

Representation, Use and Participation: Three Ways of Looking at Art/Science

The visual arts and science each rely on the image to make visible that which is not otherwise separable from the flow of sensory data experienced in the course of living. Images abstract data from that flow and reform them to selectively identify what is of importance to the image-maker. Theories of reception recognise that images operate in terms of expectations and within a context. The art/science interface presents particular challenges to the reception and interpretation of imagery, as disciplinary strategies for the presentation or investigation of material may or may not be transferrable. Through a series of examples, this essay considers a tripartite division of the ways that images operate in art/science contexts. The three categories of representation, use of the other's methodologies or values, and participation are suggested as tools to navigate the art/science encounter. Thought experiments are also considered. The essay accepts as a historical fact the polarising of art and science in the epistemological framework of early modern western European thought. It is important to note that the polarities of art and science are better described as particular moments within a complex epistemological and cultural network. However, assumptions tend to cohere around the poles, as do notions about what constitutes research and what supports funding.

Representation involves picturing something otherwise not visible, or else portraying it in such a way that particular features are made more evident and therefore clarify, explain or articulate a process or a concept; that is, these features become a kind of evidence. Use implies either art or science adopting a specific tool, methodology or process from the other's armoury. In participation, a shared end draws on the skill sets of each. Representation, use and participation may overlap and they entail different emphases and balances of power and different social and political agency.

THE THOUGHT IMAGE OF THE CAT IN THE BOX

Illuminating (perhaps inadvertent) art/science connections occur in the use of thought experiments to visualise concepts. In 1935, when the problematic issue of the applicability of quantum mechanics theory, based on particle/wave duality and probabilities, to the 'classical' or predictable and clockwork Newtonian model of the world we inhabit was first discussed, Erwin Schrödinger disagreed with the implication of his own theories and argued against them by proposing a thought experiment.¹ He proposed a cat in a box with a jet of cyanide, a quantum event that would

release that cyanide, or not – the fact indeterminable until observed, in this case by someone opening the box. The thought experiment extrapolated the issue from the minute realm of particle physics into the scale of the world we normally inhabit. The term ‘Schrödinger’s cat’ has a far wider life than its originator expected; it has become a leitmotif of popular science and is used in art contexts to explore the idea that human agency is transformative on a far greater level than commonsense experience would imply. The thought experiment to clarify issues around the action of particles has become an extreme instance of the unseen. Quantum theory argues that particle events occur only in relation to the presence of another element. The state of the particle which would or would not release the gas remained only a probability until another participant impinged on it. Schrödinger literalised, indeed anthropomorphised this element into the concept of the ‘observer,’ which might simply be any other material entity within the box.

The image remains in the public psyche because it has many of the features of a successful kitsch artwork: suspense, pathos, doubt, death, compassion, and even a pet. A skilled artist might have warned Schrödinger that it contained too many such features to be usable. In 1951 Schrödinger wrote, “I think I must accuse Bohr – though in actual fact he is one of the kindest persons I ever came to know – of an unnecessary cruelty for his proposing to kill his victim by observation.”² Perhaps it was the presence of these elements that led Steven Hawking to cite the famous (and often misattributed) remark, “when I hear the word culture [Schrödinger’s cat in his version] I reach for my revolver.”³ Within popular culture, the thought experiment has led to absurd and perhaps even irresponsible interpretations and applications of the notions of alternative worlds. The undetermined event was the release of the cyanide and its impact on the cat, rather than a change through quantum transformation within the cat itself, but I know that students often cite the story to justify notions of the transformability of mind and body in precisely the macroscopic realms that Schrödinger, who hated the theory anyway, was arguing it manifestly did not apply to. Roger Penrose however does think that it is, in theory, applicable in the wider sense of the possibility of alternative worlds, and has twice elaborated on the image, changing the experiment a little and putting the observer inside the box (wearing what looks like a space suit to protect him from the cyanide).⁴ Ultimately, the thought experiment has acted more like an artwork, generating its own indeterminate, open-ended, and affective results. In contrast, Thomas Young’s 1801-5 experiment and Claus Jonsson’s 1961 reframing of this for quantum mechanics demonstrates the wave/particle conundrum with a diagram of a plane with two parallel slits in it through both of which one particle might have passed.⁵ This has far less purchase on the imagination.

