6.
# Embodiment and the Perception of Nonhuman Sentience in Virtual Reality Interactive Art

Nicola Plant

The exploration of our understanding of a human experience is a key function behind art and performance, offering modes of thought that intend to express alternative perspectives on the human situation. As human experience is underpinned by our embodiment, artistic expression is in its form privileged to contribute an insight as it creates an experience that is inherently visceral and by its very nature deals in direct sensorial engagement with the body.

To be embodied is the fundamental condition of human experience. For each of us our individual embodiment is characterised experientially through direct sensorimotor perceptual feedback and kinaesthetically from a set of movement possibilities, all provided moment-by-moment through our body. We cannot move or act in the world without understanding ourselves as embodied beings. Further, our experience of embodiment extends beyond inhabiting a body to the experience of that body within its environment, but also as a body interacting with other embodied beings.

Immersive and interactive technologies, such as virtual reality, offer a medium for artists to mediate the interconnection between sense perceptions of our body, the physical environment, and other embodied beings with computational processes. Creating a mediated reality in this way lends the potential for artists firstly to envision and imagine alternative ways of perceiving a shared external world but secondly to interrogate our existing processes and approaches of perception.

Figure 6.1. Alexandra Adderley and Nicola Plant, title Image of *Sentient Flux, 2015*. To experience the artwork, users wear a virtual reality headset and headphones and are instructed to stand in front of a depth camera to track their movement. The virtual environment is a dark, underwater-like scene where users stand in the centre of a round organic cave structure with light flecks floating in the air. Users interact with glowing particles that swim around their hands, arms and body in response to and in time with the users movements. Users listen to a 3D soundscape of quietly humming machines and bells intended to provoke a sense of meditative contemplation. Image credit: Alexandra Adderley and Nicola Plant, 2015.

## Embodied Cognition and Interactive Art

The experiential form of interactive art such as that exemplified in *Sentient Flux* speaks to the recent movement in the cognitive sciences towards an embodied cognition. Taking a phenomenological perspective, embodied cognition asserts that thought is inseparable from the body. Thought is via, through and an act of the body itself (Varela et al 2017: pp. 147-185). Embodiment is a fundamental component to the experience of reality, or in Heideggerian terminology a sense of 'being-in-the-world', offering the capacity to interact with the world and others in it (Dreyfus 1991: p. 8). The embodied affordances available when creating interactive artwork, especially in immersive media such as virtual reality, leave the opportunity for an artist to create a *not-quite-reality*, presented in a form that can be contemplated in the same embodied way as though it were reality, as a world understanding is not separate from our exploration of it (Penny 2019). Interactive art that presents computationally mediated ways of experiencing our embodiment have the potential to disrupt, alter and enhance the perceptual

nuances that hold together the way human experience unfolds, for not only our relationships with the physical but also the social structures with other sentiences within which an understanding of the world is formulated.

*Sentient Flux* was created out of a curiosity in virtual reality and movement tracking technology as a medium holding the potential to elicit alternative viewpoints on our reality, or more specifically a strategy to understand how we perceive embodied reality. *Sentient Flux* is a VR artwork that immersed the participant in glowing particles that interacted with the body and the piece intended to see if users interacted back to the particles as if they were sentient (Figure 6.2).

The piece asks; what are the fundamental conditions for the user to perceive something computer generated or artificial as sentient when the perception of the entity is reduced to its movement alone? Somewhat like a movement-based Turing test, but instead of testing whether there is a human behind in interaction; the work intends to test the constitution of nonhuman sentience.

The particles' embodiment (or form) is available, as simulated visual information, to the user only via the particles' movements. The piece questions if these particles might interactively move in such a manner that the user perceives a sympathetic connection between their movements and their own. What sort of connection indicates to the user that particles are exhibiting an awareness of the user's existence? Is there a quality of interactive movement dynamics exhibited by the particles that contribute towards expressing a nonhuman or artificial sentience?

