

INSIDE THE LOOKING-GLASS

**SELF AND THE WORLD IN
VIRTUAL REALITY**

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Introduction

As a burgeoning technology, there is currently a wealth of interest in the ontological and phenomenological implications of virtual reality (VR). Some of this interest, and the research funding it represents, connects with cognitive science research on perceptual illusions, which VR makes use of to place the viewer in a vulnerable state of immersion. VR requires these perceptual illusions to be as seamless as possible, for if the viewer is subjected to any disturbances in rendering while immersed in a virtual environment – such as conflicts in bodily perception and actions not bound by physical laws – they may experience “stimulator sickness”. This jolt of consciousness exposes the insufficiency of the simulation and reveals to the individual the instability of their spatial self-representation.

While such disruptions can impair user experience in VR applications like gaming, VR art installations can make productive use of this perceptual insufficiency to decentre the viewer as the hegemonic objectifier of an artwork. Using VR, an immersive installation can tap into a viewer’s engagement with the world, turning their attention to their own bodily experiences and how they act on objects and the environment around them. In this way, immersive VR installations transform the experience of one’s self as a consciousness in enveloping space into an aesthetic event.

As people situated in the world, we are not exempt from responding to the environments around us. Psychologists have developed the term “affordances” to refer to all possible actions available in the environment to an individual, whether the individual is conscious of them or not. In this dissertation, I argue that VR is an ideal space for exploring the perceptual interplay between self and the world thanks to VR’s capacity for facilitating one’s awareness of the self as a consciousness embodied in enveloping space. In making this argument, I will focus on VR as a component of art installations, and how these installations turn viewers’ awareness to pre-reflective states of consciousness, mainly bodily awareness.

The dissertation is divided into sections of: Concepts, Experiments and Analysis. In Char Davie’s “Osmose” and Virtual Reality Defined, I will explore what it means to feel immersed in an art piece, and deconstruct what it means to be embodied and aware of one’s self. In Long Arm Illusion, I will explore the relationship between our body and objects: how we interact with physical objects, and how affordances affect our perception. Finally, I will delineate what it means to be in a built environment, and discuss aesthetics of experience. Additionally, in the sections of Rubber Hand Illusion, Full, Long Arm Illusion and Body Transfer Illusion, I will use full-body and partial illusions to offer a cognitive neurological standpoint on the embodiment of the self. I will make use of these illusions as supportive evidence of perceptual fallacies experienced within VR installations, and the neurological equivalents of such experiences.

As a case study I will draw upon Char Davies’s “Osmose”, an art installation that explores the perceptual interplay between the self and the world. Aligned with the discussion that experience can be seen as art, virtual environments can elicit feelings of catharsis and become aesthetic environments within a double illusion.

Char Davies's "Osmose" and Virtual Reality Defined

"Where am I?" you ask yourself as you float solitary and weightless in a boundless ocean abyss. Relax. Breathe. You are aware that you are alone. Osmosis is your mode of transport, and you feel your own solubility as moving images enable your spatial transition: you travel through the molasses-like cytoplasm of a monocellular organism to emerge into the dense undergrowth of a wet evergreen forest. Any depth of inhalation draws you to different biological planes – from subterranean earth, to forest clearing, to clouds, to code. A motion-tracking vest controls your buoyancy like a diver, allowing you access to different constructed worlds through bodily inclination.

Your soft passing over shimmering swathes of opaque cloud is so weightless that you are unsure whether you are flying or diving.¹ This extraordinary perspective disorients your senses; your proprioception struggles to correct for the perceptual conflict. After an initial stage of mild panic, your vision adapts and you realise you are floating in a microcosm. You start to notice each abduction of your body, each breath that projects you past organisms and across voids. Char Davies calls this her 'natural interface' – a point of contact where subject and machinery interact.² Her VR installation "Osmose" "explores the dissolution between the mind and body, space and time in an osmotic journey through a dozen virtual world-spaces."³ The virtual environment reduces the observer to a disembodied view within a Cartesian space whose pixels reach out to infinity.

The technology for VR head-mounted display has existed for forty years, although the conception of machines for immersive virtual reality has been around since at least 1838 and the invention of stereoscopic viewers. The first "Ultimate Display" concept was created by Sutherland in 1965, and it had an explosive effect on many sectors, including scientific visualisation, media and art installations. VR is defined by its technological medium: computers, head-mounted displays, trackers, headphones, and occasionally some haptic sensing effectors such as motion-sensing gloves. The standout feature of VR, however – the technology that makes it a distinct immersive experience – is the head-mounted display (HMD) and its tracker. The HMD is a portable liquid-crystal (LCD) or cathode ray tube (CRT) display mounted in a helmet with stereoscopic imagery – the display projects two different images onto each eye at slightly different angles to create depth.⁴ Sensors inside the HMD track the user's head rotations, and peripherals monitor the translational movements of their body and hands. However, VR is defined not only by its hardware, but through the processes, effects, and resulting immersive environment which make it such a unique medium for discovering presence and embodiment.

The most salient experience of VR is the experience of one's self situated in a mediated environment. The goal of VR can be said to be this creation of presence – the agent embodied in a simulated reality. As the audience for this simulation, the viewer is immersed into a perceptually constructed illusion of the virtual world. They become less aware of their external physical environment (although it never fully disappears) as their experience of the VR system becomes more acute and intensified.⁵

¹ Oliver Grau, *Virtual Art* (Cambridge, Mass. [u.a.]: MIT Press, 2007), p.193

² Oliver Grau, *Virtual Art* (Cambridge, Mass. [u.a.]: MIT Press, 2007), p.193

³ "Osmose", *Immersence.Com*, 2017 <http://www.immersence.com/osmose/> [accessed 22 June 2017].

⁴ "Head-Mounted Display – Virtual Reality And Augmented Reality Wiki – VR & AR Wiki", *Xinreality.Com*, 2017 https://xinreality.com/wiki/Head-mounted_display#Stereoscopic_3D_Imagery [accessed 22 June 2017].

⁵ Riva, G., F. Davide, and W. A. IJsselstein. "Being there: The experience of presence in mediated environments." *Being there: Concepts, effects and measurement of user presence in synthetic environments* 5 (2003).

This disrupts traditional ways of seeing the world, and brings their own bodily self-as-object from the background to the foreground.