REPRESENTATION

Representation is deceptively close to the scientific strategy of observation. In the late medieval period Western European thinkers began to reconsider Greek scientific thought and its focus upon empirical data. This led to an increased focus on observational drawing by all professions for which observation was relevant. Neither art nor science was distinguished as such. Yet to occur was the separation of the inventive imagination from the depiction of what was understood to be a more-or-less factual representation of something existing in either a secular or a heavenly realm. The polymath Leonardo da Vinci added to his observational drawing skills the instincts of what would much later be seen as scientific thinking as he sought to find underlying principles through observation; for instance, in the movement of water, the growth of plants, and the physics of machines. To place him as an early ‘artscientist’ misses the point; rather, like other less skilful colleagues, his interests found their niche in whatever context was then appropriate. While Freud argued that da Vinci was

temperamentally incapable of finishing artworks, it is equally possible to argue that he had got as far as he needed to with them; had figured out the problem, and had no interest in dwelling further in the virtual realms of art.⁶ It is important to note that the projection of today's notion of the artist as the channel of society's values produces a skewed reading of da Vinci's intentions.

Galileo's ability to draw enabled him to understand what he saw through his telescopes. His drawings of the moon established that the surface of the moon was pitted but, more importantly, that it was lit by the sun's rays travelling across it.⁷ It was because he knew how to draw solids in different light conditions that he realised he was dealing with a light source creating tonal changes on an irregular and moving body. Here his representational skills, as devoid of the use of metaphor as a skill can be, enabled accurate recording. During the same period, anatomical drawings of dead bodies both enabled and stood in the way of the recognition that blood (no longer flowing in the veins of the cadavers in question) circulates round the body in two directions. Around the same time metaphoric elements were added to the study of anatomy, as an artform of rather frighteningly sexualised wax and plaster bodies with their viscera half exposed grew up alongside the development of surgery, as now immortalised in the extraordinary museum La Specola in Florence.



Figure 1. Lilly Daff, *Chrysophanus salustius*, *Vanessa gonerilla* (Butterfly studies, n.d), watercolour. Hocken Collections Uare Taoka O Hākēna, University of Otago; reproduced with permission.

By the eighteenth century, ability in drawing and watercolour was one of the accoutrements of both the upper middle class and the professions for whom representation was important: surveyors, scientific thinkers and collectors, and army strategists. The perceived gentility of painting and drawing enabled many women to participate in the data gathering and classification that was the focus of seventeenth- and eighteenth-century science. In 1679 Maria Merian published *The Wonderful Transformation of Caterpillars and their Singular Plant Nourishment*; her drawings were of live specimens and designed for the scientific market.⁸ She later sailed to South America to collect and draw specimens. Exquisite observational drawings remain a valued part of the art/science continuum. Lilly Daff's butterflies were drawn as research for her display work with museums in the 1930s (see figure 1). Museums still create dioramas; these provide work for many artists as museums keep abreast of techniques in visualisation. However, representational artforms that seek to mimic what they depict offer particular challenges for artists. The human eye will only be tricked for a moment; it quickly sorts out what is simulated. For this reason accurate representation and forms of virtual reality remain constants in many genres of art. Ron Mueck's hyperrealist

experiments with the impact of scale in the representation of human subjects draw their impact from the dissonance between extreme representational accuracy in one field and complete disjunction in another.⁹ Likewise Patricia Piccinini's cross-species simulacra, such as her *The Young Family* (2003), ask us to respond, almost eye to eye, to the implications of inter-species genetic modification.¹⁰ Each artist relies upon skilled observation or its contemporary equivalent – digital modelling – to provide the data that makes these artworks appear to be a kind of evidence. A cogent use of representation is also found in the presentation of scientific data to reflect climate change; public art projects increasingly make use of such data. But those not involved in the sciences often fail to recognise that they are seeing data transformed by the application of colour and sound systems designed to distinguish and add aesthetic value to what is otherwise simply invisible to the human sensorium.

ON USING

Entirely normal and familiar deployments of scientific processes by artists occur in all fields. All material processes are implicated in the strategically differentiated world of science and its relation with objects. All artists benefit from the results of experimentation in the development of new products and practices. This is one of the invisible art/science relationships.

