Sue Broadhurst

Professor in Performance and Technology,
Drama Studies,
School of Arts
Brunel University,
London,
UB8 3PH, UK
Direct Line: 01895 266588
Fax: 01895 269780
Email: susan.broadhurst@brunel.ac.uk.

Title: 'Theorising Performance and Technology: Aesthetic and Neuroaesthetic Approaches'

Abstract

This paper seeks to contextualize the rapid growth of digital technology in performance as an established and popular art practice. In doing so, I intend to examine and compare neuroaesthetic and aesthetic theorization in order to provide interpretative strategies that would be capable of addressing this new and sophisticated *genre*. First, I provide a comparative study of the writings of Maurice Merleau Ponty, who recognized that our experience of the world has an undeniably 'embodied' quality, overriding various post-Cartesian models, which can be extended by proxy through specific instrumentation. At the same time, I examine a neuroaesthetic approach linking performance and art practices with recent neurological research on cognition and behaviour, which suggests some future understanding of the biological underpinnings of aesthetic experience. It is my belief that such diverse approaches, although widely varied in their premises, have much to contribute to interpreting developments within these emergent artistic directions, which have gained critical recognition without significant antecedent theoretical discussion**.**

Notes on Author

Susan Broadhurst is a writer and performance practitioner and Professor of Performance and Technology in the School of Arts, Brunel University, London. Susan's research entails an interrogation of technologies and the notion of the embodied performer, expressed in her publications, performance practice and interdisciplinary collaborations. Her publications include *Digital Practices: Aesthetic and Neuroesthetic Approaches to Performance and Technology* (2007), *Sensualities/Textualities and Technologies: Writings of the Body in 21st Century Performance* (2010) and *Identity, Performance and Technology: Practices of Empowerment, Embodiment and Technicity* (2012) all published by Palgrave Macmillan. As well as being the co-editor of the online journal *Body, Space & Technology* now in its thirteenth year of publication, she is also co-series editor for Palgrave's 'Studies in Performance and Technology.'

Keywords

Performance and technology; art and perception; aesthetic theorization; defamiliarization; Merleau-Ponty; extended body; 'visible' and 'invisible'; embodied experience; neuroaesthetic approach; visual perception.

Introduction

In this paper it is my intention to examine and compare aesthetic and neuroaesthetic theorization in order to provide interpretive strategies that would be capable of addressing sophisticated technological art practices. In doing so, I will provide a study of two mutually enhancing approaches to this analysis namely, the writings and aesthetic theorization of Maurice Merleau-Ponty and a neuroaesthetic approach linking performance and art practices to neuroscientific research in order to provide some understanding of the biological underpinnings of aesthetic experience. It is my belief that such diverse approaches have much to contribute to interpreting such developments. Due to the vast amount of research undertaken in this area, visual perception is central (though not exclusive) to this biologically-related approach. The general direction of such research illuminates the problem as summarised by Francis Crick that: 'It is difficult for many people to accept that what they see is a symbolic interpretation of the world – it all seems so much like "the real thing"'.[1]

Context

Performance, an extensive, but for some, challenging zone between drama, dance and happening, has entered new territory which reflects our enveloping experience of the contemporary world, capturing that primitive sense of interactive consciousness which Heidegger called simply 'being in the world'.[2] In a short period of time there has been an explosion of new technologies that have infiltrated, and irreversibly altered, our lives. The consequences are not without problems, but these developments have given performance practice powerful new dimensions.

As far as performance presentation goes, it seems to have developed from sporadically held events, staged in 'real time', in obscure venues, with the minimum of props, into multi-media stagings, attracting large audiences and employing a panoply of technological devices. Its artistic ambitions, too, appear to have enlarged, embracing multi-layered content which attempts to address more elusive and broader themes, reflecting our enveloping experience of the contemporary world. Of course in this period there has been an increasing mainstream acceptance of stage practices which depart radically from textually-based drama or traditional dance, as witnessed by the immense impact of Bausch's *Tanztheater*. It is my belief our changed technological resources constitute a critical factor in this evolution. The analogue processes of film and magnetic tape have frequently served in the past as components and amplification of live performance, but their relationship to the latter was one of simple synchronicity: they ran on their course inexorably, and the performer(s) would coordinate to a greater or lesser degree with them.