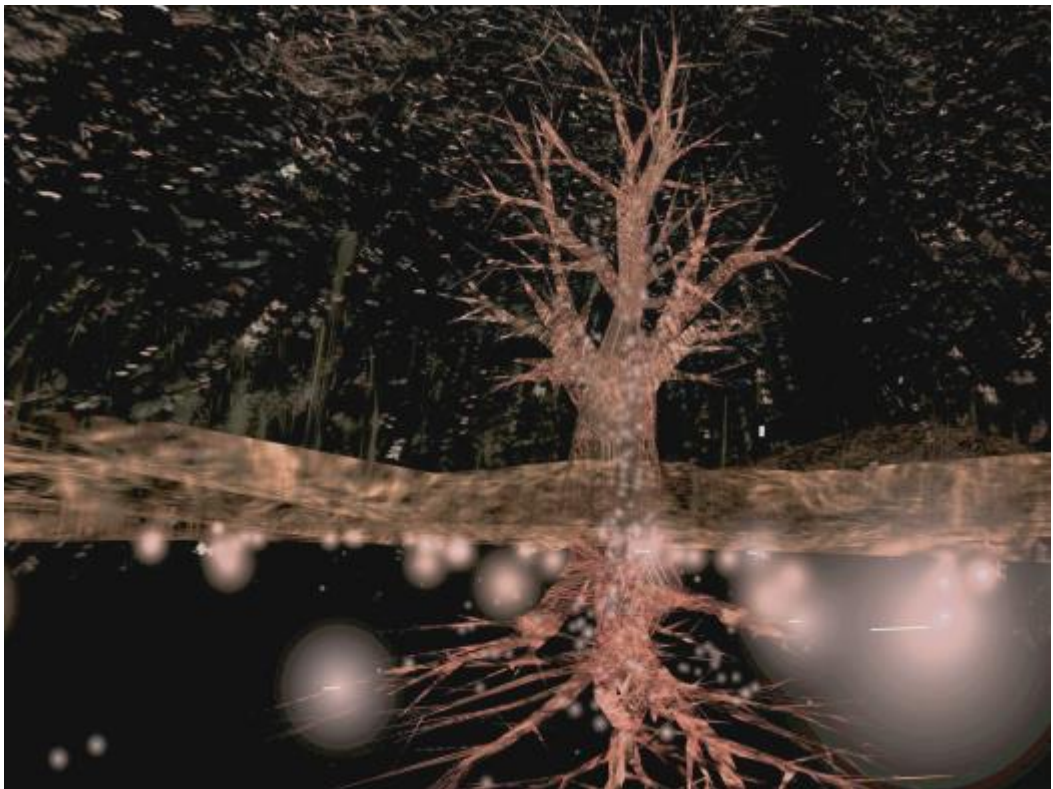


Fig.1 Char Davies, Osmose (1995)

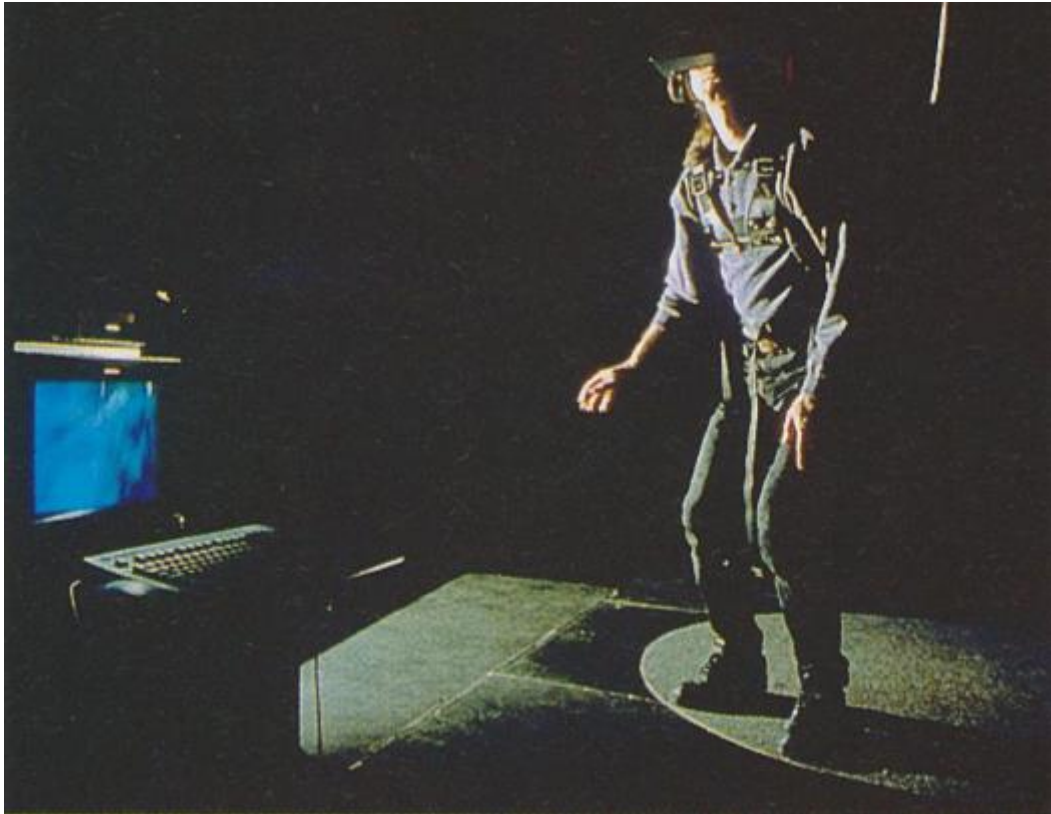


Fig.2 Char Davies, Osmose (1995) Participant with an HMD and sensory tracking

Self and the World

Artists such as Char Davies construct their installations around the ideology of integrating viewer and art with bodily and spatial awareness. The human participant and their corresponding sensory mechanisms become a singular entity within the artwork surrounding them, and they require technological components to react to these provided stimuli and to act in mimicry of how they might normally act in the physical world. The binding feature of these installations is the process of breaking down the barrier between viewer and work of art. VR art installations normally require the audience to be there for the experience and to be physically inside the installation. The focus of the artwork shifts from flat representation as an object for the viewer – as in a painting – to an immersive experience containing the viewer or participant. Bishop calls this ‘decentering’ the viewing subject. Instead of representing texture, space, and light, VR installation art brings these elements from the world outside the gallery space and presents them for the viewer to experience. It taps into the viewer’s engagement with the world, and turns their attention to their own bodily experiences and environmental interactions.

Bishop claims that VR installation art oscillates between the ambiguity of two subjects and that it possesses the ability to “simultaneously center and decenter the viewer”.⁶ VR in installation art exposes us to our decentered self, and makes us keenly aware of our unstable phenomenological condition. It is an optimal medium for exploring the

⁶ "Student:S12-Installation/Andrew/Essay4 - Stenner:Teaching", *Art-Tech.Arts.Ufl.Edu*, 2017 <<http://art-tech.arts.ufl.edu/~jack/wiki/Student:S12-Installation/Andrew/Essay4>> [accessed 22 June 2017].

instability of the phenomenal self, because of its limitless possibilities to shape our imaginations within a mediated reality. Bishop goes on to suggest that “rather than having a stable and certain viewing position, the subject in virtual reality is continually prompted to examine and reflect upon its changing perceptions.”⁷ Subjects are aware that they are continuously deceived by a mediated reality, yet they embody the illusion as if were reality.

