Abstract

The purpose of this paper is to explore the relationships between embodiment, presence and immersion in contemporary forms of VR. The term virtual reality (VR) refers to the generation of three-dimensional environments using computer-graphics or 360° video imagery. Using VR headsets such as Google Daydream, HTC Vive, Oculus Rift, Samsung Gear and Sony PlayStation™ (PSVR) it is possible to remove visual stimuli from the outside world, replacing them with computer-generated or video imagery, to create a sense of being present within another realm. At present, commercially available hand-held devices such as motion controllers do not replicate the weight, solidity or surface texture of objects. However, these hand-held devices do enable us to interact and respond to objects within VR environments and add to the sense of immersion. A key issue to explore is what happens to our sense of embodiment, when we feel immersed and present within VR environments? Debates surrounding phenomenological approaches to embodiment, as well as the ideas found within dance and movement scholarship, provide useful entry points to explore embodiment and VR. For instance, Rudolph Von Laban provides a precise lexicon for describing movement. By testing out and applying Laban's movement analysis, it is possible to offer fresh insight into embodiment, immersion and VR. Furthermore, by focusing on Laban's insights into movement, it is possible to heighten our sense of embodiment in order to become more aware of how we interact and respond immersive VR experiences.

Key words: virtual reality, immersion, embodiment, being-in-the-world, movement, presence.

Introductory Remarks

The term virtual reality (VR) refers to three-dimensional computer-generated or 360° video environments that aim to be engaging and immersive. Using headsets, we can shield our visual perception of the outside world, replacing these stimuli with computer-generated or video images. In this way, the focus of our attention is the VR environment, adding to the sense of being-in-a-virtual-world. For the purposes of this discussion, I follow the work of Professor of Virtual Environments Mel Slater (1999) who regards immersion as the sense of being encompassed and present with VR.

From the 1990s onwards, Professor of Virtual Environments, Mel Slater has produced a wealth of research about VR. Slater (1999) discusses the ways in which immersion in VR refers to removing sensations from the external environment, accommodating as many sensory modalities as possible and having rich representational capabilities. Indeed, the enveloping, three-dimensional and interactional qualities of VR also contribute to our sense of immersion within another realm.

In the 1980s and 1990s, there was a prevalence of mind versus body scenarios surrounding VR. For instance, visions of transcending the physical body through immersion in VR were popularised through Hollywood films from *Tron* (1982) to *The Matrix* (1999) and science fiction novels such as *Neuromance*r (Gibson, 1986), *Virtual Light* (1993, Gibson) and *Permutation City* (1994, Egan). During the 1990s, VR systems such as Virtuality (produced in the UK by W Industries) were mainly found in entertainment centres and gaming arcades. These early VR applications included simulations of rollercoaster rides, motorcycle rides, racing cars and skiing. However, there were limitations to the movement offered by these VR systems since they mainly utilised cumbersome head-mounted displays and an array of cables tethered them to a fixed location.

During the 1990s, artists started to experiment with the aesthetic potential of digital technologies creating works such as *Legible City* (1991) by Jeffrey Shaw, *Virtual Body* (1993) by Catherine Richards and *Osmose* (1995) and *Ephémère* (1998) by Char Davies. Whilst studying the history of art and design in the 1990s, I questioned whether VR would enable us to feel immersed within a work of art. This question was at the forefront of my experiences of immersion in *Osmose* at the Laing Art Gallery, Newcastle Upon Tyne. What was distinctive about my experience of immersion within *Osmose* was that it utilised a cyber vest to monitor breathing patterns, aligning them with imagery in the VR world. In this way, my bodily movements were an integral part of the immersive experience. I provide further discussion of the experience of aligning embodiment and VR through *Osmose* in *Virtual Reality: Representations in Contemporary Culture* (Chan, 2014). *Osmose* is significant to this discussion because it instigated new questions and debates about immersion and embodiment in VR, which are continuing to reverberate in contemporary culture.

