories from a lifetime of physical action.[47] Bergson referred to this as "bodily memory," which he described as a "quasi-instantaneous memory" consisting of "the sum of the sensori-motor systems organized by habit."[48]

In *White Island*, my embodied or "bodily" memories collided with the conceptual understanding that the virtual world was not actual and I could not have physical contact with it. It was from the in-between-ness of these memories and concepts, this center of indeterminacy, that I perceived the virtual environment. My blurred body existed between the definable points of physical and virtual and so enabled them to be permeable, to intersect, in my embodied experience. This allowed me to do the undoable by drawing on and extrapolating from bodily memories in order to color my interactions with the virtual world. Returning to my earlier reference to Schechner's modeling of the stage actor, the body's experience of the virtual environment is "not-not-real." The behavior of the virtual environment in relation to the body is not the same as that of the physical environment. However, the embodied subject experiences some of the same sensations and responses that it would do in the physical environment because, as a center of indeterminacy, it is embedded with the memories of a lifetime's relationship with the physical world. In *White Island* I experienced the act of crashing into the virtual mountainside as *not being not-real*. I referred earlier to Sheets-Johnstone's assertion that the tactile-kinesthetic body "cannot be fooled." My body was not fooled, but my perception of the virtual experience was deeply informed by my embodied knowledge of being in the world. Bergson described how actions exist independently from the type of information received about an object: "It seems that the movement of my body in order *to reach and to modify* an object is the same, whether I have been told of its existence by the ear or whether it has been revealed to me by sight or touch. My motor activity thus appears as a separate entity, a sort of reservoir whence movements issue at will, always the same for the same action."[49]

Regardless of how we process or give hierarchies to experiential and conceptual information or physical and virtual objects, the action of reaching out toward an object retains the same fundamental proprioceptive experience at its core. It is this that allows us to experience interactions with the virtual world as not-being-not-real and thus to do the undoable, rehearse the unrehearsable, to begin to feel a little of what it might be like to be in a war zone in the desert, to fight zombies, to be blind. When there is only one person in the virtual world, as in *White Island* or *Notes on Blindness,* the designer of that world need be concerned only with that person's experience, as in a one-on-one performance. However, when multiple people are in a virtual world together, as in *Desert Rain*, the interaction among them has to be taken into consideration as part of the experience and the design becomes more complex, as any creator of participatory performances will know. Part of that complexity comes from the subtle and unsubtle ways that participants interact with one another within the performance.

**Virtually Touching**

Digital performance practitioner and academic Steve Dixon has observed that people in telematic spaces (remotely located while visually represented in a shared virtual environment) will often attempt to touch one another far more quickly and intimately than they would normally do if

they met in physical space.[50] Telematics uses direct visual representations of participants as their avatars, so onscreen I see a visual image of my own body reaching out toward a visual image of someone else's body. If the image of my hand touches the image of the other person, then we appear to make contact. Telematic artist Paul Sermon describes this as "touching with my eyes,"[51] as the visual feedback informs both of us that the touch has occurred in the virtual world, even though the other person and I might be many miles distant in the physical world. Dixon and Sermon collaborated with Mathias Fuchs and Andrea Zapp in 2005 to create the telematic performance *Unheimlich* (2005) in which participants on a blue-screen stage in a studio theatre in Rhode Island interacted in real time with actors in a blue-screen studio in Salford, England[52] (fig. 4).

A camera filmed each blue-screen area, and the images of participants and actors were overlaid, with a layer of background images, so that they all appeared to be in the same space. The composite image was projected back into each space so that they could see themselves together in that space as they performed. Verbal communication was also possible between the two spaces. Dixon's comments about the desire for touch were evidenced clearly in the repeated attempts to touch the remote "Other" in this improvised performance. Almost immediately, individuals attempted to put an arm around someone in the other location, to help someone up off the floor, to stroke someone's hair. The fact that one cannot make contact with the flesh of the other person in the virtual environment seems to suspend some of the social prohibitions associated with physically touching the bodies of relative strangers in Western cultures. Instead, VR affords, even invites experimentation with the doing of the culturally or physically undoable through the suspension of "real"-world sociocultural norms and rules. The critical factor is that the undoable remains undoable: you both know that the touch will not occur in any physical sense, even though you enact touching and perhaps also being touched. So the norms can be safely suspended by (usually tacit) agreement among participants. Yet, the affordance is offered to experiment with the *doing of action*, which draws on proprioceptive memories to inform the experience, thus providing at least partial access to embodied knowledge of this particular act, which might otherwise remain unknowable. The process enables the body to experience something of the physical anticipation of the culmination of the act, as can be seen in my physical responses to crashing into the virtual mountainside (raised pulse, mild adrenalin rush, the urge to brace myself against a physical impact that will never occur). Thus the norms are not quite suspended because the individual is engaged in the embodied experience of doing the action, even if conceptually she knows that the act can never be completed as it would in the physical environment.