Due partly to the viewer’s assent to and awareness of this illusion, VR installations such as “Osmose” are uniquely situated to offer new insights into the age-old discussion of “being”. The essence of the enquiry is: What is the self, and how does our consciousness influence our physical states?⁹ A concept that defies definition, what it means to have a corporeal existence is proved most readily in an intuitive way: the acknowledgement of one’s own existence in this world. We can say assuredly, “I am here”, with the singular pronoun “I” used as a reflexive self-awareness of oneself. In *Being and Time*, Heidegger states that “Being” is the most shared feeling, universal, and self-evident concept.⁸ Metzinger defines “being a self” as “a distinct, holistic entity capable of global self-control and attention, possessing a body and a location in space and time.”⁹ No longer is our body merely a house for the mind, but philosophers extend the concept of embodied cognition further to encompass our physical bodies as part of our self-consciousness. “Cognition is deeply dependent on the features of the physical body of an agent.”¹⁰ The self is not set in a vacuum of space, but is subjected to external stimulus from the environment with a wealth of information processed by our faculties. We know this because “touch”, “smell”, “sound” are descriptors for this subjective experience: I feel myself floating. I feel the cool air as I breathe. These sensations are governed by bodily participation of the relationship between us and the physical world.

We see the world as one invariable constant, so it is fair to assume that our consciousness is stable and unwavering. That is, until it fails us and our perception is disrupted. Our integrative percept binds us to see ourselves as a holistic entity and we fail to experience ourselves as fragmented. Derrida claims that “Rational consciousness has long retained its position at the centre of the self.”¹¹ He observed that consciousness is stable, reliable and the source of fundamental immobility, whereas the unconsciousness is unstable, volatile and dangerous.¹² However, it is unlikely that the agent is entirely decentred nor entirely unified: it would imply they are bordering psychosis or they are absolute subjects.¹³ Lacan describes this subjectivity is reconfigured from various loosely-processed sensory impressions, and continuously confronted by the ‘Other’.¹⁴ If the self is the centre of the structure-immobile and stable—the ‘Other’ comprises all of reality and external presence in which its instability continuously questions the unified self and renders it precarious and vulnerable.¹⁵ The

⁷ “From Margin To Center: The Spaces Of Installation Art, Understanding Installation Art: From Duchamp To Holzer, Installation Art In The New Millennium: The Empire Of The Senses, And Installation Art: A Critical History”, *Caareviews.Org*, 2017 <<http://www.caareviews.org/centennial/2006>> [accessed 22 June 2017].

⁸ Martin Heidegger, *Being And Time*.

⁹ Olaf Blanke and Thomas Metzinger, “Full-Body Illusions And Minimal Phenomenal Selfhood”, *Trends In Cognitive Sciences*, 13.1 (2009), 7-13 <<https://doi.org/10.1016/j.tics.2008.10.003>>.

¹⁰ “Embodied Cognition (Stanford Encyclopedia Of Philosophy)”, *Plato.Stanford.Edu*, 2017 <<https://plato.stanford.edu/entries/embodied-cognition/>> [accessed 22 June 2017].

¹¹ “Decentering The Self”, *Ktismatics*, 2017 <<https://ktismatics.wordpress.com/2007/06/16/decentering-the-self/>> [accessed 22 June 2017].

¹² *Ibid*.

¹³ Claire Bishop, “Antagonism And Relational Aesthetics”, *October*, 110 (2004), 51-79 <<https://doi.org/10.1162/0162287042379810>>.

¹⁴ *Ktismatics*.

¹⁵ Bishop., 53

self is kept in a state of flux by its external environment and is characterised by its disorder and internal conflict. This has a similar description that is applied to the sublime, that refers to a moment ‘of intense awareness, following an initial moment of disorientation, during which attention peaks and the self is filled with awe’ as opposed to the catharsis of the beautiful.¹⁶ The attention given to the conflict of the unstable self that is exemplified by the experiments of embodied presence and the feeling and presence accompanying is aesthetic.

Rubber Hand Illusion

“The body is to be compared, not to a physical object, but rather to a work of art.”

– Maurice Merleau-Ponty, *The Phenomenology of Perception*

VR has also been used as an immersive technology for research and development into simulating physical reality within cognitive neuroscience and behavioural studies. Yet, it is a medium that has potential to go far beyond anything we have experienced in terms of transcending the bounds of physical reality, through transforming our sense of place and through non-invasive alterations of the sense of our own bodies. It is a distinct medium in its own right to explore the possibilities of creating new forms of experience beyond our physical limitations.¹⁷

VR studies in cognitive neuroscience and behavioural research—such as the full body-illusion, and rubber hand illusion (RHI)—attempt to deconstruct the qualia of embodied cognition. Simulations of the self in variations of place and bodily distortions in extreme and fantastical conditions modify the way we see the world and become transformative. They push past the constraints of sensorimotor capabilities and expand our horizons just as art objects do.¹⁸ By exposing the awareness of our shortcoming as an ‘event’, they disrupt traditional ways of seeing and become aesthetic experiences. These experiments show us the possibilities of VR as an ideal technological medium for discovering the shortcomings of our own perception which leads to a transformative experience by inducing surreal experience.

Embodied cognition—with the surge of new empirical studies related to the area—is a transdisciplinary field that has overturned many traditional cognitive science theories. This framework is a novel position that incorporates the corporeal and the role of the body into the theory of cognition: it explores the situated-ness of cognition; and the ability to offload storage to our surrounding environments.¹⁹ The unique aspect of

¹⁶ Ivan Hagendoorn, "Some Speculative Hypotheses About The Nature And Perception Of Dance And Choreography", *Journal Of Consciousness Studies*, 11.3-4 (2004), 79-110(32).

¹⁷ M. Slater, "Place Illusion And Plausibility Can Lead To Realistic Behaviour In Immersive Virtual Environments", *Philosophical Transactions Of The Royal Society B: Biological Sciences*, 364.1535 (2009), 3549-3557 <<https://doi.org/10.1098/rstb.2009.0138>>.

¹⁸ Annamma Joy and John F. Sherry, Jr., "Speaking Of Art As Embodied Imagination: A Multisensory Approach To Understanding Aesthetic Experience", *Journal Of Consumer Research*, 30.2 (2003), 259-282 <<https://doi.org/10.1086/376802>>.

¹⁹ "Embodied Cognition (Stanford Encyclopedia Of Philosophy)", *Plato.Stanford.Edu*, 2017 <<https://plato.stanford.edu/entries/embodied-cognition/>> [accessed 22 June 2017].

embodied cognition is the idea that our consciousness is not constricted to just our brain: it can be spread to the peripherals of our bodily foundations, and even into our surrounding environments. Our cognition is constantly mediated by our environment. The studies on bodily ownership investigate the relevance of our sensorimotor skills and how the way it feels for us.