In the last two decades, however, the development of digital processing facilitated an unprecedented interactivity between performer and device (characteristically demonstrated by Troika Ranch amongst others), bringing hugely increased computing power to these functions, and, in virtue of its ability to break down information into mutable combinations of bits, the opportunity to mould and sculpt, so to speak, the qualities of the presented material. Digital technology transformed a fundamentally passive, recipient relationship of performer to media devices, into one of active reciprocity and joint enterprise. I would suggest that, culturally, as a result of these developments, our sense of our bodily frontiers has undergone a radical expansion, and so too has our conception of the 'incarnate' nature of consciousness, in which respect I regard Merleau-Ponty's theorization as pivotal. I also contend that the above-mentioned field of neuroaesthetic analysis might provide some insight into why the more obscure instances of contemporary performance have the artistic value that we apparently accord to them.

It is my belief also that such exemplary features demand a new mode of analysis which foregrounds the inherent tensions between the physical and virtual. As a development of previous theorization on liminality,[3] an aesthetic theorization is central to this analysis. However, other approaches are also valid, particularly, those offered by research into cognitive neuroscience,[4] particularly in relation to the emergent field of 'neuro-esthetics' where the primary objective is to provide 'an understanding of the biological basis of aesthetic experience'.[5]

Merleau-Ponty and the 'incarnate mind'

Much critical theorization in recent times has focused on the perceptual role of the body and much of this emphasis has been directly attributable to the work of Maurice Merleau-Ponty. By shifting the perspective from Husserl's latterly idealist position to the 'primacy' and 'phenomenology of perception', Merleau-Ponty instituted the 'corporeal turn' so crucial to contemporary theory and practice. This theoretical emphasis on the *corpus* is important since within technologically informed performances the body, both physical and virtual, is pivotal.

As a philosopher Merleau-Ponty inherited features of the aforementioned project of European *phenomenology*, chiefly its commitment to attempting to describe the contents of consciousness directly, without trying to prune away unsafe knowledge claims or to provide causal explanations (as previous philosophical tendencies had done), and also to take as its point of departure the acting subject, already engaged with, and directing different modes of attention onto, the world, rather than a passive, Cartesian, somewhat disembodied self, disinterestedly deriving conclusions about it.

For Merleau-Ponty, the 'perceiving mind is an incarnated mind' and perception is not simply the result of the external world on the body: 'what recent psychologists have come to formulate: the lived perspective, that which we actually perceive, is not a geometric or photographic one'.[6] 'Vision is not the metamorphosis of things themselves into the sight of them'; it is rather, 'a thinking that deciphers strictly the signs given within the body'.[7]

There is no perception in general; there is only perception as it is 'lived' in the world. As a result, the perceiving subject is always changing, always going through a process of rebirth; 'my body *obeys* the pregnancy … flesh responding to flesh … This definition of pregnancy as implying motivity … a sense by transcendence'.[8] The performance artist Stelarc, as I discuss below, amply demonstrates this through his performance and art practices since he shows 'to be a body is to be tied to a certain world'.[9]