According to bodywork specialist Deane Juhan (2003) technologically developed, westernised societies have become intoxicated with the realm of the mind, imagination and fantasy at the expense of embodied awareness. Juhan contends that this mental realm is a virtual reality in which disengagement from the embodiment has become pervasive. On this point Juhan states that: "the technical revolution …is replacing the once ubiquitous need for human contact, and is being avidly downloaded – not embraced – by generations of human beings increasingly trained to be comfortable and competent only in its virtual mindspace…" (2003, p.347). In addition Juhan claims that this "…mindspace is becoming large enough and complex enough within itself to easily occupy their imaginations for a lifetime with a minimum of distractions from an increasingly distant and irrelevant body" (Juhan, 2003, p.347). Juhan's comments resonate with the ways in which social interactions

now frequently take place via technological networks such as wireless connections to the Internet) and the use of devices such as (smart-phones and tablets).

Yet, this paper argues against the notion that VR renders the body irrelevant. Instead, the discussion indicates that VR technology and embodiment intertwine through processes such as immersion and interactivity. Indeed, this paper contends that embodiment is integral to understanding the sense of being immersed and present within VR. In her study of VR, environmental psychologist Karen A. Franck comments on embodiment, interaction and immersion in VR. Franck reminds us that: "To see I must move my head. To act upon and do things in a virtual world I must bend, reach, walk, grasp, turn around and manipulate objects" (2002, p.240). In this way, Franck challenges the idea that VR offers a way of transcending the limitations of the physical body. Instead, she indicates that bodily movements are essential to the immersive VR experience.

Philosopher Helen de Preester (2011) also provides a useful definition of embodiment that is pertinent to this discussion. De Preester states that embodiment is "a very comprehensive phenomenon, including both the feeling of body ownership and subjective feelings of embodiment related to the sensorium" (2011, p. 128). The notion of body ownership and subjective feelings of lived embodiment are central to the discussion of immersion in VR. For the term embodiment refers to the subjective qualities of lived experience, whereas the objective body is a socio-cultural concept that changes over time. Sociologist Alexandra Howson explains that: "In the German language, this division between the subjective and objective body is referred to in a more subtle way. *Körper* refers to the body as an object, while *Leib* refers to the felt, experienced body" (2004, p.15). As our embodied interactions are part of our practical engagements in the world, it is important how this relates to the process of immersion in VR. At first glance, it may appear that immersion in VR involves subjective feelings of embodiment (*leib*) within another realm whilst the objective body is beyond the VR system, in the world at large. However, this discussion attempts to go beyond binary oppositions such as the mind versus the body or the subject and object, to find new ways of approaching immersion in VR.

Notably the work of psychologist James J. Gibson (1904-1979) indicates that embodiment in VR and the world at large (beyond the VR system) are not in an oppositional relationship. For as Gibson remarks our world is:

> …not a new environment – an artificial environment distinct from the natural environment – but the same old environment modified by man. It is a mistake to separate the natural from the artificial as if they were two environments; artefacts have to be manufactured from natural substances (1986, p.130).

Ultimately, Gibson's point is that there are fundamental aspects of the environment (such as earth, air, water) upon which all life depends. Expanding these points Gibson remarks, "we all fit into the substructures of the environment in our various ways, for we were all, in fact formed by them. We were created by the world we live in" (1986, p.130). Gibson's exploration of kinaesthesia, muscular

exertion and the position of the body in space are also relevant to the study of immersion in VR. Dance scholar, Susan Leigh-Foster (2011) states that Gibson shows that kinaesthetic information is synthesised from various sources such as muscles, audition and visual stimuli. Therefore, kinaesthetic experiences of immersion in VR involve synthesising the movement of the muscles as well as aural and visual stimuli. Leigh-Foster also observes, "Gibson's theory proposed an ongoing duet between perceiver and surroundings in which both were equally active" (2011, p.116). Extrapolating from these points, immersive experiences are an ongoing duet between a perceiver and the VR environment.

In agreement with interaction designer Professor Janet H. Murray (2012) the design of mediated environments can offer rich opportunities for interaction by providing greater degrees of involvement. Considering Murray's point, designing responsive features and offering opportunities for using tactile controllers can create a compelling sense of embodied presence and immersion in VR. For example, the *To the Top* (Electric Hat, 2017) VR climbing and platform-based game maximises opportunities for movement by simulating jumps through hoops, rock climbing and riding down slides. It is equally important, though, to study the sorts of embodied movements that VR engenders. For instance, when studying embodiment and VR we can note which parts of the body are moving, the speed of movement and the direction in space of those movements. Furthermore, we can pay attention to the emotional aspects of movement and immersion in VR. For instance, immersion and engagement with VR environments such as *London Heist Getaway* (SIE Gateway, 2016) for the PSVR can stimulate the thrill and excitement of racing high-speed cars. Similarly, horror-based VR games such as *Resident Evil 7 Biohazard* (Capcom, 2017) or the Google Cardboard game *Chair in a Room* (Wolf and Wood Interactive, 2017) could result in fearful, even stomach churning experiences for players.