An example in the domain of memory in visual consciousness: Imagine you scribble a reminder on a notebook to buy an orange for breakfast—in this case, the tool for remembering (the notebook) and subsequent corresponding and possible actions associated with the note serves as an external aid for the retrieval of information. Of course, not all theories are absolute and embodied cognition takes an extreme stance. In fact, a lot of researchers of embodied cognition find some of these claims very radical.²⁰ Firstly, the definition of embodied cognition is hotly debated, there are six different pathways branching from this core topic. Secondly, how far does embodied cognition take us? If cognition is an array of resources in an extended system, then there are no states of mind—our consciousness will truly be ‘decentred’. Many have proposed a different approach to embodied cognition, and change the framework to what Wilson calls “replacement hypothesis”. However, the focus of this paper reflects on how our cognition is biased on the states of the body and how awareness of the conflict elicits a transformative response, instead of discussing brain-body-environment cognitive systems.

Artists and cognitive scientists in recent years have examined embodied cognition as their subject of inquiry, even though their approaches differ: the former creates novel and creative constructs while the latter deconstructs the phenomenon and quantifies it. There is a plethora of domains associated with embodied cognition—such as memory, concepts and moral cognition—so it is pragmatic to only focus on one. The studies cited in this paper are specifically on the domain of visual consciousness within embodied cognition.²¹ The core theories of visual consciousness within embodied cognition claim that vision is constantly mediated by the situated embodied agent, whose movements are crucial and guided by visual agency.²² The external peripherals of the body and world are not just seen as a source of input and stimuli, but are non-neural substrate for the realisation of visual consciousness. We can use empirical investigations of body perception and self-consciousness to explore the correlating sensations with an aesthetic approach, and tackle the following questions:

- 1) Can body ownership illusions induce aesthetic experiences by questioning our sense of self as an approach to elevate us from our everyday lives?
- 2) Do these illusions refocus our attention to re-experience ability to be aware of the self?
- 3) Is VR as a medium sufficient to explore the questions of self?

Recent studies have shown that synchronous multisensory stimulation of a real and corresponding virtual body can result in body transfer of a limb or even the whole body as strong defendants of the embodied cognition theory. In this paper, we discuss the rubber hand illusion (RHI), long arm illusion and the body transfer illusion in

²⁰ Andrew D. Wilson and Sabrina Golonka, "Embodied Cognition Is Not What You Think It Is", *Frontiers In Psychology*, 4 (2013) <<https://doi.org/10.3389/fpsyg.2013.00058>>.

²¹ "Embodied Cognition (Stanford Encyclopedia Of Philosophy)", *Plato.Stanford.Edu*, 2017 <<https://plato.stanford.edu/entries/embodied-cognition/#EmpDomForEmbCog>> [accessed 22 June 2017].

²² "Embodied Cognition (Stanford Encyclopedia Of Philosophy)", *Plato.Stanford.Edu*, 2017 <<https://plato.stanford.edu/entries/embodied-cognition/#VisCon>> [accessed 22 June 2017].

relation to refocusing our attention to re-experience our decentred selves. In these studies (long arm illusion and body transfer illusion), the experimental protocol includes a head mounted display with visual information contingent on tactile stimulation in the form of stroking or tapping a person's body or limb with its corresponding virtual event. These experiments quantify factors of synchrony and asynchrony in visuo-motor conditions (felt and seen) between virtual and real body part. What these studies found is that basic self-attribution breaks down when multisensory stimulation follows the same spatiotemporal information between the real and virtual limb or body.²³ The user experiences a sudden transfer of sensation to the non-limb. This illusion becomes so salient that it occurs consistently and with a bewildering plausibility. The agent is experiencing disembodiment of his own self, yet a convincing embodiment of the 'Other'. He observes a heightened somatic awareness and becomes more aware of the instability of his own perception by shaping an alternative view of his own body construct and modifying his view on the world.²⁴

A prominent case study that exemplifies this vitalising experience is the RHI. In this study, the experimenter places the subject's real hand in a box out of sight, and a true-to-life rubber hand in the same visuo-spatial location of where the true hand would be if it were placed on top of the cardboard box. Having the rubber hand aligned with the arm so it visually seems to be attached the arm in the same posture of the real hand directly enhances the illusion. The subject is given a few seconds to judge and acknowledge the position of the rubber hand. After the few seconds, the experimenter lightly brushes the subject's concealed index finger congruently with the seen rubber index finger in perfect synchrony. Suddenly, the subject would experience the rubber hand belongs to them as if their hand is transposed to the rubber substitute in a baffling illusion:

"I think it...it genuinely beginning to become hard to tell whether it...yeah...I mean...it's beginning to feel like...yeah I'm buying it. It's stroking my hand. Part of my brain is telling me that it's not possible that that's happening, you know, and when you're not touching it, I go, no, not happening then you touch it and I'm like yeah you're feeling it there. There's no question that that is my hand (rubber hand) you're touching."²⁵

"Something changed, something changed in the sensation, and then after a while, well, I felt the... I felt not only the brush on my hand here, there, (on the rubber hand), but I also felt the contact of my fingers with the piece of cardboard (under the real hand)."²⁶

²³ Konstantina Kilteni and others, "Extending Body Space In Immersive Virtual Reality: A Very Long Arm Illusion", *Plos ONE*, 7.7 (2012), e40867 <<https://doi.org/10.1371/journal.pone.0040867>>.

²⁴ Annamma Joy and John F. Sherry, Jr., "Speaking Of Art As Embodied Imagination: A Multisensory Approach To Understanding Aesthetic Experience", *Journal Of Consumer Research*, 30.2 (2003), 259-282 <<https://doi.org/10.1086/376802>>.

²⁵ <https://www.youtube.com/watch?v=DphlhmtGRqI>

²⁶ Camila Valenzuela Moguillansky, J. Kevin O'Regan and Claire Petitmengin, "Exploring The Subjective Experience Of The "Rubber Hand" Illusion", *Frontiers In Human Neuroscience*, 7 (2013) <<https://doi.org/10.3389/fnhum.2013.00659>>.



Fig.3 National Geographic clip showing the Rubber Hand Illusion www.youtube.com/watch?v=DphlhmtGRqI

There is no doubt it was a moving experience for the subject, as he pondered: “part of my brain is telling me that it’s not possible that that’s happening, you know, and when you’re not touching it, I go, no, not happening then you touch it.” For the subject, the staging and execution of the event elicited a profound experience for the viewer.²⁷ He is now solely focused on the sensations of his index finger and it becomes paramount to him as he struggled to find words to describe his feelings. Hagendoorn said when referring to aesthetic forms: “Just how indeterminate and conflicting aesthetic experience can be, is exemplified by the many words we use to describe our feelings, or indeed our struggle to find the words that carry exactly the right subtleties. This does not attest to the inadequacy of language, but rather to the complexity of the feelings involved” The subject becomes aware of his bodily sensation transferred to something that is conceptually “not his” and the event mars yet expands his knowledge of himself. His own perception fails him, and his body extends its borders beyond his physical form. This is characteristic in experiments of body ownership: the study of a person’s feeling ‘mineness’ or sense of bodily self. This ‘mineness’ refers to both sensation and a representational concept of the self: our brains innately have a representation of our bodily location and sensations called the body schema and a neural capacity to imitate.²⁸ Somatosensory, proprioceptors and visual cues attest to our bodily awareness.

