

## SHIVERING DOMAINS: TECHNOLOGICALLY MEDIATED EMBODIMENT AND ECOLOGIES

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### Abstract

This article examines contemporary developments in the biomedical and ecological sciences and their impact on hybrid art practices in relation to the 'shivering domains' of cross disciplinary discourses and biotechnological research. Examples from the author's projects: *Temporal Interval*, *machina carnis* and *Urban Swarming* [1] are introduced to illustrate the points discussed. Evolving media technologies and historical perspectives are reviewed and located within the framework of an exploration into the permeable membranes of cellular consciousness and the biomedical sciences; which also considers the nature of constructs of corporeality and the 'self' in a socio-cultural context.

**Keywords:** Embodiment, biotechnology, ecology, non-human others, life sciences, corporeality, interaction.

### Introduction

The art/science research projects I will describe in this article aim to encompass a range of strategies through which corporeality is mediated. I will outline several paradigms for meaningful collaborative intersections between art and science that explore what I refer to as the 'shivering domains' encapsulated in the permeable and shifting boundaries of cross disciplinary art/science practice. These paradigms are situated within the contemporary research context and the underlying question posed in this text is: 'how are contemporary discourses on non-human others and recent developments in biotechnology impacting on constructs of corporeality and 'human-ness' '?

In order to consider the destabilization of our understanding of corporeality and expand upon methodologies for cross-disciplinary art/science research I will introduce three projects:

*Temporal Intervals*- which recontextualises an early scientific recording device in conjunction with what was at the time cutting edge internet technology to examine the essence of corporeality through both remote and real-time participant access and interactivity.

*Machina carnis* - which employs contemporary biomedical research in the laboratory which later forms the basis of an interactive installation where I explore the possible consequences of adult stem cell research and the modification of the human body at a cellular level.

*Urban Swarming*" - which draws upon my experiences of proximity in a design-

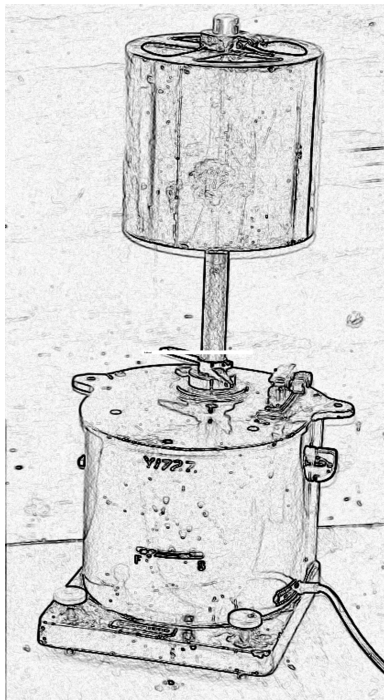
nated honeybee research area and seeks to examine comparative interspecies behaviours and connections.

By expanding upon the rationale behind these artworks' varied installation structures and the ways that they reference both contemporary and historical technologies, I locate them within the current art/science debate on the nature of corporeality, the 'self' and interspecies proximities.

### *Temporal Intervals*

Sometimes apparently random acts like parking a car can have a wider significance. So it was with regard to the genesis and evolution of the artwork *Temporal Intervals*. When parking behind the School of Biomedical

**Fig. 1. The kymograph** (© Artist. Photo © Artist.)



Sciences at the The University of Queensland I noticed a skip for unwanted objects from a long abandoned University store cupboard. Trawling through the contents of this skip on visits to the laboratory I came across a fascinating, but unknown machine. Captivated by its mystique, I took it home to research its origins. It turned out to be an iteration of a machine known as a Kymograph [2].

At the beginning of the nineteenth century, with the invention of electricity, a whole new generation of scientific machines evolved. Utopian visions held by the scientists of the day were founded on the premise that these new technolo-

gies would enable scientists to isolate the individual workings of the human body and thus come to an understanding of its galvanic 'vital force' or bioelectricity [3]. Carlo Matteucci's explorations in the field of bioelectricity when using an early form of kymograph demonstrated the impact of electric impulses on a 'rheoscopic' frog's leg [4]. Needless to say these utopian notions of the potentials of bio-neurology proved as unrealistic as the more recent capabilities promised by virtual technologies and the potentials of digital worlds.