In replacing objective notions of embodiment by embodied experience, Merleau-Ponty goes beyond the limited subject/object ontology not by returning to a reductionist dualism (of binary oppositions), which would simply prioritize one term over another, but rather by attempting to understand the interplay of the biological and physical, 'the inside and outside'. Merleau-Ponty asks us to reflect on the consciousness of lived experience: 'Consciousness … is not a matter of "I think that" but "I can"'.[10] The body is seen not as an objectifiable entity, instead, 'I am not in front of my body, I am in it, rather I am it'. It interprets itself and it is to be 'compared, not to a physical object, but rather to a work of art … It is a focal point of living meanings'.[11] Here, Merleau-Ponty is suggesting that perception is not only intertwined with the scientific and rationalistic but also with the 'aesthetological', the 'mute' artistic, the 'primordial'.[12] An instance of this is provided by bioart practices where 'we are witnessing the birth of a new form of art: art created in test-tubes'. [13] Since her first work of bioart, *Nature?* (2000), involving the microsurgical modification of live butterfly wing patterns, Marta de Menezes has employed a variety of scientific technologies including images derived from her own brain FMRI in *Functional Portraits* (2002), fluorescent DNA in *NucleArt* (2001) and protein synthesis in *Proteic Portrait* (2002).If the body is also seen as an intertwining of movement and vision then 'we cannot imagine how a *mind* could paint; it is by lending his body to the world that the artist changes the world'.[14]

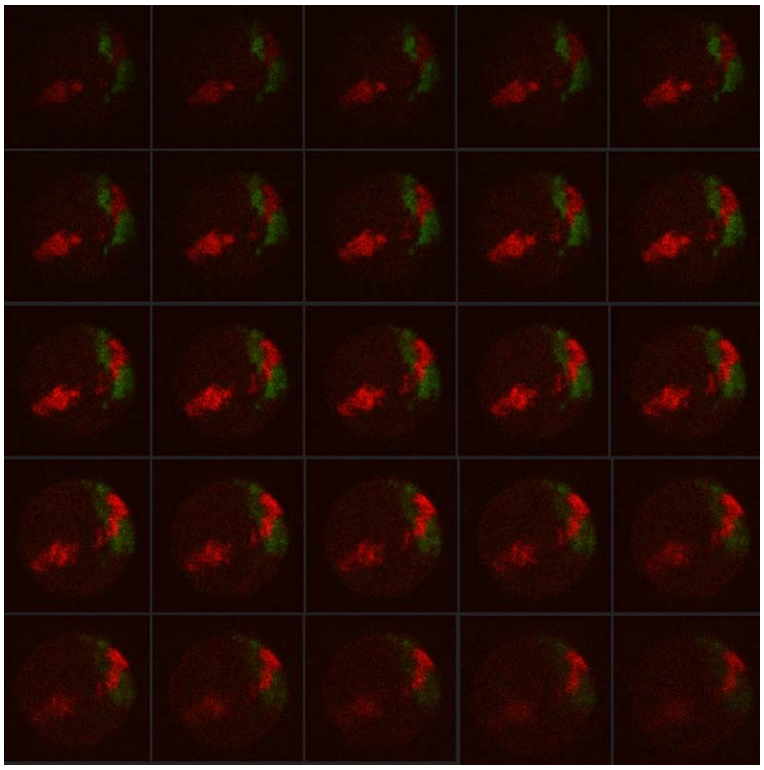

Fig 1 Marta De Menezes *NucleArt* 2000-2002
Human cell with painted chromosomes.
Frame from video-installation, projected onto
3D screens

As a development of his previous post-Cartesian phenomenological approach, Merleau-Ponty's in his later writings, 'Eye and Mind' and *The Visible and The Invisible* , emphasizes the 'flesh of the world' rather than a lived perceiving body.[15] He indicates that perception is not an intentional act but rather simply a being in the world or a 'being at' in the world, 'the seeing and the visible, the touching and the touchable … is not an act, it is a being at … the reflexivity of the body, the fact that it touches itself touching, sees itself seeing … does not go beyond a sort of *imminence*, it terminates in the invisible'.[16]

Susan Kozel in *Closer* correctly indentifies that Merleau-Ponty's notion of: 'the invisible is significant to digital media because it challenges the supremacy and literality of vision'. She argues that it allows consideration for media such as 'sound and haptics' other than 'simplistic notions of moving images'. As she mentions Merleau-Ponty, in his uncompleted theorization on the 'visible' and 'invisible', enables the introduction not only of 'corporeal roots of vision but also kinetic and kinaesthetic qualities'.[17]