Figure 6.2. A user of *Sentient Flux* interacting with glowing particles that responded when agitated by the movement of the body. The particles reactive movement patterns are generated by using the human user's body as a repellent or attractive force. In this sense, the particles have a three-dimensional awareness of where the user's body is in local space. A representation of the user's body is constructed from a depth map of the real-world surroundings as detected by a depth camera, giving the particles a view of the user's embodiment. A small amount of turbulent movements was added to these forces so their movement was not always moving towards or away from the user in a linear fashion; this was programmed into the piece with the view to give the particles an artificial sense of their own volition, or possessing mind of their own, rather than being simply reactive to the movement of the user. Image credit: Alexandra Adderley and Nicola Plant, 2015.

## Presence in Virtual Reality

Virtual reality experiences can mimic the affordances of physical reality as spatial and temporal aspects of experience by retaining the conditions to which they are organised. For example, the affordances allowed by of our embodied interactions with the real world can be retained, such as our viewpoint changing with the orientation and position of our head and body, or using our hands to manipulate objects in the virtual environment (Gillies 2016: p. 3).

For Michael Madary and Thomas K. Metzinger (2016), virtual reality experiences can be processed by audiences as analogous to everyday experience in all its cultural and social context (Madary and Metzinger 2016, p: 4). However, for a virtual reality experience to be fully immersive and to deliver the impression of being in another world, it must hold a sense of presence. If successful, this sense will cause the user to suspend disbelief and instinctively respond to their environment as though it were real (Slater 2009: p. 5). This is an important aspect in the decision to use virtual reality as a medium for *Sentient Flux*. In order to draw insights about the processes behind our everyday embodied perception of movement and other entities, the experience of the work must be considered in the same way as everyday perception and reality. In other words, experience must be experienced within itself and cannot be experienced from the outside; it must be in first person, and importantly for this piece, an embodied perspective.

In Janet H. Murray's (2020) critical analysis of virtual reality experiences she points out that previous experience with the medium itself will guide how users approach interacting with an immersive experience. This point was reflected in the user's response to *Sentient Flux*, as at the time of exhibition virtual reality experiences, especially those that involved movement interaction, were novel to the public. This led to the piece needing to be facilitated by the artist or a gallery assistant to instruct users to move their body in order to experience the piece fully. Otherwise, users might not have understood that they had agency over their movements in the virtual environment at all.[2]

**Bodily Form in Virtual Reality**

Drew Leder (1990) explores the phenomenological experience of being embodied, suggesting sense-perception is not regarded as 'thought' but is a more visceral form unique to the body. Leder argues that a sense of self, or the ability to self-reflect, is only achieved in the presence of a 'foreign gaze' (Leder 1990: p. 96). The apprehension of an embodied Self is only defined in the eyes of another or, as originally explored by Maurice Merleau-Ponty (1971), 'such intersubjectivity draws upon an intersubjectivity implicit within my own body. In gazing upon or touching itself, my body actualizes 'a sort of reflection' (Leder 1990: p. 23). Leder

[2] Further, shortcomings of the virtual reality hardware, such as the heaviness of the HMD on the user's head and face, being tethered by cables limiting the user's ability to walk around very far and the absence of tactility, taste, and smell all contribute and shape the experience of immersion and illusions of presence.

proposes that ‘mutual incorporation' or Merleau-Ponty’s notion of intercorporeality, entails an individual's capacities and interpretations to find extension through the lived body of the Other.

*Sentient Flux* presented the user with a foreign embodiment in the form of a transparent, shadow-like avatar body that flashed with a faint blue light, a material unlike real skin or flesh, not quite human, but other. The avatar body had arms, legs and a torso in the general proportions and with the same movement potentialities of a human body. Although users would look down and observe their avatar perform their full body movement, they would perceive their embodiment in an alternative and alien form to their own. Observing a foreign body performing induces a sense of a foreign gaze, an observation of the user’s own movements from an outside perspective that intended to highlight or make more apparent to the user the nuances behind their own expressions.

**Embodiment and a Constitution of Sentience**

To constitute is the mental process that forms a concept via the connection of other known structured objects of thought. To constitute another sentience, the experience of our own embodiment is fundamentally implicated in this process as it is both reference point and the means for interacting with the embodiment of other beings. It is this interaction that generates a further layer of expressive phenomena, spanning the social and cultural concepts in which we formulate a shared understanding of each other. Returning to Merleau-Ponty’s notion of intercorporeality, there exists a mutual understanding of the body as bearer of expressions and intentions reciprocal to ourselves (Merleau-Ponty 1964: p. 168). This intercorporeal relation within an embodied interaction is primary to us, we understand each other as sentient without theoretical inference or by simulation, but this constitution occurs as a direct relation between people (Scheler 2017: p. 31). *Sentient Flux* considered whether these expressions or intentions can be recognised if the interacting body that bears them is reduced to being represented by movement alone, and if so, must there be a specific quality to these movements? What would they look like? Not only this, but what can we understand about how we constitute sentience if we can attribute expressivity and intentionality to a nonhuman entity represented by moving particles?