Hybrid experiences involving technology and the body, such as VR game playing, are now part of everyday life. In line with geographer Nigel Thrift's argument, this discussion takes the view that "…an authentic nature/ inauthentic technology narrative…" (2005, p.470) is no longer viable. Moreover, according to Thrift, some criticisms of techno-mediation of experience are underpinned by the notion that technology is the Other rather than regarding technology as a part of human life. The study of embodiment, presence and immersion in VR is important because as mobile media scholar Ingrid Richardson observes "…considering the number of hours that many people spend engaging with the media in contemporary life, the body-screen relation in particular may be one of our most significant human-technology relations" (2012, p.135). In agreement with Thrift and Richardson, in contemporary culture hybrid experiences in which the physical and digital realms become intertwined, have become more commonplace. Additionally, the ethnographic studies of Sarah Pink et al (2016) indicates that interacting with mobile devices has generated new sorts of embodied engagement with media through hand movements such as scrolling and swiping. For instance, Pink et al highlight the importance of studying mobile devices (smart-phones, tablets and screen interfaces) in terms of their sensory qualities beyond their "…representational or symbolic status" (2016, p.241). Instead, Pink et

al advocate investigating how "…people *feel* their way through the world…" with these devices (2016, p.241). Similarly, this paper is concerned with how users of VR feel present within VR. Notably, it is now possible to use VR headsets and tactile controllers with mobile devices. Therefore, it seems likely that virtual reality has the potential to become widely available through integrating with existing commercial and technological infrastructure such as Internet access, devices such as smart-phones and software applications (apps).

Due to the cumbersome aspects of heavyweight head-mounted displays and tethered equipment, in the 1980s and 1990s virtual reality was still mainly a technological fantasy that had yet to be realised. Now, things have changed, as contemporary VR systems such as Google Daydream, HTC Vive, Oculus Rift, Samsung Gear and Sony Playstation™ VR (PSVR) are lightweight and offer greater degrees of mobility and interactivity. As I was writing this paper an International Festival of Music and the Moving image was taking place in Leeds, West Yorkshire which included numerous (VR) related events, workshops and exhibitions. Participating in these events and attending exhibitions provided valuable insight into the study of embodiment and immersion in VR. Indeed, my earlier idea about the possibility of immersion within a work of art was finally realised, to a certain extent, when I used the HTC Vive Headset, motion controllers and the Tilt Brush (Google, 2016) art application. The motion controllers were two black devices that resembled the remote controllers used with television sets. Once immersed within Tilt-Brush, I saw these controllers as two free-floating black rectangles, one for each hand. By reaching out my hand, I could manipulate these virtual controllers. For instance, using the left-hand I could make lines and shapes, whereas the right hand-controller functioned as a palette (offering different colours, brushes and visual effects). Using flowing scattering arm movements, I could make three-dimensional lines and shapes in virtual space. Through experimenting, I quickly learned how to play around with the VR system by using slow, arching movements or quick, frenzied jagged movements to make lines and shapes. Moreover, I could even jump through or crawl beneath lines and shapes. Yet the movements that appeared to occur in VR did not seem connected to my sense of embodiment in the world at large. Instead, the focus of my attention was on the enveloping blackness of the three-dimensional space generated by Tilt Brush and the creative opportunities within it. Furthermore, I did not have a precise vocabulary to express the experience of embodiment and immersion in Tilt Brush. However, this initial foray into contemporary VR provided the stimulus for exploring embodied experience of immersion in VR in more depth, through reference to the work of Laban.