*Temporal Intervals* took the form of a quasi-scientific experiment which imaginatively connected obsolete scientific machines, such as the kymograph and spirometer, in a structure which was participant interactive. This artwork explored the nature and transmission of information both at the installation site and remotely via the artwork website. Created in 2003, the use of Internet technologies in *Temporal Intervals* that enable remote participant interaction is now no longer cutting edge. In fact, in 2013, it could more appropriately be situated within the media art historical canon. The installation referenced the disparity between the ephemerality of data and the analogue processes of obsolete scientific machines and the informational transmission of a 'corporeal self' over distance. Viewer/participants left fragile traces of both real-time and virtual interactions that created a complex interplay between participants, machines and locations [5].



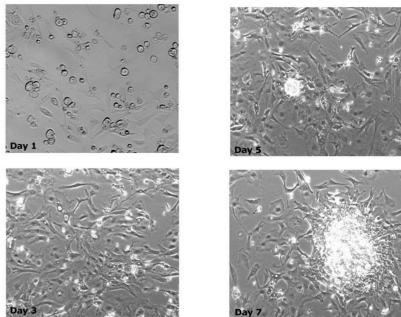
**Fig. 2. Overview of the *Temporal Intervals* quasi-scientific installation.** (© Artist. Photo © Artist.)

### *Machina carnis*

The *machina carnis* project [6] had a two-part structure: It began with my participation in a biomedical science experiment and culminated in an interactive artwork of the same name. The project evolved after I read an article in the journal "Science" that suggested the ground-breaking 1999 discovery that

some pluripotent adult stem cells could ‘change fates’ [7] and become other types of cells should be regarded as the ‘scientific discovery of the year’ [8].

Excited by the potential to modify the human body through biotechnology I began to collaborate with Dr. Victor Nurcombe [9] in the laboratory at the School of Biomedical Sciences, The University of Queensland. For this pioneering project I used adult stem cells from my un-screened blood. The University ethics committee took almost a year to grant ethical clearance but in spite of this, I considered experimenting on my own cells was vital for developing viewer identification and empathy with the cellular image data to be used later in the installation. It also created a unique model of the artist/researcher as ‘human guinea-pig’ and both the subject and the object of the research [10].



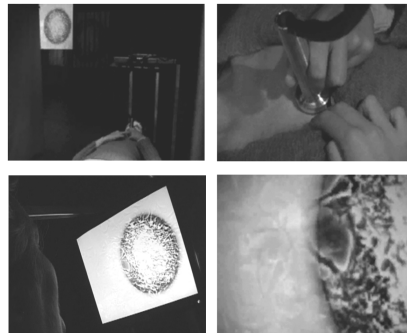
**Fig. 3. Digital videomicrograph images of Adams adult stem cells in culture from Days 1 -7. (© Artist. Photo © Artist.)**

At the beginning of the *machina carnis* project a doctor took my blood sample from which the stem cells could be separated and cultured under laboratory conditions. After three days the drug 5'AZT and a mixture of cardiac differentiating factors, with one patented ingredient, were added to these cell cultures in order to change the undifferentiated stem cells into cardiac cells. When this unique chemical mix was added to the adult stem cells they began to reproduce, mature and develop the characteristics of heart cells. Fig.3 shows still images of these developments on Days 1, 3, 5 and 7. In addition, each cell has a signature combination of proteins with a fraction of DNA. In the case of heart cells they are drawn to each other to cluster and synchronise their beating. Each cell has recognition modules on its surface membranes that ‘interdigitate’ or link ‘gap junctions’ like ‘open portholes’. After seven days my modified adult stem cells could be observed forming clusters of beating heart cells that were recorded by

time-lapse video microscopy, providing me with my visual data resource.