Touch is particularly important in participatory virtual worlds, partly because of the intriguing playfulness of disrupting sociocultural norms, but also as part of a fundamental negotiation of the body's flesh in a virtual world. Susan Kozel explains that "digitally mediated communications can be construed as processes of connecting, intents to achieve proximity, and attempts at touching, rather than the accomplished states of communication, proximity and touch."[53] Attempts to touch are manifested in the processes of reaching out toward other participants.[54] The reach demonstrates the

desire for bodily connection that seems to be a key part of negotiating co-presence with someone else. Many of Sermon's telematic artworks do not include the option to talk to other participants, and so physical gesture and movement become the primary modes of communication. However, even though verbal communication is prominent in *Unheimlich*, touch is obviously important for most participants. In contemporary society, we are accustomed to speaking with people remotely via the telephone, but the attempts to touch in VR seem to indicate that we feel almost close enough to reach one another. Visual proximity seems to engender the desire for corporeal exchange, perhaps as a way to create a virtual sharing of corporeal space. Our bodies may appear to be missing, but the enaction of touch constitutes evidence of a shared presence.

Returning to Bergson's proposition, motor activity (kinesthesia), tactility, and the other proprioceptive senses seem to sit outside the binaries of conceptual/experiential, or in this case virtual/physical, enabling a blurring in-between-ness where embodied experience exists without recourse to those static perspectives. Just as embodied memories can color virtual experiences, so also can touch carry some connotations into the virtual world. Anne Cranny-Francis describes physical world interactions in which "uninvited or unexpected touch may be regarded as crude, ill-mannered, presumptuous or even criminal," and unintended touch, for example on a crowded train, is usually followed by an apology or ignored "as if the touch—and therefore connection—has not occurred."[55] Connection and touch are critically entwined for Cranny-Francis. She explains that "[o]ne cannot not touch, so one is always connected to the world—to other people, species, objects, phenomena."[56]

But in a virtual environment the experience is the opposite: the user cannot touch the virtual objects, people, and phenomena, although she can touch her own body and the physical objects around it (which may not be visible in the virtual environment). Therefore the everyday physical connection of touching is partially missing, and the constitution of self in relation to others is disrupted. In this situation, reaching out to another person in a virtual environment invites the opportunity for my body as flesh, represented by a digital avatar, to cause the other person's body as flesh, represented by a digital avatar, to be born in the virtual environment. If the person accepts my reach by enacting being touched, then we both have presence in that environment *together*, and our physical/virtual flesh is constituted through the connection that is made between us. However, it is still possible to touch by accident. For example, when negotiating the position of your image in a shared telematic space, it is easy to step the wrong way and visually "bump into" other people, as can be seen at times in *Unheimlich*.[57] Indeed, the act of touching can still be perceived as "crude, ill-mannered or presumptuous," since reaching out to touch carries with it the sociocultural values implicit in the intended touch.

The partial suspension of sociocultural rules and expectations that I have noted in relation to VR is also relevant to immersive theatre, but the emphasis is a little different. In *Immersive Theatres* Josephine Machon explains that these environments exist outside "of 'everyday' rules and regulations."[58] In Punchdrunk's immersive performance *The Drowned Man: A Hollywood Fable*

(2013) in the vast, disused Royal Mail sorting office in West London, we were given some rules in advance, such as the requirement to wear a mask at all times, except in the bar. Some rules we learned, such as the fact that the majority of performers did not respond to audience members most of the time, but simply carried on doing their tasks or staring into space. However, unlike VR, the proximity of physical bodies implied an inherent awareness of risk and a corresponding duty of care between performers and audience members, and among audience members. A group of audience members chasing headlong after a performer paused to allow an elderly lady to negotiate the stairs in the opposite direction. In immersive theatres, some sociocultural rules can be twisted or broken by permission from the environment and performers, but there is another level of ethical rules that are governed by empathic responses, and these seem more difficult to break.