In exhibition contexts, the simplicities of physics and optics currently stand in for the delights of modernist abstraction. The works of Olafur Eliasson deploy techniques in optics and light technologies to provide experiences in abstracted and saturated colour.¹¹ Eliasson's approach is to take a single optical demonstration and present it in a form in which its impact can be appreciated within the context of an art gallery; for this a doubling of notions of beauty and a minimalist approach to concept functions well. Histories of the theological and intellectual significance of light form a subtext; the art/science concern provides another. Saturating a visual field with yellow light makes all that is outside of that field suddenly seem to be coloured in yellow's complementary colour, purple.¹² Another experiment with complementary colour involves a rotating disc which transmits part of the spectrum and reflects the rest of it, so that when a coloured light is shone onto it disc-shaped fields of colour appear on the adjacent walls, one of transmitted and one of reflected light, in complementary colours.¹³ Sometimes the machinery is apparent, as when lenses rotate or mirrors create kaleidoscopes; at others the optical machinery is hidden behind walls or involves light-sensitive surfaces. Eliasson's optical effects are not explained but produced on a macroscopic scale for visual pleasure.

In a work replicating the blue of melting glacier lakes the artist Spencer Finch created a dye-laden meltwater situation, its refrigerator system visible.¹⁴ Contextually, issues of global warming and the melting of the glaciers seemed signaled by the loop between the visible presence of electric usage and the freezing and melting of the ice. However, in conversation the artist rejected the connection, his concern being to identify the colour and dilution of the dye necessary for 'white' ice to melt into the right blue. In another of his works neon lights replicated the colours within an ice cave (see figure 2).¹⁵ Finch's very beautiful explorations investigate the spectrum and, like Eliasson, he prefers to be detached from the socio-political contexts in which these effects and also these artworks occur. In this sense, he and Eliasson enact the now almost exploded 'purity' of the twinned notions of science for knowledge's sake and art for art's sake.



Figure 2. Spencer Finch, *Ice Cave Fox Glacier* (2008), neon tube and gel. Dunedin Public Art Gallery; reproduced with permission.

A parallel art/science field is the production of images that in colour and form replicate the aesthetic purity of the invisibilities of chaos theory and, more recently, string theory. Using digital imaging programmes and the right algorithms beautiful forms emerge. During the 1980s and 90s chaos theorists used the charm of the Mandelbrot forms to argue for the application of these theories to the re-evaluation of everyday experience. This generated unexpected problems, as an unthinking application of notions of chaos theory to the areas of life that art normally engages with – for example, subjectivity and human aspiration – fed by the delights of such images, led to worrying reconceptualisations of experience; exemplified in the film *What the Bleep do we Know* (2004) which ends with a psychiatric patient throwing away her medication on the basis that she can change her thought patterns at will.¹⁶

Two works challenging particular uses of science in contemporary life used scientific techniques to create artworks that highlighted issues in genetic modification. In each case they signaled science's implication in the political and commercial realm by getting the material 'off the shelf.' The artist Eduardo Kac commissioned a laboratory in France to add the genetic indicator GFP to a rabbit, resulting in a rabbit (*GFP Bunny*) that glowed in the dark, but had to spend the rest of its life in the lab.¹⁷ In 2005 Dr Steven Kurtz and Hope Kurtz, of the group Critical Art Ensemble, used freely available genetic modification kits to develop an educational exhibition around the genetic modification of corn. *Free Range Grain* was exhibited at the Massachusetts Museum of Contemporary Art (MoCA).¹⁸ When Hope Kurtz died suddenly of an unrelated heart attack, the ambulance services observed the petri dishes and rang the CIA on the basis that the artists were engaging in germ warfare of some kind. Dr Kurtz was arrested, initially under terrorist charges, and waited until 2009 to be cleared of any wrong-doing.¹⁹

Roger Hiorns and Lucy Skaer, two of the four 2009 Turner Prize finalists, make work that draw on scientific ways of handling materials as they explore different kinds of ending: species and individual death.²⁰ Roger Hiorns exhibited wall pieces constructed of plastinated bovine brain matter and, on the floor, a field of dust of different kinds of silvery grey: a pulverised jet engine.²¹ While the nightmare of bovine spongiform encephalopathy (commonly known as BSE or mad cow disease) remains a concern in Britain, Hiorns does not refer to this. Instead, adopting the same position that Bruno Latour argues for in *The Politics of Nature*, Hiorns lets the materials take their own trajectories.²² In an earlier work Hiorns filled an apartment with a solution of copper sulfate, which developed dense crystals over three weeks.²³ He said, "I was looking for a material which would create its own aesthetic," and that the "artist sets up processes but isn't the person who needs to be referenced when you see the work."²⁴ This is a refusal of the subjective empathetic modernist notion of the art/artist/audience relationship but one that, in establishing a non "art" aesthetic, seems to call on its polar opposite, science/technology, to establish a kind of objectivity.