Jordan Zlatev (2007) breaks the constitution of sentience down into different levels of intersubjective understanding, including states like attention, intentions and emotions. The most basic foundation of intersubjectivity is bodily mimesis. He scaffolds intersubjectivity through stages of mimetic representation. The projection of another's sentience out of bodily mimesis occurs during a cross-mapping of another's action onto one's own proprioception in a kinaesthetic sense (Ziemke et al 2007). Our own embodiment is crucial as a reference for understanding the actions of others through bodily mimesis. Further, *Sentient Flux* suggested that for there to exist a sense of intersubjectivity within an interaction with a sentient entity then this mimetic process would be reciprocal; the act of mimetically moving together would allow the user to consider that a sentient entity is producing the particles' movements.

*Sentient Flux* intended to reveal the affective movement features that are prerequisites to recognising sentience in movement. The movement of the interactive particles manifested without any iconical or indexical content, such as gesturing symbols or objects. In other words, any expressive phenomena depicted by the particle system was not in the form of gestures of physical objects or actions, but instead took on a more abstract representation of the affective dimension in its movement dynamics. The movements were generated out of a particle system that possessed no bodily form but emerged energetically around the user's hands, arms and body (Figure 6.3). The movement of the particles responded mimetically to the user's expressions, with a view to determine whether this simple mimetic movement evoked a sense that the essence portrayed by the particle system was empathetic to the user's inner experience. An expression of our affective or emotional states is manifest in how we navigate the external world. The dynamic qualities of our expressions and actions go toward revealing the affective dimension that produced them. Take the example of getting up from a chair: When the sitter gets up out of the chair in a slow and careful manner, we can predict they are feeling tired or weary. In contrast, by getting up out of the chair quickly our sitter might be excited to attend something or perhaps they are jumping up in a panicked frenzy. It is argued that a reaction to the world can be manifest physically and emotionally and that these manifestations are perceived unmediated by others (Foster 2005: p. 89). Returning to Zlatev's bodily mimesis and moving together as indicative of sentience, the particles in *Sentient Flux* mimetically reflect the user's movements, revealing an affective dimension; does this contribute to the illusion that the particles are sensitive to the emotions behind the movements?

Figure 6.3. Digital Photograph of a user interacting with *Sentient Flux* with projection of viewpoint on an adjacent wall. Once the users of Sentient Flux entered the virtual environment it was not always immediately obvious to them that they could interact by moving. Users took time to look around first and it was only when they noticed that they had a bodily form that they would start to move their arms and legs. Judging from the vocal exclamations and surprised facial expressions; the moment that the user discovered their body, the movement affordances they had and the presence of the particles reacting to their movements was a marked moment in the experience for many. Users extended their arms and reached out as if to grasp the particles, starting the interaction by waving their hands around or flicking the particles away with their fingers. These exploratory acts led to dancing or performing with the particles as though the particles were an entity sharing the virtual space. Although the experience is presented to the user through vision – users seeing the virtual environment in the stereoscopic lenses of the head mounted display – by viewing their moving body users could sense their own embodiment and the computationally mediated experience unfolding around it. In this sense virtual reality served as a virtual interface offering the possibility for external phenomena to be presented in nonhuman ways and human embodiment to be abstracted and interrogated. Image credit: Alexandra Adderley and Nicola Plant, 2015.

## Social Processes and Expressive Movement

Susanne Langer (1953) argues that it is in the expressive manifestations, or the dynamic forms of our direct, sensuous, mental, and emotional life that are congruent with artistic and expressive form. This form is not thought, but felt and experienced (Langer 1953: p. 215). In the field of theatre and performing arts, Simon Shepherd (2006) interprets Langer's writing to suggest that emotions are performative bodily expressions (Shepherd 2006: p. 79).