Physical body-to-body encounters carry a set of sociocultural expectations and laws that are fundamental to co-presence, even if immersive theatre might not impose "'everyday' rules and regulations." A recent increase in studies of empathy stems largely from neuroscience's influence on wider discourses about the body and self. These studies acknowledge the deep-seated human tendency to recognize and respond to the perceived experiences and emotions of others.[59] As Elaine Scarry explains: "having a body means having sentience and the capacity to sense the sentience of others."[60] Awareness of the sentience of others tends to be affective, according to Dee Reynolds's research on kinesthetic empathy: "In terms of embodiment, affect refers to that point at which the body is activated, 'excited,' in the process of responding; but this process has not yet reached consciousness to the extent of producing cognitive awareness that can be translated into language."[61]

The precognitive nature of affective empathic response makes it difficult to counter because it is hard-wired into the body and usually underscored by norms and rules of sociocultural behavior instilled from birth. We can learn to counter those sociocultural rules that are cognitively understood, even if some might evoke embodied responses (such as peeping through a gap at a woman getting undressed in *The Drowned Man*). But it is harder to transgress those norms that place the bodies of others and ourselves at risk of what we perceive to be genuine discomfort, pain, or distress. The virtual nature of theatre reduces the perception of some types of discomfort or distress being experienced as genuine (they may be acted), and it can even give permission, in some cases, for levels of genuine discomfort by means of performance. However, the line is drawn somewhere for each audience member and performer. The engagement among human bodies has ethical implications, transmitted through a sense of empathy and affinity, aligned with deeply embedded cultural norms at a precognitive level. This is an ethics of embodiment that is almost impossible to bypass as a human body among other bodies, even in theatre. But what happens if the body is missing?

**Towards an Ethics of Embodiment**

Virtual reality engages the body at an experiential level, blurring physical/virtual distinctions through proprioceptive senses, corporeal space, and bodily memory. This engagement bridges the differences

between the materialities of body and environment, enabling me to feel physical responses to crashing into the virtual cliff. When I reach out to touch someone in a shared telematic environment, I know that her body exists somewhere, and I feel a sense of connection if she acknowledges my virtual touch. But I can punch that person's virtual image as hard as I like and it will not hurt her, although my action might cause social tension between us.

In Sermon's 1994 version of *Telematic Dreaming*, performer Susan Kozel's live telematic video image was projected onto a bed in a gallery installation, and visitors to the gallery could interact with her via her virtual body on the bed. Kozel described how she was violently attacked by two male visitors to the gallery, even though such action was not invited or suggested by the artwork or environment.[62] She was shocked though unhurt as the act was carried out on her projected image, while her physical body lay in another room. Participants in both VR and telematic environments may bind together physical/virtual in embodied experience, yet virtual bodies have no physical presence and are perceived by others as feeling neither pain nor ecstasy. Indeed, Kozel reported that she felt complete withdrawal of her physical embodiment from her separate virtual body during the attack—perhaps because of the shock, or perhaps because the physical violence was beyond her bodily comprehension—although she was still shaken and disturbed by the experience.

There is no implicit ethical response in interactions with virtual bodies, as the image feels no pain and there are currently no laws that she could bring into force against the perpetrators for that action. Human bodies do not necessarily experience the same fundamental levels of empathy or affinity with the image of a body as they might with a fleshy body. Consequently, the interactions between virtually represented bodies may be governed by sociocultural norms and rules, but they are not necessarily subject to the precognitive ethics of embodiment in the manner of physical body interactions. Yet, as this essay has explained, the embodied experience of immersive VR can be not-not-real, and so acts done to the virtual body can be experienced as being shades of the physical experience, affecting the body physically as well as emotionally. Kozel may have withdrawn completely from her separate telematic image, but in immersive VR my adrenalin levels rose and pulse raced before the crash in *White Island*. In shared telematic environments there is a disjuncture between the embodied experience of the virtual body and the perception of that body by an "Other." It is only a matter of time before fully immersive VR is experienced regularly as a shared space with other people, with embodied experience enhanced accordingly.

