Agency and interactivity

Agency and the sense of embodiment, and thus the ontology of the subject, is inherently reconfigured when the human subject is entangled with interactive technologies. This question of entangled ontology has been the focus of a series of creative arts projects I have developed, often collaboratively. Two of these will be the focus of this discussion - *Crosstalk* (2014) and *Double Agent* (2018). Whilst the works use similar modes of interactivity, employing motion-tracking and other methods to capture information about people within the environments, they each explore distinct modalities of agency.

Human agency is profoundly affected when subjects engage with interactive technologies, especially where those technologies have higher degrees of autonomy. In order to appreciate and interpret these affects it is helpful to establish a framework for understanding human and machine interaction.

Bruno Latour has argued that actor-network theory (AT)

> … does not limit itself to human individual actors but extends the word actor - or actant - to non-human, non-individual entities. Whereas social networks add information on the relations of humans in a social and natural world […] AT aims at accounting for the very essence of societies and natures. It does not wish to add social networks to social theory but to rebuild social theory out of networks. It is as much an ontology or a metaphysics, as a sociology." (Latour 1996)

Latour's framework for agency allows both human and non-human agents (actors or actants, in his terms) to exist similarly within a network. As such, it offers a context where human and machine interaction can be considered a generative ontology, where each conditions and affects how the other comes into being. This would seem to offer a model for understanding agency in environments where human subjects and technological systems interact with one another in generative ways, as is the case in the artworks discussed here.

Similar to Latour's argument, but with an approach informed by a phenomenological privileging of experience and interpretation rather than observable networks, N. Katherine Hayles has proposed that human and machine agency exist as a cognitive assemblage, proposing such cognition foregrounds

> … interpretation, choice, and decision and highlights the special properties that cognition bestows, expanding the traditional view of cognition as human thought to processes occurring at multiple levels and sites within biological life forms and technical systems. Cognitive assemblage emphasizes cognition as the common element among parts and as the functionality by which parts connect. (Hayles 2016)

Hayles states that her

> … reason for choosing assemblage over network (the obvious alternative) is to allow for arrangements that scale up. Starting with cognitive processes occurring at a low threshold—using information to make choices within contexts—cognitive assemblages can progress to higher levels of cognition and consequently decisions affecting larger areas of concern. (ibid.)

Hayles' approach allows us to consider not only the ontology of an assemblage (or network) but also our understanding of it, erasing distinctions of subject (being within the assemblage) and observer (being out-with the assemblage). This approach permits a form of phenomenological 'bracketing' that does not rely upon a dualistic framework of inside or outside but, rather, is emergent from and intrinsic to the phenomenon being considered - the assemblage. As Hayles notes, such an approach allows for "arrangements that scale up" (ibid.) and thus this is a useful framework for addressing the kinds of generative assemblages that are created when developing the interactive performance systems discussed here.

Interactive technologies can be defined as technical systems that have the capacity to adapt, and thus change their state, in response to the activity of other agents (human or non-human). Interactive systems can possess varying degrees of complexity and autonomy, from a simple on/off switch through to a neural network based surveillance system capable of learning to interpret complex phenomenon and responding with equally complex outcomes. To a significant extent the task of the artist who develops interactive artworks is to develop scenarios for effective and affective assemblages that combine human and technical components in as seamless manner as possible. The objective is to create a scenario where the human subject within an interactive system (hereafter referred to as the interactor) is progressively less able to distinguish between their own and a technical systems' agency whilst foregrounding how the operation of the assemblage (the interactor

and the technical system) generate this state. This is a very different agential aesthetic than that found in many forms of interactive system, such as computer games or command and control systems, which are generally oriented towards intentional behaviour. In the interactive artworks discussed here the relations between the various agents that comprise the assemblage function more like an ecology. Agency is less a question of intentionality and more one of interdependency and interconnectivity, where the relational and generative dynamics of the assemblage are foregrounded.