The resulting digital video micrograph time-lapse images of cardiac cells beating was edited for use as source material for the installation video. Physical engagement with the installation enables viewer/participants to probe diverse constructs of ‘humanness’; reflecting on the ways in which their understanding of themselves could be changed by contemporary developments in biotechnology and at the beginning of the twenty-first century.

**Fig. 4. Participants interacting with *machina carnis*. (© Artist. Photo © Artist.)**



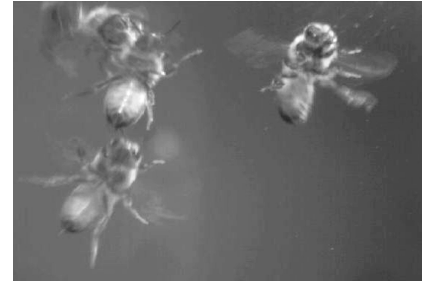
### *Urban Swarming*

During my *machina carnis* laboratory experiments, my close observations of the cells aroused questions about cellular consciousness that I aimed to investigate as artist in residence with Professor Mandyam Srinivasan at the Visual and Sensory Neuroscience Group, Queensland Brain Institute [11]. The Visual and Sensory Neuroscience group carry out their research on the European honeybee in the largest indoor bee facility in Australia. Here, the bees fly around freely from hives to experimental sites and, to my surprise, protective clothing is not routinely worn. In this environment the honeybees and human beings co-existed side by side in their parallel operational spheres. Honeybees and humans were functioning independently – but juxtaposed – within the same habitat. This experience of intersecting domains inspired my video, *HOST* [12]. For this artwork, the scientists trained the honeybees to come and feed on sweet liquid on the palm of my hand. I made use of the available scientific technologies: fast capture cameras, to record the flights of the honeybees at 250 frames per second, resulting in slow-motion digital visual data.

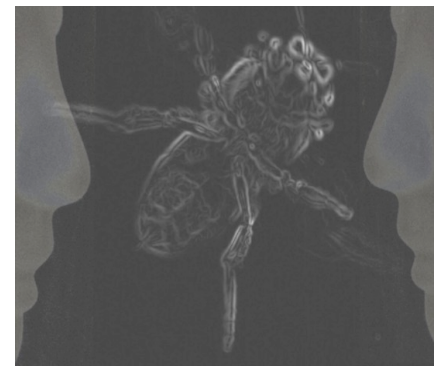
Having been in close proximity to productive communities of honeybees I

decided, to use the available photographic technologies to capture the aggressive responses of honeybees. This

**Fig. 5. Documentary footage of aggressive bee responses. (© Artist. Photo © Artist.)**



aggressive behaviour of the previously gentle honeybees led to the creations of the work *Urban Swarming*; an artwork that considers the dangers of extinction to global honeybee populations posed by Colony Collapse Disorder [13]. *Urban Swarming* encourages viewer/participants to envisage human communities in urban surroundings in similar stress to that of the aggressive honeybees. Through a viewing experience played out against the hubbub of commuters in the rush-hour at busy urban locations, a comparative juxtaposition of the behaviours of honeybee and urban dweller is created.



**Fig. 6. Video still from the video “a space to cross” which forms the basis for the artwork: *Urban Swarming*. (© Artist. Photo © Artist.)**

*Urban Swarming* takes the ubiquitous, recent technology of the QR Code and instructs viewer/participants to use it to download the video “a space to cross” on to their iPhones in busy urban locations. In this way the video images of desperate honeybee responses are viewed against the backdrop of the rushing mass of the urban population, scurrying hither and thither. Both humans and honeybees exhibit mindless – possibly doomed –



behaviours. I place the emphasis on the location where the viewer/participant experiences this work, thus appropriating a commonplace technology and going beyond its usual function in a way that requires engaged audience participation [14].