Analysing Movement

The work of movement and dance scholar Rudolf Van Laban (1879-1958) provides a precise vocabulary for the discussion of embodiment and immersion in VR. According to Laban (1971) his approach to movement differs from scientific approaches. For instance, Laban outlines the ways in which scientific approaches focus on ways in which the body is subject to laws of gravity and thermodynamics. Furthermore, scientific approaches to movement emphasise how the nerves that control muscles respond to external and internal stimuli. From a scientific perspective, it is possible to precisely measure and monitor movement through time and space. Laban concedes that the law of gravity applies to inanimate objects, such as the ways in which a stone falls to the ground when dropped from a height. However, he states that the movement of the human arm is not the same as the stone. For instance, we could move our arms haltingly, suddenly or jerkily. Moreover, human beings have the capability to choose how they respond to environmental conditions, such as struggling against them or yielding to them. Therefore, through exploring Laban's work it is possible to heighten our sense of embodiment and movement so we become aware of how we respond to environmental conditions, such as engaging with VR.

Laban's (2011) concept of the three story architectural plan as a way of exploring and explaining movement provides a useful way of exploring immersion in VR. Firstly, he states that mental life relates to the intangible aspects of life such as thought or emotions. Secondly, he acknowledges the concept of an objective observer of movement, such as a researcher who is investigating embodiment, presence and immersion. Thirdly, there is the first person perspective of someone who enjoys the experience of immersion in VR. According to Laban, our sense of embodied aliveness involves all three elements of the architectural plan. Extending the concept of the architectural plan further, Laban created his own system of movement notation. The first dimension, of the notation system, refers to the spatiality of movement. The second dimension refers to the rhythmic qualities of movement. Finally, the third dimension refers to the emotional characteristics of movement. Laban's work is useful because it aims to heighten our awareness and understanding of the holistic aspects of movement to counter fragmentary perceptions, such as considering immersion in VR as a form of mind-body dualism, which creates divisions and disharmony.

Laban calls the straight, curved, twisted or spiral shapes made by the moving body as "trace forms" (2011, p.5). Whilst Laban is referring to movements in the world at large, it is interesting to test out and applied these ideas to immersion in VR. For immersion in VR involves moving in the world around us, yet appearing to create trace forms in the virtual environment. The distinctions Laban makes between space in general and our personal sense of space are also relevant to the discussion of embodiment and contemporary forms of virtual reality. Laban refers to personal space as the "kinesphere" (2011, p.10) and states that it is linked to the space around our bodies. It is the space we can reach, or extend into from a fixed resting position of the foot, which Laban terms "the stance" (2011, p.10). We can reach into this space with our limbs and when we move from the stance we extend our kinesphere. Outlining this process, Laban states "when we move out of the limbs of our

original kinesphere we create a new stance, and transport the kinesphere to a new place" (2011, p.10). Taking Laban's terminology into account it is possible to claim that the process of immersion involves extending one's kinesphere into a virtual world.

Returning to Laban's concept of living architecture allows us to study embodiment, movement and immersion in VR with greater precision. For example, Laban refers to the spatial levels of the body whereby the first floor refers to our grounding in the environment through the feet, the second floor refers to movements that occur at the middle of the body (mid-height) and the third floor refers to the height of the hands when reaching over the head. Applying these ideas, it is noteworthy that PSVR and HTC Vive tracking systems synchronise the embodied movement of the user and their kinesphere with the parameters of the virtual environment. For with these tracking systems it is possible to make movements at mid-height across the body, to reach out, touch and move virtual objects.

Phenomenology also provides valuable insight into the sensory processes of embodiment, immersion and presence in VR. From a phenomenological perspective, the structure of sensory motor features of the human body in conjunction with brain activity produces a wide range of sensory experiences. For instance, seeing is a specific sensory activity because the retina is spherical, the eyes rotate and we blink. Our senses interact producing what philosopher Maurice Merleau-Ponty (1905-1961) calls a "synergic system" (1991, p.234) providing a rich multi-sensory dimension to our experiences. Interestingly, Movement Education scholar Maureen Connolly and Physical Education scholar Anna Lathrop (1997) trace some of the similarities between the work of Merleau-Ponty and Laban. For instance, they note that what Merleau-Ponty and Laban have in common is a focus on the experiential qualities of embodiment. Talking about Merleau-Ponty, Connolly and Lathrop remark that his work provides "…a completely unrestricted reflection on the whole of human experience…" (1997, p. 28). Meanwhile outlining the context of Laban's work, Connolly and Lathrop note that he challenged the practices of classical ballet, such as placing dancers in a flat grid, a pre-existing spatial domain. Instead, Laban's vision is "…of dynamic space…perceived as a volume of multiple directions, dimensions and scales" (Connolly and Lathrop, 1997, p.31). Indeed, Laban counters the notion of a pre-existing spatial realm, asserting that movement creates space. If, as Laban asserts, we create space as we move then movement is an integral part of the immersive experience. For instance, as we twist and turn whilst playing a VR game, then we are actively engaging and creating virtual space.