In the artwork *Crosstalk* (Biggs, Hawksley & Paine, 2014a) the aim was to create an interactive system where human and machine agency weave through each other interdependently to create a process of constant adaption, from state to state, at multiple levels and through a number of phenomena and media. The artwork employs large-scale immersive video projection, real-time body tracking, surround sound and live voice acquisition, including speech to text capability, to allow two computers, one dedicated to generating the visual and textual elements of the work, the other generating the aural elements, to interact with the physical and speech activity of two dancers within the interactive environment. The key elements in *Crosstalk* are human generated movement, speech and sound, which are presented as a cognitive assemblage that incorporates the interactive system's manipulation and generation of audio-visual material, similarly composed of movement (both visual and sonic), language (spoken and written texts) and sound. This work is described as beginning

> … with two dancers speaking descriptions of each other. Automatically transcribed in real time into a virtual three-dimensional world, using speech to text software, these descriptions become textual objects that inhabit the environment and interact with other elements within the system, both human and non-human. The spoken texts form the foundation for an evolving sonic environment. When moving the performers collide with the text objects, causing them to also move. As the text objects interact, they re-write each other, facilitating the emergence of new textual and sonic material, created through the recombinant computation of the texts in the collided objects. (Biggs, Hawksley & Paine, 2014b)

The re-writing of the texts, which originate as spoken sentences from the two dancers, that describe either themselves or their actions, is undertaken heuristically by the computer,

employing feedback control, which analyses the syntax of each sentence that is involved in a collision, within the simulated physics-based environment the dancers are immersed in, and switches syntactically similar terms between the sentences. This leads to the generation of novel sentences which the dancers subsequently read, sometimes aloud (generating further iterations of text objects), and interpret to determine their physical activity (the dance). Through these mutually recursive and iterative processes the dancers' movements and use of language, along with the visuals and sounds generated by the computers, evolve, state by state, throughout the duration of the work (the performance can be of indeterminate length but is typically constrained to approximately 30 minutes). It is not possible to predict how the detail of the work will evolve, partly because the heuristic process is non-deterministic and partly because of the many opportunities for noise to enter the system and corrupt various elements (eg: the speech to text software misinterpreting a spoken word or a dancer mis-reading a sentence object). *Crosstalk* is entropically structured, a work subject to a constant process of corruption and decay that, if left to its own devices, will eventually cease-up in a state of over-loaded chaos. *Crosstalk* proposes a generative ontology, but not one that is endlessly so, engendering the work with a sense of fatalism that evokes the limits of both human and technological autonomy.

In a work, such as *Crosstalk*, agency is distributed across manifold elements, including the dancers movement, the motion-tracking sensors and head-microphones, the computer software and hardware, the surround-sound feeding-back into the head-microphones, the interpretative grammar engine and the dancers speech. This is an assemblage mediated by information, including sound, movement data, speech, text and projected imagery. It is both physical and ephemeral, although this is not an unproblematic duality. Information is presented not as an abstraction but as materiality, evoking Claude Shannon's conception of information as physical matter, in its simplest form as a bit of information; for example, as a positive or negative state in a digital system (Shannon, 1948). The interaction of all these elements, some the product of intentional behaviour, some emergent and some simply noise, function as a feedback-loop, where each state informs the next state, with unforeseen consequences. Entropy is the governor, witnessed in *Crosstalk* as both ephemeral (representational and epistemic) and physical (the decay of digital information and human performance).

This collapse of dualities is manifest in the equal import in the work of human movement and speech. The former is generally regarded as something immediate, pre-linguistic and not primarily concerned with representation, whilst the latter is concerned with language of a precise representational and semiotic nature. In *Crosstalk* each of these elements are treated equally in the system, each affecting the other, physical movements causing sentences to collide and rewrite themselves and the sentences then interpreted by the dancers in order to direct or condition their movement. In *Crosstalk* information is grounded as a physical phenomenon within a system that resembles Turing's conception of a simple automatic machine (a Turing machine) capable of manipulating and reading sequences of symbols (Turing, 1937). This allows a two-fold recursive agency to emerge in the work - where computational information effects physical behaviour and physical actions effect both computational processes and information, that information again effecting physical behaviour - and so on. People and information are, here, of the same ilk. People generate information but information also generates people. *Crosstalk* is a generative system "… where things, including people, are produced by one another" (Biggs, Hawksley & Paine, 2014b) and therefore it can "be considered a people making machine" (ibid.).