This experiment is also an example of pre-reflective awareness of the self in visual consciousness, which is inherent in the subjective feeling of ‘mineness’. It is important to distinguish pre-reflective with reflective introspection of oneself as a self-narrative. Pre-reflective consciousness is the “awareness we have before we do any reflecting on our experience”²⁹; it always comes before an explicit reflective self-consciousness. It is the awareness that “I feel ticklish on my right foot”. In Osmose, that “I feel weightless”. I would argue for a type of aesthetic stance related to pre-reflective awareness where Kant’s “detachment from action thus is not meant to preclude emotional involvement

²⁷ Annamma Joy and John F. Sherry, Jr., "Speaking Of Art As Embodied Imagination: A Multisensory Approach To Understanding Aesthetic Experience", *Journal Of Consumer Research*, 30.2 (2003), 259-282 <<https://doi.org/10.1086/376802>>.

²⁸ Giovanni Berlucchi and Salvatore Aglioti, "The Body In The Brain: Neural Bases Of Corporeal Awareness", *Trends In Neurosciences*, 20.12 (1997), 560-564 <[https://doi.org/10.1016/s0166-2236\(97\)01136-3](https://doi.org/10.1016/s0166-2236(97)01136-3)>.

²⁹ Shaun Gallagher and Dan Zahavi, "Phenomenological Approaches To Self-Consciousness", *Plato.Stanford.Edu*, 2017 <<https://plato.stanford.edu/entries/self-consciousness-phenomenological/#PreRefSelCon>> [accessed 22 June 2017].

but rather promotes a receptiveness, where the pause of in action allows the experience to play with our emotions, sensorimotor resonance and potentially with our memories and imagination.”³⁰ The paramount sensation felt during states of pre-reflective awareness is affirming the stance that aesthetic experiences should be “strong and automatic”, and that “many emotional and embodied responses (aesthetic experiences) are hypothesized to take place involuntary and below awareness” an aesthetic experience. But, this not exclude explicit mental attitudes of aesthetic involvement.³¹ The subject can have an aesthetic experience in the involuntary state, then impose their aesthetic judgement on the experience. In essence, the feeling of ‘mineness’ is grounds for a pre-reflective aesthetical stance.

Often, body ownership is associated with studies of motor events generated by a person’s body and their corresponding agency. An important aspect of embodied cognition is the relationship between perceiving-acting.³² This particular theory in relation to task-related methods of embodied cognition suggests that perception is not passive reception, but active exploration of the environment.³³ However, the RHI and subsequent studies (long-arm illusion and body transfer illusion) only investigates an embodied cognition that is pre-reflective and passive, which focuses on reception, emotion and imagination. I would like to make a distinction between passive viewing and an active viewing with a sense of agency in pre-reflective awareness. Pre-reflective self-awareness involves both self-ownership and also a sense of agency.³⁴ The sense of agency is knowing that I, the subject, is in control of my movements and actions whereas self-ownership is the feeling of an event that is happening to me: the experience of something happening to my body. Char Davies, in essence, incorporates the sense of agency in Osmose, which is known to enhance the perception of ownership and being in place.

Somatoparaphrenia Patients and Minimal Phenomenal Selfhood

In order to understand how and why RHI occurs, we must dissect the correlating neurological faculties. This process of investigation is what Metzinger called the “minimal phenomenal selfhood”; this idea originated from Zeki’s method of looking for neural correlates of visual consciousness which is highly debated. The fundamental criteria for a minimally sufficient condition for phenomenal self is:

- 1) It is the simplest form of self-consciousness.
- 2) It takes place in a disembodied, non-neural, artificial system possessing no effectors.³⁵

While it is important to consider the neural correlates of partial body embodiment as a cause-and-effect neurological basis, it is vital to note that this method of investigation is not sufficient evidence for visual conscious experience.³⁶ Zeki argues that our

³⁰ Alfonsina Scarinzi, *Embodied Aesthetics*.

³¹ *Ibid.*, 8

³² Andrew D. Wilson and Sabrina Golonka, "Embodied Cognition Is Not What You Think It Is", *Frontiers In Psychology*, 4 (2013) <<https://doi.org/10.3389/fpsyg.2013.00058>>.

³³ Shaun Gallagher and Dan Zahavi, "Phenomenological Approaches To Self-Consciousness", *Plato.Stanford.Edu*, 2017 <<https://plato.stanford.edu/entries/self-consciousness-phenomenological/#PreRefSelCon>> [accessed 22 June 2017].

³⁴ Lawrence A Shapiro, *The Routledge Handbook Of Embodied Cognition*.

³⁵ Olaf Blanke and Thomas Metzinger, "Full-Body Illusions And Minimal Phenomenal Selfhood", *Trends In Cognitive Sciences*, 13.1 (2009), 7-13 <<https://doi.org/10.1016/j.tics.2008.10.003>>.

³⁶ "Embodied Cognition (Stanford Encyclopedia Of Philosophy)", *Plato.Stanford.Edu*, 2017 <<https://plato.stanford.edu/entries/embodied-cognition/#VisCon>> [accessed 22 June 2017].

conscious percept is an integrated image of multiple microconsciousness binded together—a decentered self.³⁷

Somatoparaphrenia patients are studied as they exhibit behaviourally and physiologically equivalent symptoms related to the loss of ownership for a body part. Somatoparaphrenia patients encounter damage to their right temporo-parietal cortex, which induces a rare sensation of misattributing their hand to belong to another person. Most likely it is someone familiar to the patient.³⁸ Crucially, the patients experience this illusion in their contralesional hemisphere. What this means, is that any damage occurred in one lobe—let us say right somatosensory lobe—will affect any body part on the left side. This illusion never occurs in the ipsilesional body part (same side). In this case, the right temporo-parietal cortex is damaged, so the opposing side of the lesion is the left hand of this particular subject. Let us call her Patient A.