Philosopher Mark B. N. Hansen also offers fresh insight into our consideration of embodiment and VR, by exploring the philosophical ramifications arising from a phenomenological approach to subjectivity and experience. Hansen's critique provides a useful warning about the ways in which phenomenology prioritises consciousness, subjective experience. Outlining an alternative approach, Hansen states that "…worldly materiality operates on and through an agent (or unity of experience)" (2012, p.223). At the same time, however, the subject (or in Hansen's terminology the agent) cannot consciously capture, master or directly perceive this worldly materiality. To illuminate his argument,

Hansen refers to a performance art piece called *Gatherings* by Jordan Crandall (2011). Crandall's performance piece is relevant to this discussion because it places him within a responsive and shifting environment of media feeds, which has similarities to interacting with VR environments. Outlining the significance of *Gatherings*, Hansen states that it is "…a form of media that operates predominately beneath or beyond the registers of human sense experience" (2015, p.222). Instead of a subject interacting with an objective world 'out there', *Gatherings* suggests that conscious experiences arise through interacting and engaging with data flows in the environment. Therefore, the embodied subject is no longer at the centre of an experience. Instead, the subject is a participant in what Hansen terms a 'happening event', which is an assemblage of sensory data, processing, reflection and interaction with a technologically mediated world. Similarly, immersion in VR involves interacting with and responding to data flows from multiple sources. Therefore, in Hansen's terminology immersion in VR is a 'happening event' that intertwines embodiment and technology. To further explore this concept of intertwining embodiment and technology, it is useful to outline some of the debates surrounding immersion and presence.

Immersion and Presence

Professor of Architectural Computing, Richard Coyne (1994), discusses two contrasting theoretical approaches to perception and VR that are of interest to the discussion of immersion and presence. One view is that having more data input such as high-resolution imagery provides greater degrees of immersion in VR. Another view, the constructivist approach, contends that it is not necessary to have more input to generate immersive experiences. Outlining the constructivist approach, Coyne observes that: "…we rely on simple cues and clues from the environment" (1994, p.66) to construct our perception. Therefore, "…VR technology does not have to strive for realism though better and more complete sensory input" (1994, p. 46). Moreover, Coyne remarks that immersive VR experiences depend on many factors including where we focus our attention, our state of mind, personal beliefs, interests, expectation, prior experiences and familiarity with the medium.

However, Coyne's is sceptical about some of the claims made about contemporary forms of VR. To support his claim, Coyne refers to a blog post by Mark Zuckerberg (2014), when Facebook acquired Oculus Rift. In this blog post, Zuckerberg states that when you use the Oculus Rift headset:

> … you enter a completely immersive computer-generated environment, like a game or a movie scene or a place far away. The incredible thing about the technology is that you feel like you're actually present in another place with other people. People who try it say it's different from anything they've ever experienced in their lives.

In response to this blog post, Coyne states that if the Oculus VR experience is different from anything that people have experienced before, then to what extent is it real. Indeed, Coyne argues that contemporary VR technology has produced devices that aim to simulate and stimulate the senses such as high-resolution digital images and surround sound, yet they do not provide a complete sense of immersion. Instead, Coyne remarks it is possible to feel a sense of immersion by playing a low-resolution game or reading text on a page, since we bring our imaginative capabilities to the experience. Concurring with Coyne, our imaginative capabilities are a part of the immersive experience of VR. In addition, taking Coyne and Slater's research into consideration there are links between our sense of awareness, presence and immersion. For example, some people may choose to place their attention on a VR environment, rather than the world beyond it. By placing their attention in the VR environment, they may feel incredibly immersed within it. One way of focusing attention on the VR environment is through rich interactional opportunities using motion controllers and tactile devices. Therefore, to get an even deeper understanding of embodiment and VR, it is helpful to discuss tool use and prostheses.