Shepherd argues that through the body's direct experience of both the emotional and unconscious realms of the psyche, movement is endowed with a special charge and emotional states are transmitted through bodily movement. The emotional or mental state of each other comes inherent in interaction, which is composed of gestures, signals and bodily movements. For Shepherd, rhythm plays an important part in this transmission, proposing that emotions can have a familiar physiological pattern, recognisable to some degree across cultures. In performance, rhythm is considered intensely affective in comparison to mere imitation as rhythm bypasses the intellect and connects directly with basic bodily processes (Shepherd 2006: pp. 77-97). This goes towards dissecting what the act of *moving together* between the particles and the users of *Sentient Flux* might look like. Critical here is that the particles' movements are more than a straight imitation; the timing or pattern of the mimetic interactions reflect the emotional charge present in the expressive movement performed by the user.

When observing interactional behaviour in a study on normal conversation (between humans), William Condon and William Ogston (1966) suggest that 'patterns of change' emerge as an ongoing behaviour. Rhythm is danced by both interacting parties, termed as interactional synchrony. Condon and Ogston argue the idea that there are complex and numerous 'configurations of change' that appear to be responsible for the creations of patterns of expressive behaviour. Interlocutors converge and echo these patterns by sustaining and changing movement together in an ordered fashion in a mutual performance of synchrony (Condon and Ogston,1966: p. 4). Patterns of interactional synchrony was simulated in *Sentient Flux* as a function of the computational processes that governed the particles' mimetic movement.

In addition, anthropologist Lorna Marshall (2002) states that rhythm is used as a primary mode of communication, especially emotional communication. In a real sense, rhythm is emotion. It is in rhythm – how quickly or how slowly you do the actions, how long you wait between them – that are the prime conveyers of thought and feeling (Marshall 2002: p. 188). Thus, for

*Sentient Flux*, even though the particle system only responded with simple computational processes that moved the particles mimetically, as these were based on the rhythm of the user's movements, the structures of meaning were already embedded.

When interacting with *Sentient Flux* the exploratory nature of users' movements indicated that they did not feel as though they were controlling or performing using the particles as a simple system but that they were dancing with particles moving in a reciprocal fashion (Figure 6.4). For Merleau-Ponty and Zlatev, as discussed above, an awareness of this reciprocity pointed to the user's apprehension of particle sentience.

Figure 6.4. Digital Photograph of a user interacting with *Sentient Flux*. Users of *Sentient Flux* exhibited exploratory and investigative expressions that often appeared like dancing in a form that was intrinsically expressive and organic. Expressive rhythm was reflected in the mimetic movements of the particles, but only as they responded to those rhythms produced by the user. Quick movement elicited quick flashes of brightness. Changes in hue, brightness and the quantity of particles oscillated in relation to the dynamic properties of the user's movement. The speed at which the particles were attracted towards or repulsed by the user's body were approximated by the speed in which their body moved. Image credit: Alexandra Adderley and Nicola Plant, 2015.

## Conclusion

The possibility of a computationally mediated reality in virtual reality holds the promise of presenting nonhuman ways of perceiving not only the external physical world but also our perception of sentience in external phenomena and the social processes that underpin this constitution. *Sentient Flux* exploited the embodied affordances of virtual reality to interrogate how a sense of agency, sentience and intersubjectivity with a nonhuman entity is constituted. Users' interactions with the piece indicated that moving together is fundamental within intersubjective interaction. When thinking about how a computer-generated entity might be perceived or might communicate expressive phenomena, the concept of embodiment is the key component. *Sentient Flux* asked: what are the movement qualities in these expressions that describe the dynamics of a human experience of the world? What is required for abstracted movement to communicate sentience?

The interactive coordination that users exhibited when moving expressively with the particle system in *Sentient Flux* are aligned with the interpersonal coordination found in real human interaction. Interpersonal coordination refers to the degree to which the behaviours in an interaction are not random but patterned or synchronised in both time and form (Lakin et al 2003). The vital qualities of expressive movement that portray sentience are in simple but dynamic mimetic and synchronous interaction with the user's body. The crux of determining a sense of agency, sentience and intersubjectivity in a virtual entity is by embodied movement.

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