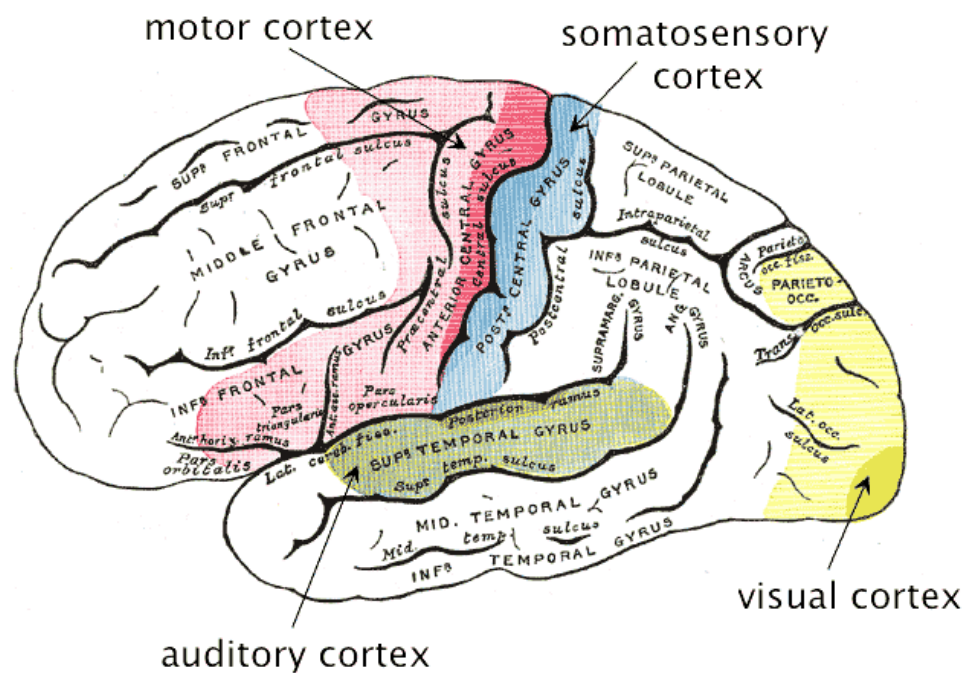


Fig.4 Neurological processing of the temporo-parietal lobe and all its associative modalities.

But first, a background of this modality’s function: The right-temporo parietal lobe of the somatoparaphrenia patient lies between the temporal and parietal lobe of the cerebral cortex. This is important because this area is known for its integrative function of the modalities around the gyrus, which means it is part of processing more complex brain functions and coordinating information as opposed to any one-to-one input-output stream as in simple sensory processing. It is a modality known to be responsible for the theory of mind and lower-level, bottom-up processes of reorienting attention.³⁹ The temporoparietal junction is more specifically a processing system named after the coordinated interaction between the medial prefrontal cortex and the

³⁷ S. Zeki and A. Bartels, "Toward A Theory Of Visual Consciousness", *Consciousness And Cognition*, 8.2 (1999), 225-259 <<https://doi.org/10.1006/ccog.1999.0390>>.

³⁸ Metzinger., 10

³⁹ S. C. Krall and others, "The Role Of The Right Temporoparietal Junction In Attention And Social Interaction As Revealed By ALE Meta-Analysis", *Brain Structure And Function*, 220.2 (2014), 587-604 <<https://doi.org/10.1007/s00429-014-0803-z>>.

posterior temporal gyrus.⁴⁰ It is formally known as a heteromodal association cortex, which is a type of modality that integrates sensory information from the lateral and posterior thalamus with visual, auditory, somesthetic and limbic areas. With its capacity to form connections between these sensory and motor areas, the junction plays a critical role in comparing signals arising from self-produced actions with input from the environment.⁴¹ This area is critical in the discussion of agency and motor in embodied cognition.

Somatoparaphrenia patients experience problems that can break down ownership of partial body parts: a condition necessary to elicit transfer of ownership to a body part that does not belong to the participant's, as seen in the Rubber Hand Illusion. Patient A is a woman with this temporoparietal damage caused by blunt force trauma describes seeing her hand as her sister's; she jokes and composes poems on looking for her lost hand:⁴²

(Translated from Italian) "I am looking for my little hand, which I lose every morning, I am looking for it and do not find it, where will it be, para papa? It will be with other hands to play their game. Yes, play on your own tomorrow, but your life belongs to me pere pepe pere pepe. Come back, I wait for you—you know the way little hand..."⁴³

⁴⁰ Jean Decety and Claus Lamm, "The Role Of The Right Temporoparietal Junction In Social Interaction: How Low-Level Computational Processes Contribute To Meta-Cognition", *The Neuroscientist*, 13.6 (2007), 580-593 <<https://doi.org/10.1177/1073858407304654>>.

⁴¹ *Ibid.*, 581

⁴² Matteo Pugnaghi and others, "'My Sister'S Hand Is In My Bed': A Case Of Somatoparaphrenia", *Neurological Sciences*, 33.5 (2011), 1205-1207 <<https://doi.org/10.1007/s10072-011-0874-z>>.

⁴³ Matteo Pugnaghi and others, "'My Sister'S Hand Is In My Bed': A Case Of Somatoparaphrenia", *Neurological Sciences*, 33.5 (2011), 1205-1207 <<https://doi.org/10.1007/s10072-011-0874-z>>.

Io cerco le mie manine
le cerco, ma non le trovo
chissà dove sarò
parò parò parò parò
Sarò con altre mani
e giocarsi una partita
me vinci il mio dome
ni, perché tu appartieni
a me, ferì ferì ferì ferì
Mai tutti ti aspettiamo
da noi sarai festonate
non fare le blichine
ritorna oh mie manine
parte a noi felicitè
Parò parò parò parò

Fig.5 Somatoparaphrenic patient describing her condition.

Long Arm Illusion

We have seen in the previous section that the sudden extension of the feeling of ‘mineness’ of your bodily self forms the basis for an aesthetic event that gives the user a sublime experience due to a shock in response to the sensation. It includes the elucidation of different aspects of embodied cognition and argues that this paper focuses on passive embodiment of the self in the visuo-tactile domain. I have also backed up the theory of the RHI with neural correlates of partial body ownership in somatoparaphrenia patients. The subsequent section explores the long arm illusion that builds on the RHI, but includes elongating and distorting a virtual arm using VR equipment. In this section, we will exploring whether the surreality of VR experiences is essential to the sublime experience.

The experimental procedure begins with the subject standing with his dominant right hand outstretched onto a cardboard box lined with green felt. The subjects were not allowed to see the boxes in reality so they were wearing a HMD set at the start of the experiment that immerses him in the virtual testing world. This environment is modelled in a Cartesian space with StudioMax, including a virtual box equivalent to the size and shape to real box the subject is touching. In the virtual world, the subject has an avatar with a virtual arm, seen in first person perspective: the body is not seen unless he looks down and sees his chest, and sees a virtual arm extended in the same spatial location as his real arm. The participant’s height and arm length are measured to simulate the control for inverse kinematics. The VR sensors tracks his head and body position, location and orientation, and the virtual body moves synchronously to the subject’s actions. The subject is then asked to stroke the stimulus box, and in every subsequent iteration, the stimulus box progressively moves away along the depth axis while the virtual limb elongates to maintain visual contact with the tactile sensation of the felt box. The virtual hand keep in sync with the real hand’s stroking movements, so any felt contact with the texture is seen touching the box to maintain visuo-tactile correlations.⁴⁴

⁴⁴ Konstantina Kilteni and others, "Extending Body Space In Immersive Virtual Reality: A Very Long Arm Illusion", Plos ONE, 7.7 (2012), e40867 <<https://doi.org/10.1371/journal.pone.0040867>>.