Virtual worlds offer unlimited possibilities to experiment with the undoable, to rehearse the unrehearsable, to expand our understandings and experiences of other people, situations, and environments. Yet, where does one draw the line if there is no implicit ethics of embodiment in shared bodily presence? How should we encounter others ethically in virtual worlds, given that the embodied experience of virtual bodies can be not-not-real? The problem is not one of disembodiment, as so many earlier assumptions about VR suggest; instead, as I have suggested here, the problem is in the proprioceptive mismatch between the embodied experience of self and the perception of the

disembodied "Other"—an ethical asymmetry. In both solo and shared virtual worlds, this ethical concern is fundamental to the design of the experience, but in shared worlds it is also about how individuals behave toward one other.

In computer gaming there has been a prevalence of war games with separate avatars on desktop screens. If these games persist into the new wave of immersive VR (as they will) and we experience some level of embodiment, then what are the possible psychological impacts of such games? In computer games there is little sense-making of embodied experience, since the emphasis is on the achievement of targets, or on staying "alive" in game. Theatre may not necessarily offer much to VR in terms of storytelling, but it can provide an understanding of what it means to be present with someone or something else. The desire of telematic performance participants to touch or reconnect with what is perceived to be missing in telematic and virtual environments suggests the potential for a new ethics of embodiment that recognizes the virtual "Other" as being connected to the physical "Other." However, it requires further practical exploration to see how different forms and modes of touching objects and people establish both individual and co-presence. Eventually, remote interaction in VR is likely to become as familiar as using a mobile, but for the moment there are questions to be asked that theatre is well-suited to answer, and indeed it is perhaps the only place where such questions can be asked effectively.

As VR headsets become more widely accessible, they will be used more extensively in the arts and entertainment industries, as well as in education and training, healthcare and medical rehabilitation, and many other contexts. How far will artists and audiences wish to push the ethics of embodiment in immersive VR encounters? And what will be the consequences? Artworks that give us perspectives on the lives of other people can reveal a great deal about human experience, as in *We Wait*, *Notes on Blindness*, and VR immersive journalism. However, as the pedophile's virtual realm in Hayley's *The Nether* shows, there is an inherent moral dilemma in VR's embodied experience of presence/absence, combined with the ability to do the undoable, which could be taken to extremes alarmingly quickly and easily. As VR inevitably becomes more prevalent in theatre, it will be important for artists and performers to keep in mind both the differences and similarities between physical and virtual bodies, together with the experiences they share. It will take a while for audiences to develop ethical awareness of virtual bodies as both perceived and experienced, as computer games will not necessarily take account of such concerns in the face of commercialization. Ethical awareness will need to be actively considered when designing and reviewing theatrical experiences incorporating VR.

Taylor and Nicolas Salazar Sutil were invaluable in the development of these ideas. I am deeply indebted to Jen Parker-Starbuck for her supportive and insightful editorial feedback.

FIGURE CAPTIONS:

Figure 1. The author using a VR headset with smartphone and headphones.

Figure 2. Ruth Gibson and Bruno Martelli's *White Island* (2013). The hot-air balloon basket's handrail circles the participant at approximately waist height. (Photo: Copyright © Ruth Gibson and Bruno Martelli, reprinted with permission.)

Figure 3. Ruth Gibson and Bruno Martelli's *White Island* (2013). (Photo: Copyright © Ruth Gibson and Bruno Martelli, reprinted with permission.)

Figure 4. *Unheimlich* (2005) by Steve Dixon, Mathias Fuchs, Paul Sermon, and Andrea Zapp, performed by Anna Fenemore and Niki Woods. (Photo: Steve Dixon, reprinted with permission.)

FOOTNOTES

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[1] Originally, the word *avatar* described the physical form taken by a Hindu god to enable him or her to appear to earthly beings. These forms often included a swan, a deer, or a person. It is now used as the term for any virtual body or object that represents the participant or user in the virtual world. So in practical terms, it "stands in for" the user in the virtual world.

[2] See Noma Labs's *Virtually Dead* website at *http://virtuallydead.co.uk/*. This performance installation was first shown in London in March 2016.

[3] See William Gibson, *Neuromancer* (New York: Ace, 1984). *Neuromancer* was Gibson's most influential book, in which he coined the term *cyberspace*. He published numerous other science fiction stories of a similar style.