For Merleau-Ponty, visibility always involves non-visibility and likewise the visible entails the invisible. According to him, 'when we speak of the flesh of the visible, we do not mean to do anthropology, to describe a world, covered over with all our own projections'; instead, what is meant is a carnal being of 'several leaves or faces'.[18] In this

sense, the lived corporeal body remains absolutely central to his writings but also I would argue crucial to technologically informed creative practices.

How can one associate these positions with the phenomenon of performance today? I suggest that there are, so to speak, three degrees of proximity: influence acknowledged *by* performer; concurrence of performer's creative intent *with* previous theorization; use of such theories to retrospectively *analyze* performer's work.

In performance and technology, instrumentation is mutually implicated with the body. The body adapts and, in effect, extends itself through external instruments. In this way, 'the body is our general medium for having a world'.[19] To have experience, to get used to an instrument, is to incorporate that instrument into the body; 'habit expresses our power of dilating our being in the world, or changing our existence by appropriating fresh instruments'.[20] The experience of the corporal schema is not fixed or delimited but extendable to the various tools and technologies which may be embodied.

Moreover, the body is a system of possible actions since when we point to an object, we refer to that object not as an object represented but as a specific thing towards which we 'project' or propel ourselves,[21] in fact a 'virtual body' with its phenomenal 'place' defined by task and location.[22] This emphasis on a virtual body has resonance with and points to a deconstruction of the physical/virtual body of digital practices, a body of potential and indeed, infinite creativity.

An example of this 'instrumentation' is magnetic or optical motion capture and has been used widely in performance and art practices for some time now. This involves the application of sensors or markers to the performer or artist's body. The movement of the body is captured and the resulting skeleton has animation applied to it. This data projected image or avatar then becomes some part of a performance or art practice.

Kozel writes of her own early improvisation with 'mocap data' where she experienced an '"open circuit" between her body and the figure'. Her avatar provided direct extensions of her movement but there was no convergence 'between her and the visible figure'. She claims that 'we borrowed from each other' and adopting Merleau-Ponty's notion of 'encroachment': 'we "encroached" on each other' and 'we also gave to each other',[23] she continues: 'The figure with which I perform is always at the same time both my own body and another body … If we follow Merleau-Ponty, perception is more than just the neurophysiological mechanisms by which I apprehend the world … perception is ontological.[24]

Motion tracking is used especially in live performances, such as, Merce Cunningham's *Biped*,[25] where pre-recorded dancing avatars are rear projected onto a translucent screen giving the effect of a direct interface between the physical and virtual bodies**.**

Cunningham's use of motion capture, in collaboration with Shelley Eshkar and Paul Kaiser, displaces the boundaries of physicality in a fairly radical way. Physical movement generates virtual bodies through the mediation of technology and the digital designers.

Hand drawn abstract images and figures by Eshkar, animated by motion capture data provided by real dancers are seen together with live dancers on stage bringing into question notions of embodiment, identity and origin.

Other forms of instrumentation are MIDI (musical instrument data interface), Max (a real-time programming environment that has the special advantage of being interactive with visual and network technologies) and OSC (Open Sound Control),[26] which are central to the performances of internationally renowned Troika Ranch (Composer and Software engineer – Mark Coniglio; Choreography and Artistic Director - Dawn Stoppiello) who fuse traditional elements of music, dance, and theatre with real-time interactive digital technology thus providing technological extensions of the body.

They are pioneers in their use of MidiDancer and Isadora software, which can interpret physical movements of performers and as a result that information can be used to manipulate the accompanying sound, media, and visual imagery in a variety of ways, thus providing a new creative potential for performance. This is exemplified by their forthcoming work SWARM, which will be an immersive multimedia performance/installation where the movements of the audience as community allow them to collaborate on composing the sonic scene, visual materials, theatrical lighting and the actions of the performers. The crux being that only through co-ordination, conversation, and collective action can the audience – the Swarm – fully realize and experience the performance.