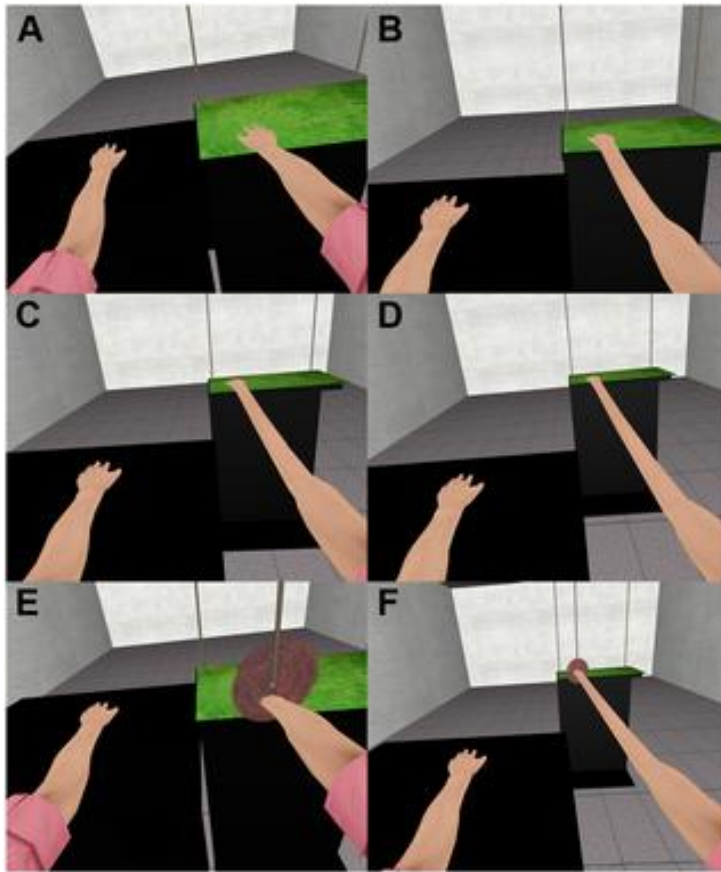


Fig.6 Inside the virtual environment: A Showcase of the long arm illusion

In the congruent condition, the participant's hand touches the stimulus box in the same location, posture and position of the virtual hand. The subject is asked to feel the material, and the same gesture and visuotactile feedback is identical to the virtual world's. In the incongruent condition, the stimulus box is instead placed four meters in front of the subject's in a reachable position so that the virtual movement is the same as physical, but the subject does not see the hand touching the box when he feels the softness of felt. This incongruity measured against the synchronous condition tests how far gross asymmetries in the fake body elicits the illusion.

This task includes the aspect of agency in the experimental procedure. As mentioned before, there is a difference between in passive ownership experience or an task-oriented embodied cognition—the radical hypothesis in embodied cognition involves an active agent that assembles its resources in the environment, brain and body into a system to solve the task at hand.⁴⁵ Now that action is involved, as the agent requires a form of interaction with the world, the subject now has a sense of agency. Agency is all the probable events and outcomes of voluntary actions an agent can make in possible actions an environment has provided for them.⁴⁶ It is also known as the feeling that the agent is directly in control of and the cause of the actions and subsequent responses of these actions. In the case of RHI, there is a sense of ownership but not agency; whereas in the long-arm illusion, control of motion is built into the VR experience.

⁴⁵ Andrew D. Wilson and Sabrina Golonka, "Embodied Cognition Is Not What You Think It Is", *Frontiers In Psychology*, 4 (2013) <<https://doi.org/10.3389/fpsyg.2013.00058>>.

⁴⁶ Konstantina Kilteni and others, "Extending Body Space In Immersive Virtual Reality: A Very Long Arm Illusion", *Plos ONE*, 7.7 (2012), e40867 <<https://doi.org/10.1371/journal.pone.0040867>>.

More importantly, voluntary action is proposed to induce a stronger response in body ownership and facilitates self-recognition.⁴⁷

The long arm illusion tests how flexible the body schema is and how far it can accommodate for experiencing an extended arm as one's own. What they found was that there is a large margin for which our bodies can accommodate for owning foreign parts. Our internal body representation can be significantly altered and that body representation is highly flexible. Kilteni argues for the reason to be that body ownership illusion is dependent on both “top-down” processing of implicit prior body knowledge, and “bottom-up” sensorimotor information. These bottom-up processing are able to interrupt the top down processing and produce a conflict in our perception. This shows the amount of plasticity of body representations and how easily malleable and deceivable our cognitive systems are.

In Osmose, Char Davies explored how our bodies respond to impossible visual movements of our body. Ramachandran claims that “The purpose of art is to distort reality”, and these experiments successfully prove that we can even embody surreal equivalents of our selves. These simulations also turn our body into an object to be viewed, and simultaneously unsettle yet expand concepts of self in a phenomenological way. In concordance with the RHI, this study also proves that body ownership works in VR with a human avatar and makes the illusion even stronger. The aesthetic experience is meant to “play with our emotions, sensorimotor resonance and potentially with our memories and imagination.”⁴⁸ and VR with its set constraints but limitless possibilities of representation can extend our views of the world even further than just mere imitation.

Body Transfer Illusion

This section is dedicated to bringing global ownership studies as part of the embodied cognition problem. This study is worth mentioning, because all the previous studies focus on solely partial representation. However, in order to exist as a fully embodied person in another space, we must consider a more holistic representation of the self as shown in this study on global ownership. This experiment explores whether remapping of the body schema can be extended to the full body. Moreover, this section argues for the ‘out of body’ experiences subjects experience in this illusion as a transformative and sublime moment.

Slater et al. in “First Person Experience of Body Transfer in Virtual Reality” simulated a body transfer illusion using new technology in VR to explore visuo-tactile synchrony as a contributing factor in ownership illusions.⁴⁹ Specifically, he was exploring visual and tactile synchrony independently and the saliency of a one versus third point perspective. In his study, seated participants entered a virtual reality equipped with HMD and motion-tracking sensors. Upon entering the virtual scene, they see a furnished room with a television, sofa and see a virtual chair the same height and size

⁴⁷ Konstantina Kilteni and others, "Extending Body Space In Immersive Virtual Reality: A Very Long Arm Illusion", Plos ONE, 7.7 (2012), e40867 <<https://doi.org/10.1371/journal.pone.0040867>>.

⁴⁸ Ștefan-Sebastian Maftei, "Aesthetics And The Embodied Mind: Beyond Art Theory And The Cartesian Mind–Body Dichotomy", *Studia Phaenomenologica*, 16 (2016), 602-607 <<https://doi.org/10.5840/studphaen20161624>>.