In a more recent project, titled *Double Agent* (Biggs, 2018a), the question of human and non-human agency is explored through the interaction of human subjects and machine-learning based autonomous systems. The work also explores the subjective sense of exterior and interior dynamics, through the means of visual haptics, by representing the connectivity of dynamic elements that not only envelope the body of the interactor but also function within the body.

Laura U. Marks has discussed in detail, through a number of articles and books, her conception of 'haptic visuality', where the viewer of a moving-image work, such as a film or video, gains a strong kinaesthetic impression through the evocation of memories associated with the physical sense concerned. Marks has observed that our kinaesthetic sense, or sensory-motor schema, can be disturbed (or shattered) as the quality that

> … characterizes time-image cinema describes a suspension of the usual relations among the senses and their automatic extension into movement. I suggest that the very perceptual forms that encode memory may be revealed, by this shattering effect … (Marks, 2000. pp. 194-195)

Marks analysis concerns the non-interactive media of film and video and how the moving image can evoke physical sensations, including movement, associated with memories. The proposition here is that this potential for haptic visuality is further enhanced when the dimension of interactivity is introduced, where the viewer or interactor receives direct and immediate feedback about their effects on the moving image environment they are immersed within, as a response to their own physical actions.

Motion-capture and tracking technologies do not, as yet, allow data from within the body of a subject to be captured and visualised. However, in *Double Agent* the body schema is not represented as the typical rigid structure we expect to see produced by a typical motion-capture system. Instead what is presented are the dynamic flows around and within the body. These dynamics are produced by generating hundreds of tiny invisible particles that are simultaneously attracted to the interactor(s) joint positions and also repelled by the kinematic forces inherent in the physics engine, ricocheting off each other and the interactors kinematic joints. If the particles were visible they would resemble a dense swarm of small objects around the simulated body of the interactor(s). However, the particles and the interactors bodies are not visualised. The only things visible in the immersive projections enveloping the interactors are the fleeting connections between the particles, appearing as flowing dynamic vectors that flicker in and out of existence as the particles interact, colliding and ricocheting around the space.

As the kinematic objects, including the interactor's joints, are small the particles are able to approach each other at close proximity. They are also able to move through any part of the space, including that which would be enclosed by the interactors body-representation (if it was visible). The space the particles and kinematic joints exist in is not a vacuum. Although there is no gravity in the system there is viscosity (damping) creating the effect of liquid or atmosphere, defining the density of the material through which everything must move. The particles also possess their own properties, such as friction, affecting how slippery they are, and restitution (bounciness), controlling their response to collisions.

What is visualised are the dynamic interactions between all the elements in the system. The outcome is not a visualisation of a rigid body, or even of a fluid body, but of a dense web or mesh of dynamic flows, evoking the tensions and forces produced by the moving interactors bodies. The visual feedback to the interactor thus focuses their attention on the tensions

and forces produced by their movements, both around but also, importantly, within the body envelope, enhancing their own sense of embodiment.

When first conceiving *Double Agent* a primary aim had been to produce a feedback environment that would provide enhanced haptic information for the interactor. Careful adjustment of the various parameters, described above, allows nuanced control of the fluid dynamics of the particles in the space, resulting in a system that produces an engaging sense of haptic immersion, even though the feedback for the interactor is entirely visual.

Double Agent has been exhibited a number of times, including as a six month museum installation where the general public were able to interact with it over a period of months. It has also been deployed as a performance environment for dance, allowing super-movers (dancers) to spend extended periods of time within the work. The response from the dancers has been notable, with some commenting that the work allowed them to see what they were 'feeling' inside their body - the dynamic tensions and flows they feel in their muscles and connective tissues as they move through the work. Some, including a number with significant experience of working within motion-capture systems, have noted that they hadn't previously had this kind of experience in a motion-capture system and that this was the first time they'd had any sense the system was tracking and visualising them in a manner that was consistent with their subjective or somatic sense of their own bodies.