## Technologies

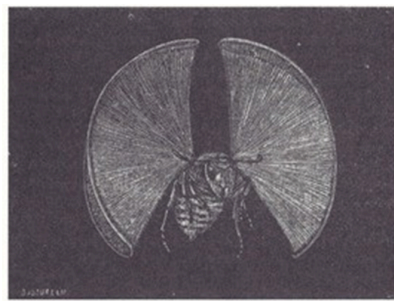
A recurring theme in my artworks is a love of combining anachronistic, analogue scientific machines and processes with contemporary media technologies and cutting edge science. By bringing together these divergent areas I draw attention to the increasingly rapid changes that are taking place in both scientific and new media art technologies.

As has been mentioned earlier, the kymograph represented the world of nineteenth century bio-neurological scientific research. Latter-day kymographs took on a more mundane role as recording devices in universities. Subsequently, they were superseded by computers, stored and forgotten. In the artwork *Temporal Intervals*, by referencing this recording function, I was able to create a fictive quasi-scientific experimental device with links to a spirometer, also obsolete. Through what were in 2003 cutting edge internet information transmission technologies, I engaged both real-time gallery participants – who are physically present at the exhibition – and remote website viewers – whose corporeal presence is off site – in the gallery-based interactive processes.

The *machina carnis* project contravened accepted scientific protocols when I took a first-person role in both the experimental processes and the actual cellular material. As previously described, by experimenting on my own adult stem cells and using the resulting visual data in the *machina carnis* artwork I aimed to increase participant empathy. Fundamental to the participant's seamless engagement with the installation was my discrete use of interactive technologies. The equipment and pre-programming of this artwork used Max MSP Jitter and iCube accessories. The only object that could be manipulated by a participant was the modified stethoscope with which he/she located their heart, causing the cardiac image data to respond to his/her presence and pulse in time with his/her heartbeats (see Fig.4.). Each participant interaction with the artwork organism not only brought it to life but also completed it.

My art outputs during my residency at the Visual and Sensory Neuroscience

Group made use of the fast capture image technologies used by the scientists in to record honeybee flights. These technologies enabled me to generate the image data used in the video “a space to cross”, which forms the basis of the artwork *Urban Swarming*. The contemporary image capture technologies are complex and require dedicated computers and software to operate them. I was interested in comparing these image capture technologies with the intricate early recording technologies, using the myograph, discovered by Etienne Jules Marey in the eighteen thirties [15]. Marey employed the myograph, a form of kymograph, to capture images of insect wing beats and was able to isolate the pattern formed by these individual beats for the first time.



**Fig.7. An example of early image data recorded by Marey showing detailed individual wasp wing moments. © J.Parrikka [19]. Photo © E.-J. Marey.**

## Life Sciences

Computer technologists, and more recently artists, have been drawing inspiration from insect behaviours and biological living systems for the structure of networks and methods [16]. In my case, the research of biologists Humberto Maturana and Francisco Varela proved most insightful, particularly their model of life systems in which cognition is understood as a biological process [17]. In their groundbreaking theory they introduced the term ‘autopoiesis’ to classify the fundamental dialogue between structure (brain) and function (process). Systems theorist Frijof Capra points to the importance of the concept of autopoiesis as a central insight within Maturana and Varela's Santiago theory of cognition [18]. Here, they refer to circular, self-sustaining autopoietic processes of ‘self-organisation,’ which connects the process of knowing with the process of life in even the simplest of cells. Therefore, through investigating the complex contemporary theories of consciousness and sentience and the

status of my cells as living entities I became aware that at all levels of life, mind and matter, process and structure are inseparably connected. This understanding of living systems encouraged me to create parodies of organic systems through both my immersive engagement with the scientific processes and the structure of the artworks themselves. Indeed, first hand microscopic observations of my adult stem cells in vitro led to queries as to their levels of sentience and consciousness that are explored during the *machina carnis* project.