[4] For a brief history of VR in performance, see Steve Dixon, *Digital Performance: A History of New Media in Theater, Dance, Performance Art, and Installation* (Cambridge, MA: MIT Press, 2007), 363–67; see also Oliver Grau, *Virtual Art: From Illusion to Immersion* (Cambridge, MA: MIT Press, 2003).

[5] See the research by Mel Slater and his team in the early 1990s at the Department of Computer Science and London Parallel Applications Centre, University of London.

[6] Susan Kozel, *Closer: Performance, Technologies, Phenomenology* (Cambridge, MA: MIT Press, 2007).

[7] Edward Castronova, *Synthetic Worlds: The Business and Culture of Online Games* (Chicago: University of Chicago Press, 2005), 285–94.

[8] See Oculus Rift's website at *https://www.oculus.com/en-us/*; HTC Vive's at *https://www.htcvive.com/uk/*; and Google Cardboard's at *https://vr.google.com/cardboard/*.

[9] Jason Ferguson, "Virtual Reality Has a Storytelling Problem and Theater Will Save It," *UploadVR*, May 8, 2016, available at *http://uploadvr.com/virtual-reality-storytelling-problem-theater-will-save/*.

[10] Sharan Matharu, "Virtually Dead," *Hodderscape*, March 21, 2016, available at *http://www.hodderscape.co.uk/virtually-dead/*.

[11] Josephine Machon, *Immersive Theatres: Intimacy and Immediacy in Contemporary Performance* (Basingstoke, UK: Palgrave Macmillan, 2012), 26.

[12] See *http://www.arte.tv/notes-on-blindness*.

[13] See *http://www.aardman.com/aardman-and-bbc-rd-launch-interactive-vr-experience-we-wait/*.

[14] See *http://www.immersivejournalism.com/* for more information.

[15] Jennifer Hayley, *The Nether* (London: Faber and Faber, 2014). The play premiered in 2013 in Los Angeles; for further information, see *http://www.thenetherplay.com/*. See also Sarah Bay-Cheng, "Virtual Realisms: Dramatic Forays into the Future," *Theatre Journal* 67, no. 4 (2015): 689–93.

[16] See Ruth Gibson and Bruno Martelli's *White Island* website, available at *http://gibsonmartelli.com/WhiteIsland.html*.

[17] Sita Popat, "Keeping It Real: Encountering Mixed Reality in igloo's *SwanQuake: House*," *Convergence: The International Journal of Research into New Media Technologies* 18, no. 1 (2011): 11–16.

[18] Mark Johnson, *The Meaning of the Body* (Chicago: University of Chicago Press, 2007); Antonio Damasio, *The Feeling of What Happens: Body and Emotion in the Making of Consciousness* (New York: Harcourt Brace, 1999).

[19] For further information, see *http://www.blasttheory.co.uk/projects/desert-rain/*.

[20] Richard Schechner, cited in Victor Turner, *From Ritual to Theatre: The Human Seriousness of Play* (New York: PAJ Publications, 1982), 120–21.

[21] Jaime Banks, "Object, Me, Symbiote, Other: A Social Typology of Player–Avatar Relationships," *First Monday* 20, no. 2 (2015), available at *http://firstmonday.org/ojs/index.php/fm/article/view/5433*.

[22] Mel Slater, "Place Illusion and Plausibility Can Lead to Realistic Behaviour in Immersive Virtual Environments," *Philosophical Transactions of the Royal Society B* 364 (2009): 3549–57.

[23] The author is currently leading a research project funded by the Wellcome Trust to investigate this comparison further.

[24] Oliver Sacks, *The Man Who Mistook His Wife for a Hat and Other Clinical Tales* (1985; reprint, London: Picador Pan Macmillan, 2015), 47.

[25] Ibid.

[26] Ibid. (emphasis in original).

27 See avatar body-design systems in *Second Life* (*http://secondlife.com/*) and *World of Warcraft* (*eu.battle.net/World-of-Warcraft*).

28 Deirdre Sklar, "Remembering Kinesthesia: An Inquiry into Embodied Cultural Knowledge," in *Migrations of Gesture*, ed. Carrie Noland and Sally Ann Ness (Minneapolis: University of Minnesota Press, 2008), 87.