Double Agent also involves non-human interactors. There are two projections in the *Double Agent* environment. There is the one described above, displaying interactions with the system by people who occupy the installation space. The second projection is created not by the interaction of people within the environment, although their activity influences the behaviour of the second projection, but by the interaction within the *Double Agent* physics-based system, as described above, of a simulated dancer. This consists of a "software agent embedded within the system that has learned how to dance" (Biggs, 2018b).

Employing 8 hours of recorded dance data, acquired through live motion-capture of two dancers improvising within the *Double Agent* environment, a software agent has been developed that possesses the capacity to improvise its own dance movements in response to the movements of viewers and performers (interactors) who co-habit the installation space. The software agent moves in ways similar to that of the dancers but possesses a host of novel moves, some of which would be physically impossible for a human dancer to

perform, including having limbs of dynamic dimensions (length) and the ability to move instantaneously around the space.

The development of this 'dancing agent' employed machine-learning methods, computed over a four month period, including

> … deep-learning in the form of a Long Short-Term Memory Recurrent Neural Network (LSTM-RNN) (Hochreiter & Schmidhuber, 1997). LSTM-RNNs allow computational systems to evolve models of what complex behavioural data-sets might represent in an unsupervised manner, without reference to any pre-existing dataset or knowledge-base. The system learns by identifying patterns in the data it has to hand, without reference to any knowledge framework ... (Biggs, 2018b)

The outcome of this leads to the

> … emergence of a software generated co-performer, or co-interactor, that co-inhabits the virtual installation space with the human interactors and contributes to the collective construction and experience of the artwork that subsequently emerges. (ibid.)

The objective here was to create a system, or assemblage, composed from heterogeneous but related human and non-human agencies. The contrast between the enhanced sense of immersion and haptic engagement the system possesses with the alien agency of a non-human performer was intended to further foreground the sense of agency of the human interactors within the work.

The collection of the motion-capture data of the dancers interacting with the *Double Agent* environment necessitated the dancers spending many days, over a three month period, immersed in and interacting with the system. Both dancers had prior experience of working with motion-capture systems, one of them having some twenty years of experience in this area. As such, the dancers were able to develop a close relationship with the environment, with a highly nuanced understanding of its characteristics. Later in the development of the work, when the same two dancers returned to the *Double Agent* environment to develop and rehearse a performance for the first public exhibition of the work, they also had the opportunity, over a period of weeks, to work with the now trained software generated dancing agent, adding another level of inter-agential collaboration.

In conclusion, whilst much of the discussion here has been about how interactive and immersive environments might enhance the phenomenal sense of being there, or *dasein* (Heidegger, 2008), it is has not been the objective in either of the artworks discussed to produce an experience that affirms us as subjects. As Kriss Ravetto-Biagioli has observed, when discussing works such as *Crosstalk*;

> This focus on human and unhuman interactions with digital technologies generate their own sort of aesthetic experiences— one that unsettles our perception of place (distance or proximity), notion of linear time (thereby confusing returns, repetitions, presence, and anticipation), and our sense of a self that is predicated on an image of self. Such uncanny aesthetics trouble the very notion of reflexivity inscribed in Kantian aesthetics— and by extension, without this reflexivity that binds feeling and thinking, we may cease to exist as subjects, the ground for consciousness itself. (Ravetto-Biagioli, 2019. pp. 158-159)

The intention of works such as *Crosstalk* and *Double Agent*, whilst functioning in part to evoke our sense of being there, can be considered to be primarily concerned with disturbing and unsettling our sense of subjectivity, creating scenarios where subjectivity is experienced as heterogeneous and distributed amongst a number of agents, both human and non-human, creating systems that evoke disassociated states where we are no longer ourselves.

Simon Biggs, December 2019

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