My centrality in the scientific experimental processes is replicated by the engagement of the viewer/participant, who is essential to activate and complete the artwork system. The impact of the theory of autopoiesis or ‘self-making’, mentioned above, on the *machina carnis* installation is apparent in the manipulable systems created. All the systems are inter-related and the ‘shivering domains’ of the boundaries between the body and its environment are in a constant state of interplay and flux. Both the *machina carnis* scientific processes and the structure of the artwork locate the human – corporeal – self as an essential element. When an installation participant observes the digital image data of the human cultured cardiac cells beating in synchrony with their heartbeats it is as if a microscopic simulacrum of their own beating human heart – the vital, functioning, interior engine of their body – were laid bare before them, so deeply are they implicated in the installation systems. This intimate structural relationship embodies the viewer as a network participant.

The *Temporal Intervals* artwork is an example of my previous explorations into a model where the artwork represents a living organism. The installation ‘came to life’ when participants moved within range of the sensors – the work lit up and one of the kymographs began to slowly rotate, moving a large loop of drafting film stretched around it. The semi-living organism of the artwork was now waiting for the real-time installation participant to interact with it and thus complete a behavioural cycle. Remote access to the work via the website also added a layer of engagement in this life-form and the transmission of information. Viewing the gallery participant via a webcam connected to the installation website, the remote participant could activate the dot-matrix printer in the gallery space. This interaction created a circularity of engagement whilst it

also mobilised the new capacity of the internet to transmit bodily presence in the form of pure information - thus expanding the participatory outreach of the 'living' artwork organism.

In the case of *Urban Swarming* I consider the relationship between the honeybee and its environment and compare its aggressive responses with human behaviours in crowded urban locations. Contrary to the productive community behaviours honeybees exhibit to maintain the hive, when aroused, the honeybees exhibit manic individual aggression. Media theorist Jussi Parikka suggests that environmental contexts and affects can be regarded as primary vectors for the creation of entities and their relationship both to each other and their surroundings, in this case honeybees. Parikka points out that since the nineteenth century, interest has been developing in insect communities, behaviours and social structures and the spatial conditions of variation found in all sentient animals and entities. Natural processes can be said to generate intersections between characteristics of both the natural world and media technologies. In this environmental and affective continuum, honeybees are contextualised in terms of their ability to sense their environment through their bodies [19].

In keeping with the immersive, participatory focus demonstrated in both *Temporal Intervals* and *machina carnis*, the artwork *Urban Swarming* once again places the participant in a central position within the artwork ecosystem. Each individual's locative bodily engagement - in this instance situated in the busy urban environment - is required to explore the artwork's purpose and effect its meaningful completion.

## Conclusion

My engagement with cutting edge scientific research and media technologies, both contemporary and historic, has led me to create artworks that have discretely featured the affective qualities of both the life sciences and media technologies. Inserting a personal response into the reinterpretation and recontextualisation of scientific data has involved rejecting so-called scientific objectivity and expanded upon contemporary theories about 'self' and 'corporeality'. Indeed, the newly discovered pluripotent [20] characteristics of many adult stem cells have opened the door for potentially wide ranging changes to our anatomical structure - what once appeared immutably 'human' may no longer be so. Expanded

expressions and representations of corporeality, such as those discussed in this paper, embrace open-ended and intersecting territories that accommodate malleable, hybrid identities and investigate the cognitive and sentient behaviours observed in cellular life. My considerations of inter-relational pathways and connections have encouraged me to move beyond customary categorizations and environments to traverse 'shivering domains' encapsulated in permeable cross-disciplinary membranes. Insect responses and their suggested bodily perceptions of the world around them illustrate tensions between pattern and purpose that are relevant to on-going research into media technologies and networked environmental relationships. These developing models of fruitful transdisciplinary art/science collaborative projects provide an on-going research platform for interrogation of biomedical and anatomical shifts in constructs of corporeality at the beginning of the twenty first century and beyond.