⁴⁹ Mel Slater and others, "First Person Experience Of Body Transfer In Virtual Reality", Plos ONE, 5.5 (2010), e10564 <<https://doi.org/10.1371/journal.pone.0010564>>.

with the one they are physically sitting on. Looking up, they see a woman stroking their shoulder and to the left, they would see a girl in the mirror looking back at them synchronised with the participant's movements and gestures.



Fig.7 Inside the virtual environment: Screenshots of the Body Transfer Illusion

He constructed of the scenario into three variations: in the first case, they are seeing themselves in a first perspective with the setting as described. In the second case of a third perspective, the viewpoint shifts to the right of the girl's head in line with the mirror so the participant can observe the synchronism of his movements with his avatar. In the third case, the older woman virtually slaps his avatar in a first person wide angle perspective. The three variables were perspective, movement and touch: the first and third perspective were manipulated independently, movement synchronous to the participants' were constant and touch varied synchronously and asynchronously.

Sensorimotor equivalence is induced when there is a first-person perspective and when participants are able to use their body for perception. What Slater found was that sensorimotor contingencies increased the illusion of place more than visuotactile synchronisation.⁵⁰ In other words, ownership simply elicits the illusion, whereas the ability to have agency to act on the virtual world truly immerses a person within the given situation. The two factors are mutually dependable on each other: a salient experience of ownership strongly induces a believable illusion of place. Concurrently, a sense of place is important to be plausible for the agent to believe that the situation is actually occurring and how he must react to it. As of now, VR is the ideal medium in which to push the boundaries of a person's decentred self with distortions of the body,

⁵⁰ Mel Slater and others, "First Person Experience Of Body Transfer In Virtual Reality", Plos ONE, 5.5 (2010), e10564 <<https://doi.org/10.1371/journal.pone.0010564>>.

thanks to its exceptional ability to situate the viewer as though he were “there”. This phenomenological experience is coined as “presence”. Presence is an experience of “being there” in a mediated environment. It is feeling as if you were feeling situated in a place and realizing your body is situated in the present. It has both spatial and temporal aspects to it. It depends on the factors of self-location, identification with the body as a whole, sense of ownership of the body and an egocentric perspective. You feel as though you inhabit a place in the world, and a subjective experience of an awareness of your body in relation with the world. VR is ideal for this because of its ability to immerse the viewer, in which immersion is associated as feeling emotionally engaged in an environment.

As with the RHI, this event induces a moment of surreality for the viewer. The most notable quality of this illusion is the immediacy and the ferocity of engagement. Participants were recorded saying that it was “intense and incredibly fast” when confronted with this illusion. They feel the hand stroking their body that conceptually they know is not theirs, yet own the sensation regardless. They are both intertwined in the illusion and the self and other, and blurred the boundaries between embodying two separate forms. The full-body transfer is a more immersive illusion compared to the RHI and long-arm experiment. One of the subjects noted that he “felt as if I was back in my childhood and looking at my mother”. The sensations induced come from the subject’s repertoire of memory. These out-of-body experiences not only create a complete immersion of the subject in its environment, but also engage in memory and imagination. What is also extraordinary in this experiment is that the participants were able to fully immerse in the situation even though the subject and their avatar did not share the same gender. The cause of gender switching is so they can test how radically different the form can be from the viewer’s. In all these conditions, the viewer reaches a moment where he struggles to remediate the contradictory and indeterminate feeling between unity and incompleteness.

Concluding Perspectives

Insofar, this paper has explored the disruptive and transformational experience of unstable self-representations and the phenomenal aspects of self-consciousness as the experience of “me” and “mineness” through embodiment of the self in several VR experiences: in *Osmose*, the long arm illusion and body transfer of ownership. I have summarised key concepts of “being” and self-consciousness, but this paper’s aim is not to provide an answer to these ontological questions. Rather, this paper serves to argue for VR as a platform to discover the instability of self-representation, and for the event to be an aesthetic one as a new way of thinking about VR installations. This paper also situates itself in the framework of embodied cognition as an exploration of the qualia of visual self-consciousness in embodied cognition guided by visual agency and ownership instead of the plethora of other domains. We have used multiple commentaries of subjects in these experiments of descriptions into their personal experiences as the method of deconstructing these events: it serves as a looking-glass into their phenomenal journey.

As we have seen, these VR experiences elevate us from our daily lives as they lift us from the mundane and place us in these sublime experiences. Without these experiences, we would not have been so aware of our self-representations as so fragmented and incomplete to blur the boundaries between our self and other. As Laclau and Mouffe said, “we are confronted with a different situation: the presence of the ‘Other’ prevents me from being totally myself. The relation arises not from full totalities, but from the impossibility of their constitution.”⁵¹ We become displaced from our bodies in these out-of-body events, and alter our self-representation. Do we necessarily need these surreal experiences in order to create the event of re-experiencing self-awareness? I would say yes, since we require the feeling of the ‘Other’ and a modification on how we perceive the world. The experience of disembodiment defies what we know of our bodies and requires us to experience an event that is beyond our perception. This purpose of surreality is a lens to refocus the attention to our selves and to expand beyond our own awareness. Such as in the RHI, long-arm and body transfer illusion, the allocation of attention is a crucial factor in the awareness and experience of the event. These efforts bring our awareness from the background to the foreground. A simple mimicry of reality is unable to achieve this because we are adapted to the world and the experience of our own perception remains invisible to us unless we step outside it thus revealing its properties.

There is an element of vulnerability once we submit ourselves to the HMD and expose ourselves to the vast possibilities of perception. This vulnerability and openness is an essential attitude in order to experience aesthetic events. As in installations such as *Osmose* and the experiments of ownership, the viewer has to ritualistically step into the space of immersion delineated by the VR apparatus, rendering him physically helpless to any external stimuli. We succumb to these experiences. VR is an ideal medium for experiencing the awareness of the self, because unlike installations or flat representations, VR is able to fully simulate all aspects of our perception, such as our proprioception and visuo-motor perception. The central goal of VR is to create the feeling of presence and immersion. Slater

⁵¹ Claire Bishop, "Antagonism And Relational Aesthetics", October, 110 (2004), 51-79
<<https://doi.org/10.1162/0162287042379810>>.

proposes that to have a successful immersive virtual environment, it must be made in perfect fidelity to the environment. While this may be true to a certain point, I would say a perfect mimicry completely embodies the viewer in the virtual world and the aesthetic experience would only come after the headset is taken off and the viewer reflects on his experience. Whereas the sublime experience, and focus on the awareness of oneself is solely achieved by feeling the tension and conflict between conceptually knowing oneself is disembodied yet feel embodied within the experience. It is a perfect tool to explore our decentred selves.

As a concluding remark, VR remains an exciting new technology to explore new avenues of representing the self embodied in the world by transforming our knowledge and experience of our reality and to broaden and vitalise the phenomenon of our “being”. It would be beneficial for artists and scientists to use this growing medium to deconstruct and create novel experiences to allow us to re-experience our consciousness, and to elevate our perception of the world.

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