Lucy Skaer's work in the same exhibition was another meditation on the distance between the human and the organic or animal world, with two works acting as a conversation piece: the head and beak of a whale's skeleton from a scientific museum collection, caged behind a divided wall, faced off with *Black Alphabet (After Brancusi)* (2008); twenty-six coal-dust replications of Brancusi's *Bird in Space* (1931), an alphabet of created species.²⁵ Skaer said that she was interested in the animal's eye: "how it could look, observe but not comprehend."²⁶ These kinds of studies into the psychology of consciousness and into qualia move across art/science concerns.

PARTICIPATION

Most art/science encounters are signaled as participation, but I would argue that this is the category least often achieved. In Western, or EuroAmerican cultures, each field has come to embody key competing methodologies and ethical positions. Each discourse is seen to represent the best and worst intentions of a society. Science provides the data and methodologies for the creation of food, the remediation of climate change and the production of instruments of war. Art is the visible evidence of a society's faith and values; indeed, its mysteries. A strategic division between objective and subjective values will remain while humans foreground human consciousness as central to their understanding of the world.

Participation most effectively occurs where agency is distributed among the expanded field of artist, scientist, and the material elements of the artwork. Science's recognition of a new place for affect is discussed for instance by Antonio Damasio in *Descartes' Error* (1994) and *Looking for Spinoza: Joy, Sorrow and the Feeling Brain* (2003).²⁷ Posthumanist thinking argues against simplistic polarities. Actor Network Theory is a particular instance of this, reminding us of the significance of the non-human in human life.²⁸ Climate change, increasingly the subject of artworks, requires an understanding of a complex, problematic set of events that occurs on fields that are both microscopic and macroscopic, with complex relations of agency, human and non-human.

The question of materiality, once the disputed territory of philosophy and science, has become a concern for artists dealing with relations between the human and the non-human, organic or inorganic, as values embedded in the art object are challenged by debates around the sustainability of their production. Actor network theorist Bruno Latour argues that humans need a new epistemology to acknowledge the agency of the non-human.²⁹ As artists focus on the idea of materiality itself, their engagement begins to engage more specifically with the material aspects of science. As these engagements become more articulated, knowledge transfer occurs; first, between art and science in the transfer of skills and technologies; then between artist and audience, as the legibility of such works requires a more interdisciplinary knowledge. The agency of the material elements themselves becomes an increasing element in the mix, in that processes may be set in motion or existing data used to generate new outcomes.

Joyce Hinterding's articulations of the electro-magnetic spectrum are skilled and exciting experiments with specific sites. In works such as *Aeriology* (1995) she makes visible in new ways features of the spectrum imperceptible at the normal range of consciousness; Hinterding brings these into awareness, also suggesting that the buzz and hum emerging from the stars or, in a more extreme instance, from the underground rail network in the centre of Melbourne are things we do perceive at the level of the autonomic nervous system.³⁰

Participation involves negotiation and strategic decisions around the place each party takes and their role. Here there are complications around the slippery distinctions between science and technology and also around the values that the artist is seen to represent. I would argue that most

art/science relationships currently involve representation, use and parallel play rather than the mutual engagement in open-ended research that would, in my mind, constitute active participation. End-oriented projects that use the knowledge of artists and scientists to produce celebratory or visualised outcomes are encounters that enrich the understanding of experiences in parallel ways. In an applied sense, this happens in projects that for other purposes bring artists and scientists together. Public art projects to do with the mitigation or minimisation of ecological damage may do this, though usually the artist is expected to create something that beautifies or expresses values, and the scientist to provide information and method. Regeneration projects such as Mel Chin's *Revival Field* (1990 - present) and its progeny, using plants that take up toxic chemicals, have parallel forms in the various ecological experimental stations that consider what will grow in environments deprived of various apparently necessary elements.³¹ Participation occurs more easily in fields where the ends are closer; for instance, in the field of information science and technology where the human interface in all its subjectivity is recognised and quantified in terms of its applications for research and marketing. The most cited works in this field are those of the artist Stelarc, whose attempts to engage with cyborgian interventions in his body – for instance, *Ear on Arm* (2007) – invite the curious gaze of the scientist as he pushes the boundaries of voluntary engagement in discomfort.³² But a significant element in Stelarc's work is the affective notion of the artist as hero, a subtext that is enhanced by juxtaposition with science's 'hard' unemotive aspect. Keith Armstrong accepts the place of affect in his experiments in the transmission of communication through proprioception, or the whole body's sense of space, in *Intimate Transactions, V3* (2005-8), where the use of a 'body shelf' as a mouse generates connection with another participant.³³ In related ways, Hinterding's, Stelarc's and Armstrong's projects consider both experience and the capture of consciousness in all its (explicit and non-explicit) embodied forms and their relationship to political, social and ecological concerns.³⁴ In participation, what is at stake is the transfer of values as much as techniques.