29 See Drew Leder, *The Absent Body* (Chicago: University of Chicago Press, 1990).

30 Maurice Merleau-Ponty, *Phenomenology of Perception*, trans. Colin Smith (London: Routledge / Kegan Paul, 1962), 246.

31 Maxine Sheets-Johnstone, *The Roots of Thinking* (Philadelphia: Temple University Press, 1990), 286–87 (emphasis in original).

32 Mel Slater, Daniel Perez-Marcos, H. Henrik Ehrsson, and Maria V. Sanchez-Vives, "Inducing Illusory Ownership of a Virtual Body," *Frontiers in Neuroscience* 3, no. 2 (2009): 214–20.

33 Nonny de la Peña et al., "Immersive Journalism: Immersive Virtual Reality for the First-Person Experience of News," *Presence* 19, no. 4 (2010): 291–301, quote on 293.

34 Ibid., 294.

35 Slater, "Place Illusion and Plausibility," 3551.

36 *White Island*'s creators, Gibson and Martelli, often design elements into their works that disrupt immersive experience in order to make the participant engage critically with it. See the interview with them in Jonathan Pitches and Sita Popat, *Performance Perspectives: A Critical Introduction* (Basingstoke, UK: Palgrave Macmillan, 2011), 126–31.

37 James J. Gibson, *The Ecological Approach to Visual Perception* (New York: Psychology Press, 1986).

38 Ibid., 4.

39 Henri Bergson, *Matter and Memory*, trans. Nancy Margaret Paul and W. Scott Palmer (London: George Allen and Unwin Ltd, 1911), 5.

40 Gibson and Martelli have experimented with standing the participant on a low, suspended board and swinging on ropes to mimic the movement of the hot-air balloon basket. However, they found that this tended to cause debilitating sickness and disorientation. (Ruth Gibson, personal communication with the author, Coventry University, November 2014.)

41 Grau, *Virtual Art*, 231.

42 Ibid.

43 Nicolas Salazar Sutil and Sita Popat, eds., *Digital Movement: Essays in Motion Technology and Performance* (Basingstoke, UK: Palgrave Macmillan, 2015), 5.

44 Bergson, *Matter and Memory*, 23–25.

45 Gilles Deleuze, *Cinema 1: The Movement-Image*, trans. Hugh Tomlinson and Barbara Habberjam (Minneapolis: University of Minnesota Press, 1997), 65.

[46] Nicolas Salazar Sutil, *Motion and Representation: The Language of Human Movement* (Cambridge, MA: MIT Press, 2015), 237.

[47] See Sklar, "Remembering Kinesthesia."

[48] Bergson, *Matter and Memory*, 197.

[49] Ibid., 41 (emphasis added).

[50] Steve Dixon, keynote presentation on November 2, 2008, at the *Post Me_New ID* Forum, Hellerau, Germany.

[51] See Paul Sermon's website, available at *http://www.paulsermon.org*.

[52] See the *Unheimlich* website, available at *http://www.paulsermon.org/unheimlich/*.

[53] Kozel, *Closer*, 142.

[54] Nicolas Salazar Sutil, Matthew Sansom, and Paul Krause, *Reach* (digital performance and presentation) at the Ivy Arts Centre, University of Surrey, September 4, 2013.

[55] Anne Cranny-Francis, *Technology and Touch: The Biopolitics of Emerging Technologies* (Basingstoke, UK: Palgrave Macmillan, 2013), 20.

[56] Ibid.

[57] See the *Unheimlich* documentation movie at *http://www.paulsermon.org/unheimlich/downloads.htm*.

[58] Machon, *Immersive Theatres*, 27.

[59] See, for example, Damasio, *The Feeling of What Happens*; and Shaun Gallagher, *How the Body Shapes the Mind* (Oxford: Oxford University Press, 2005).

[60] Elaine Scarry, *The Body in Pain: The Making and Unmaking of the World* (New York: Oxford University Press, 1985), 233.

[61] Dee Reynolds, "Kinesthetic Empathy and the Dance's Body: From Emotion to Affect," in *Kinesthetic Empathy in Creative and Cultural Practices*, ed. Dee Reynolds and Matthew Reason (Bristol, UK: Intellect, 2013), 124.

[62] Kozel, *Closer*, 98.