Prostheses and Tool Use

In her study, of technology and embodiment, De Preester divides prostheses into three main categories: limb prostheses that alter motor capacities, perceptual prostheses that alter sensory capacities and cognitive prostheses. Of relevance to this discussion, is that De Preester asserts that "perceptual prostheses or extensions alter our sensorium in that one of the senses is amplified or extended" (2011, p.126). With regards to VR, it is predominantly vision and audition that can be amplified. For as De Preester explains "Most perceptual extensions or 'prostheses' are audio-visual. In general, vision and audition are more easily extendible than the other senses. The tactile, kinaesthetic, gustatory and olfactory dimensions to perceptual experience are much more difficult to extend" (2011, p.127). However, De Preester does acknowledge, that attempts are underway to simulate other sensory experiences using VR. For instance, controllers, data gloves and joysticks extend our tactility into VR environments.

In his discussion of tool use Thrift argues that not only do we extend our bodies through movement of the limbs; we also extend our bodies through using tools, so that biology and technology are "…inexorably linked". (2005, p. 468). However, Janet H Murray says there are distinctions between those who use digital artefacts as tools (such as an on-line stop- watch, or using pre-programmed formulas to calculate figures on a spreadsheet) and other forms of engagement such as exploring the terrain of a virtual world. Murray's work as a digital designer involves creating interactive experiences that are satisfying because they are engaging. Murray states that matching our

expectations with the software and hardware parameters of digital artefacts produces pleasurable and engaging experiences. In contrast, poorly designed interactive features arouse our frustration and annoyance because they do not respond in the ways we expect. It is interesting to apply Thrift's idea of the "inexorable linkage" between biology and technology and Murray's emphasis on responsive interfaces to the promotional material for PSVR (http://www.playstation.com). For example, the PSVR website asks us to bring our "…hands into the game world" to increase our sense of presence and immersion. Therefore, it is important to explore the ways in which tactile interfaces, such as motion controllers, wands and joysticks aim to provide greater interaction and engagement with virtual environments.

Tactility

Studying our tactile-kinaesthetic engagement is important because it is intrinsic to exploration of the world around us. As movement scholar Maxine Sheets-Johnstone contends "Like other animals, we are always in touch with something, however far from focal attention that tactilely-felt something might be – the inside of our shoe, for example, or the shirt on our back, or the chair on which we sit, or the pencil with which we write" (2009, p.138). Our sense of being-in-the-world is tactile; we feel the ground beneath our feet and the interplay of different surface textures. Sheets-Johnstone outlines the ways in which our experiences of the roughness or smoothness of surfaces occurs through the physiognomic qualities of the human body. Explicating further, Sheets-Johnstone states that, "bodies are squeezed by things, bent by things, rustled by things" (2009, p.140). When we reach out and touch something we become aware of the qualities of an object in terms of, mass, density, malleability, roughness or smoothness. Although tactile VR interfaces do not provide the same degree of sensitivity as objects and encounters in the world around us, they do contribute towards a sense of immersion and presence within another realm. For the action of reaching out and touching virtual objects mimics the ways in which we explore the world around us. In this way, tactile interfaces draw upon our prior experience of grabbing and holding objects.

Again, Laban's work offers particular insight into tactility and expressiveness. For as Laban remarks, movements can be made with different levels of force such as a light touch or a dynamic kick. Laban also makes useful connections between the feeling tone and the motivations that instigate a particular movement. For instance, the impulse to reach an external goal is associated with grabbing something in an energetic manner whilst doubting manifests as halting, cautious movements. *Everest*

VR (Sólfar Studios, 2016) which provides a first-person photorealistic rendering of climbing Mount Everest provides a way of testing out and applying Laban's ideas. Before commencing the Everest climb, players train in a tutorial session, which explains how to orientate, move the body and acquire objects in the virtual world. After acquiring these skills, the player can move (using their motion controller) to a photorealistic rendering of a mountaineering basecamp. In this location, the player finds a number of objects placed on a makeshift table, which they must take with them on their expedition. By bending down and reaching out their arms, the player collects these objects. They then move their bodies *as if* they were placing these objects in a knapsack on their backs. These movements and gestures resemble the act of miming since on screen it appears that a pair of disembodied virtual hands are grabbing those objects and placing them into a virtual knapsack. This example highlights how the player's movements align with the parameters of the game experience, creating the sort of compelling, participatory forms of engagement that Murray (2012) discusses.