IN CONCLUSION

This essay has gathered together a collection of its own: a group of scientists, artists and artworks and art/science works that all exist on some form of a continuum between art and science. This continuum only exists because art and science remain polarised. Techniques move easily between discourses but discourses entail values. As the field of art expands into areas previously captured by other disciplines, and those disciplines in their turn become more dependent upon complex visualisation techniques, representation, use and participation will overlap more frequently. The retention of the distinction between art and science, that epistemological benchmark, has become increasingly difficult as the 'objective' values associated with systematic thinking, data collection and quantitative research have been increasingly undercut by acknowledgements of the relations between emotion and intellect. Yet a recognition of the importance of verifiable data gathered through scientific technologies has become more relevant in public art as climate change leads to the need for the plausible visualisation of these data. For art/science collaborations, the ideologies that remain embedded in each end of the spectrum can be either useful or counterproductive. Like an artwork, the image of Schrödinger's cat, its fate reliant upon probabilities of a kind understood only by those with an extensive knowledge of maths and physics, will remain in the public psyche long after its efficacy as a thought experiment within science has ceased.

- 1 In the following discussion the following sources have been used: Roger Penrose, *The Emperor's New Mind: Concerning Computers, Minds and the Laws of Physics* (London: Vintage, 1990); Roger Penrose, *Shadows of the Mind* (London: Vintage, 1995); Neils Bohr, "The Bohr-Einstein Dialogue" and Loren Graham, "Complementarity and Marxism-Leninism," both in A. P. French and P. J. Kennedy, *Niels Bohr: A Centenary Volume* (Cambridge, Massachusetts, and London, England: Harvard University Press, 1985), 121-40 and 332-44; Murray Gell-Mann, *The Quark and the Jaguar: Adventures in the Simple and the Complex* (London: Little-Brown and Company, 1994).
- 2 Cited in Graham, "Complementarity and Marxism-Leninism," 332.
- 3 The original remark occurs in Hanns Johst's pro-Nazi play *Schlagete* (1933). Hawking's comment and this context are cited in Gell-Mann, *The Quark and the Jaguar*, 153.
- 4 Roger Penrose, "Schrödinger's Cat," in *The Emperor's New Mind*, 375-8.
- 5 *About.com*, http://physics.about.com/od/lightoptics/a/doubleslit_ [accessed 22 Oct 10].
- 6 Sigmund Freud, "Leonardo da Vinci and a Memory of His Childhood," in *The Standard Edition of the Complete Works of Sigmund Freud*, vol. 11, ed. James Strachey (London: The Hogarth Press and The Institute of Psychoanalysis, 1953-1974), 59-137.
- 7 On the relation between Galileo's skill in drawing and his analysis of what he was seeing through his optical instruments, see among many others: Peter Galison, "Images Scatter into Data, Data Gathering into Images," in *Iconoclasm*, ed. Bruno Latour and Peter Weibel (Karlsruhe, Germany and Massachusetts: ZKM/ Centre for Art and Technology and Massachusetts Institute of Technology, 1999), 300-323.
- 8 A useful synopsis can be found in Whitney Chadwick's *Women, Art and Society* (London: Thames and Hudson, 1990), 122-5.
- 9 Patricia Piccinini, *The Young Family* (2002-3), silicone, polyurethane, human hair, variable dimensions. See <http://www.patriciapiccinini.net> [accessed 20 October 2010].
- 10 Ron Mueck, *Pregnant Woman* (2002), 2.5m high, fiberglass, resin, silicone. National Gallery of Australia.