In Stelarc's performances the body is also coupled with a variety of instrumental and technological devices that instead of being separate from the body become part of that body. One such performance is *Muscle Machine*,[27] where Stelarc constructed an interactive and operational system in the form of a walking robot. *Muscle Machine* couples the biological body with machine architecture, combining muscles with mechanism. Rubber muscles are inflated with air, as one set of muscles lengthens the other shortens in order to produce movement, at the same time translating human bipedal gait into a six-legged insect like motion.

Fig 2: *MUSCLE MACHINE*, Gallery 291, London, 2003. Photographer: Mark Bennett. STELARC

Additionally, artificial intelligence is featured in technological performance practices, where the challenge is to demarcate the delimited human body from an artificially intelligent life form, such as, Jeremiah the avatar in *Blue Bloodshot Flowers*[28] who was developed from surveillance technology. In the performance, his vast spectral face focuses on and tracks the movement of these like some deity, the figures he perceives being literally *sub specie aeternitatis* (‘under the gaze of eternity’).

Fig 3: Elodie Berland and Jeremiah from *Blue Bloodshot Flowers*, 291 Gallery, London, 2001. Director: Susan Broadhurst. Technology: Richard Bowden, Image by Terence Tiernan

For Merleau-Ponty, our bodies are always open to and 'intertwined' with the world. Technology as demonstrated by the above performances can thus imply a reconfiguration of our embodied experience. When, to use the word non-semiotically, the meaning 'aimed at' cannot be reached by the body alone, the body builds its own instruments and projects around itself a mediated world. Rather than being separate from the body, technology becomes part of that body, so altering and recreating our experience in the world.

A Neuroaesthetic Approach to Perception

In the last thirty years neurological research has reached a point where we can examine in some detail the nature of brain activity involved in sustaining states of consciousness, and in directing different modes of attention towards particular features in the world.

In taking a neuroaesthetic approach here, the embodied nature of experience is again central. How do we perceive? How do we see? How do we understand what we see? And how can we recollect an image that we can picture in seemingly perfect detail when the visual stimulus is no longer before us? Although light does stimulate the very sensitive photoreceptors located on our retina, it does not engage with the brain directly. The only information that the brain receives comes from electrical impulses at varying frequencies,

as signals from our senses. The signals need to be made sense of according to a colourific resolution based on a complex interaction of neural activity, experience and knowledge.

There seem to be three main zones of enquiry which such research has addressed: the relationship between various sensory stimuli and neural activity, the coordination of these to produce a coherent representation of the world, and the involvement of such factors as memory, expectation and imagination in interpreting it. Traditional empirical approaches, predating this research, would have regarded these three zones as very much sequential: stimulus-electronic impulse-coordination-interpretation. What is now apparent is that they are highly reciprocal.

Stimuli are not received as discrete events to which interpretation is 'applied', rather they are sorted and enriched by use of associable memories (themselves often completed by imagination), and by expectations derived from these. Philosophers have called this condition 'theory-laden-ness', which implicitly rejects a notion, historically called 'empirical atomism' that we are immediately aware of interpretation-free data. As scientific research progresses, bringing increased knowledge of how visual imagery is constructed, there is even more of a distinction between 'perceived appearances' and 'accepted realities', or between what we *see* and what we *know* and believe we see,[29] which ultimately leads to a questioning of the very nature of our consciousness, identity and being. This point exhibits expediently the difference between scientific and phenomenological standpoints: science has provided an 'aetiology', that is, a causal account of a phenomenon, but by its nature as a discipline in search of causes, cannot address it directly.