Laban (2011) also considers movement in relation to levels of tension or weight and these ideas provide insight into the VR game *The Climb* (Crytek, 2016). What is striking is that the trailer for the game (http://www.theclimbgame.com/) features computer-generated environments of various rock climbing scenarios such as: the Alps, bay and canyon, which involve moving a pair of disembodied hands. As the user becomes familiar with how to use the controllers their hand and arm movements become synchronised with computer software and hardware. For instance, the movements made by the hands line up with where the player looks in the VR world. What is also of interest is that the game has a visual display showing the amount of stamina for each virtual hand. When one hand grips onto something in the virtual world, it loses stamina; at the same time, the other hand gains stamina. In this way, the game mimics the shifting of tension or weight that occurs when using the arms and hands to climb rock faces. Moreover, by curling the hands inwards the player retains stamina but if they attempt to grip something that is too far away from their imaginary body, they lose stamina. The player loses stamina if they use the leap button to teleport through space so that they can complete a climb more quickly. Movement scholars Carol-Lynne Moore and Kaoru Yamamoto (2002) provide a useful taxonomy of basic effort elements that focuses on two different forces indulging in or fighting against circumstances or situations. Testing out this taxonomy in relation to *The Climb*, it is noteworthy that indulging in a situation involves decreasing pressure and the use of slow and free flowing movements. In contrast, fighting against a situation involves increasing pressure, quickening and binding movements. For instance, if the player rests occasionally (indulging in the experience rather than fighting against it) they regain stamina.

The Climb does not provide a tactile sense of gripping onto the surface of a rock face, but by displaying levels of stamina it does attempt to provide some sense of the physical exertion of an actual rock climbing experience. Furthermore, playing *The Climb* or *Everest VR* does place some physical demands on the player since they reach out, twist and turn their actual arms, hands and feet whilst engaging with the VR environment. Nevertheless, despite the synchronisation of movements of the

body with VR environments there are still important differences between immersion and presence in VR and the world at large. For VR environments do not have same epistemological and ontological ramifications as world around us. For example, if a climber falls from the rock face in *The* Climb, this results in a loss of stamina on a visual display, whereas a fall from an actual mountain could be fatal. Similarly, in real life, climbing *Mount Everest* is a treacherous undertaking involving freezing conditions and avalanches, teams of expert mountaineers and months (if not years) of planning.

Conclusions

This discussion indicates that hybrid experiences that intertwine embodiment and technology, such as engagement with VR, are pervasive in contemporary culture (Richardson, 2012, Thrift, 2005). On this basis, VR is not a transcendent "mindspace" (Juhan, 2003) that disengages us from embodiment. Instead, embodiment is integral to the sense of immersion within a VR environment (Franck, 2002). Using the work of Laban it was possible to heighten our awareness of embodiment, movement and how we respond to environmental conditions such as engaging with VR. In addition, the discussion outlined how the sense of being present or immersed within a VR environment does not necessarily involve more data input to stimulate the senses (Coyne, 2016, 1994). Rather immersion involves focusing awareness on the VR environment and increases through responsive and emotionally engaging VR environments (Murray 2012). Furthermore, as the work of De Preester (2011) indicates perceptual prostheses or extensions, such as head-mounted displays and tactile interfaces amplify and extend the senses. The discussion also outlined the ways in which immersion in VR stimulates perception and offers some degree of tactility. In this way, the paper concurs with De Preester's findings that technological interfaces extend and amplify some aspects of sensory experience (such as the visual sense) whilst reducing others.

Referring to Laban's movement analysis, the discussion indicates that there are emotional and expressive aspects to immersion and engagement with VR environments such as *Everest VR*, or *The Climb*. Indeed, VR games can provide thrill seeking experiences such as *London Heist Getaway* or those that aim to invoke fearful emotional responses such as the horror-based *Resident Evil 7 Biohazard*. These emotional responses link to expressive movement, such as shrinking or moving

away from perceived dangers. Moreover, as Laban contends transformation can occur through a heightened awareness of embodiment and impact in a positive way upon our relationships to others and the world at large. On this note, we can use VR to create engaging experiences that foster new creative forms of communication and embodied expression through an intertwining of embodiment and technology.

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