- 11 In what follows I draw on the experience of my visit to Olafur Eliasson, *Take Your Time*, Museum of Contemporary Art, Sydney (2010).
- 12 Olafur Eliasson, *Room for one colour* (1997), monofrequency lights, installation. "Monofrequency lights emit light at such a narrow frequency that they affect your normal colour perception, making the contents of the room appear in yellow or shades of black." Olafur Eliasson, *Take Your Time*, Museum of Contemporary Art, Exhibition Guide.
- 13 Olafur Eliasson, *Yellow versus Purple* (2003), colour-effect filter glass, spotlight, tripod, motor, wire, installation. "As a white spotlight shines on a rotating glass disc complementary purple and yellow reflections are cast on the surrounding area." Olafur Eliasson, *Take Your Time*.
- 14 Spencer Finch, *First Sight* (2008), ink, dye, water, freezer and mixed media. Dunedin Public Art Gallery.
- 15 Spencer Finch, *Ice Cave Fox Glacier* (2008) neon tube and gel. Dunedin Public Art Gallery.
- 16 William Arntz, Betsy Chasse and Mark Vicente, *What the Bleep do we Know* (Captured Light Industries, A Lord of the Wind Film, 2004).
- 17 See Eduardo Kac, <http://www.ekac.org> [accessed 30 June 2010] and <http://www.alan-shapiro.com/teleporting-an-unknown-state-by-eduardo-kac/> [accessed 4 July 2010].
- 18 See Critical Art Ensemble, <http://www.critical-art.net/Biotech.html> [accessed 8 Oct 2010].
- 19 See Critical Art Ensemble, <http://www.critical-art.net/> and <http://www.caedefensefund.org/> [accessed 8 Oct 2010].
- 20 I draw on notes taken when visiting the exhibition in November 2009 and interviews with the artists projected within the exhibition.
- 21 Roger Hiorns, *Untitled* (2008), plastinated bovine material and the remains of a pulverised jet engine. Exhibited in *Turner Prize*, Tate Gallery, 2009. See <http://www.guardian.co.uk/artanddesign/roger-hiorns> [accessed 12 Oct 2010].
- 22 Bruno Latour, *The Politics of Nature: How to bring the Sciences into Democracy* (Cambridge, Massachusetts, and London, England: Harvard University Press, 2004), 88.
- 23 Roger Hiorns, *Seizure* (2008), interior of flat, copper sulfate solution, installation.
- 24 Roger Hiorns, from writer's notes from digital interviews with Turner Prize exhibitors shown within the exhibition space, Tate Gallery (2009).
- 25 Lucy Skaer, *Black Alphabet (After Brancusi)* (2008), coal dust, each bird 185.43cms; and Lucy Skaer, *Leviathan Edge* (2009), sperm whale skeleton exhibited in "Turner Prize," Tate Gallery (2009).
- 26 Lucy Skaer, digital interviews with Turner prize exhibitors shown within the exhibition space, Tate Gallery (2009).
- 27 Antonio R. Damasio, *Descartes' Error: Emotion, Reason and the Human Brain* (New York: Putnam, 1994); and Antonio R. Damasio, *Looking for Spinoza: Joy, Sorrow and the Feeling Brain* (Orlando, Florida: Harcourt, 2003).

- 28 Bruno Latour, *Reassembling the Social: an Introduction to Actor-Network Theory* (Oxford and New York: Oxford University Press, 2005).
- 29 Latour, *The Politics of Nature*.
- 30 Joyce Hinterding, *Aeriology* (1995), copper wire, oscilloscope, antennae, <http://www.sunvalleyresearch.com/Luminoska/index2.htm> [accessed 26 Oct 2010].
- 31 Mel Chin, *Revival Field* (1990-present), see <http://www.satorimedia.com/fmraWeb/chin.htm> [accessed 26 Oct 2010].
- 32 Stelarc, *Ear on Arm* (2007), skin, microphone, the artist's arm. See <http://www.stelarc.va.com.au/> [accessed 27 Oct 2010].
- 33 Keith Armstrong, *Intimate Transactions V3* (2005-8), <http://www.embodiedmedia.com/#/page/1207052675> [accessed 27 Oct 2010].
- 34 Julian Priest, "Internet:Environment," in Stella Brennan and Su Ballard, *The Aotearoa Digital Arts Reader* (Auckland: Aotearoa Digital Arts and Clouds, 2008), 207-19.