## References and Notes

1. Further details on these works, Adams (2013), <<http://trishadams.tv>>, accessed 1 July 2013.
2. One kymograph information website: <<https://utsic.escalator.utoronto.ca/home/blog/instrument/horizontal-kymograph>>, accessed 1 July 2013
3. <http://www.britannica.com/EBchecked/topic/6583/bioelectricity>>, accessed 1 July 2013.
4. 'rheoscopic' literally means: 'current flowing fluid'. In the case of the frog's leg, Matteucci was able to trace and record on the kymograph the bioelectricity flowing through the frog's tissues which was making the frog's leg twitch even though it was obviously dead.  
<<http://neuroportraits.eu/portrait/carlo-matteucci>>, accessed, 1 July 2013.
5. Video documentation of the "Temporal Intervals" quasi-scientific installation in action: <<http://vimeo.com/channels/115324/12726723>>, accessed 1 July 2013
6. Video documentation of participant interacting with the "machina carnis" installation: <<http://vimeo.com/115324/12730173>>, accessed 1 July 2013.
7. 'Changing fates' describes the scientific intervention which alters the developmental path of adult stem cells so that they become other types of cells.
8. Gretchen Vogel, "Capturing the Promise of Youth," *Science* 286: 5448 (1999) p. 2238-2239.
9. I am deeply indebted to Prof. Victor Nurcombe for his expertise and support during my "machina carnis" project. Without his participation and direction I could not have undertaken the project. Vic has left The University of Queensland and now works in Singapore: <<http://www.imcb.a-star.edu.sg/php/vnsc.php>>, accessed 1 July 2013.
10. There are actually quite a number of precedents for first-person scientific processes being used to contravene accepted scientific protocols. In the nineteenth century dentists began the practice and this experimental approach has usually been adopted by scientists in extremis, who carry out research on themselves in order to prove a point. The most

recent example is the Australian Nobel Prize winner Barry Marshall, who swallowed bacteria to show that bacteria, not stress, cause stomach ulcers. This was his only recourse to break through the hegemony held by the drug companies, who stood to lose large amounts of money if his theories were proved correct: <<http://news.bbc.co.uk/2/hi/4304290.stm>>, accessed 1 July 2013.

11. Prof. Mandyam Srinivasan provided me with invaluable access and support during my part-time residency with the Visual and Sensory Neuroscience Group, The University of Queensland. <<http://www.qbi.uq.edu.au/group-leader-srinivasan>>, accessed 1 July 2013.

In addition I would like to thank scientists Carla Evangelista, Peter Kraft and Niko Leibsich for their support and assistance during my research at the Visual and Sensory Neuroscience Group.

12. The video "HOST": <<http://vimeo.com/channels/115324/12708853>>, accessed 1 July 2013.

13. Colony Collapse Disorder is decimating honeybee populations worldwide, although it has not yet reached Australia. It is a complex disorder, the exact cause of which is not yet known. Currently over farming, the varroa mite or certain pesticides are thought to be the main causes. At the moment scientists cannot decide which one of these three possibilities is the main cause of the disease, or if perhaps all are involved together in some way: <<http://science.time.com/2013/05/07/beepocalypse-redux-honey-bees-are-still-dying-and-we-still-dont-know-why/>> accessed 1 July 2013.

14. The "Urban Swarming" QR Code:



The optimized on-line access link is: <<http://www.trishadams.tv/urban-swarming/>>

15. Marta Braun, *Picturing Time: the work of Etienne-Jules Marey*, (Chicago USA: University of Chicago Press, 1995).

16. Beginning with the Macy conferences just after the Second World War, these systems links are well documented: <<http://www.ascyberneics.org/foundations/history/MacySummary.htm>>, accessed 1 July 2013.

17. The term 'autopoiesis' was introduced in 1972 by Chilean biologists Humberto Maturana and Francisco Varela to define to the self-maintaining chemistry of living cells.

18. Frijof Capra, *The Web of Life*, (London, UK: Harper Collins, 1996).

19. Jussi Parikka, *Insect Media*, (Minneapolis, USA: University of Minnesota Press, 2010).

20. 'pluripotent' is the term used to describe adult stem cells which are able to change into other kinds of cells.

Theories and concepts expressed in this paper have been touched upon in some of my other publications but the focus of each text is unique.