This is of course not to say that the two approaches are in opposition. As previously mentioned Merleau-Ponty was particularly interested in the neurological research of his time, and his work: *The Phenomenology of Perception*, vividly instances and describes the results of brain injury. It could be suggested that phenomenology projected lines of enquiry relating to consciousness which neuroscience has subsequently sought to explain in detail.

Another example of neuroscientific anticipations found in his writings are the 'intertwining and chiasm' (metonymically referring to the optical chiasma - that is, the crossover of the optic nerves) of body, experience and pre-conception work together in the act of perceiving. According to Martin Jay, 'we are always in the middle of a multilayered process … best understood as chiasmus'.[30] Binocular vision is necessary for assessing depth of vision, which results when the brain somehow compares and reconciles the input from these two incompatible positions. Digital performances such as *Dead East, Dead West,*[31] an experimental sound and movement-based piece, use 3D technologies in an attempt to replicate this stereoscopic affect on two-dimensional imagery.

Fig 4: Katsura Isobe, Dave Smith and Tom Wilton in *Dead East, Dead West* at the ICA, London. Director: Susan Broadhurst. Image by Terence Tiernan

Notwithstanding all the exploration and work that has been done by scientists, psychologists, theorists and philosophers concerning vision, there is still 'no clear idea of how we see anything'.[32] Although visual awareness is taken for granted it is not fully understood how the brain makes 'sense' of what it sees, that is, varieties of how it welds together micro electrical impulses into a coherent and navigable world-picture. Certainly fragments of this process can be understood. For instance there is certainly some idea of the location of various visual operations in the cortex of the brain but there are still simple questions that as yet cannot be answered. For example: How do we see colour and make sense of it? How do we recognize a familiar face? What allows us to see motion? Quite a lot of hypotheses have been formulated about these processes mainly as a result of what happens when things go wrong as a result of disease or injury.

Another important point is that we can never actually have a direct knowledge of objects in the world since what our brain makes sense of is not simply a succession of images, but also symbolic interpretations, and of course such interpretations can sometimes be wrong. What is epistemically 'seen' is not what is actually in front of us but what out brain believes to be there, 'coloured' as it were, by our knowledge and experience.

For Stephen Kosslyn, perception is differentiated from imagery, inasmuch as in the former a perceived object is physically present. In the latter, perceived objects are not being 'actually' viewed and these images can be changed at will. Memory also plays a role since visual images are usually built on visual memories. Although these images are immediate and transient, they can be used at different times to form new imagery (A point not lost on Descartes in his first 'Meditation'[33]). In fact, imagery (not solely restricted to vision) is important to cognition due to its ability to create and be creative.[3435] New research has shown that some areas of the brain involved in visual processing are '*topographically organized'*; that is, these areas use spaces on the surface of the brain to represent 'space in the world'. When an object is viewed the pattern of activity on the retina is projected back into the brain where it is reproduced (though with some distortions) on the surface of the brain; literally presenting a 'picture in your head'. Edward Smith and Stephen Kosslyn argue that: 'brain areas support genuinely depictive representations'. They suggest that a similar process occurs with eyes closed and a remembered object visualized in as much as topographical organization also occurs.[36]

Visual imagery is central to many digital practices, for instance, memory and the act of remembering are explored in Troika Ranch's *The Future of Memory* (2003) by means of a multi-layered collage of imagery and sound; the technology acting as a 'metaphor for memory' itself. Using 'Isadora in tandem with MidiDancer', the performers, Stoppiello, Goldman, Szabo and Tillett, manipulate sounds and images in real-time; 'floating in a chaotic world of movement video and sound, the four characters … swirl in and out of reality as they attempt to regain the memories that define who they really are'.[37]

Fig 5: The Company in *Future of Memory,* 2003. Photo: Richard Termine

The retina of the eye is not linked to the whole of the cerebral cortex but instead to a fairly localized area now generally known as the 'primary visual cortex' or area 'V1'.[38] Adjacent areas of the retina connect with V1, recreating a visual map of the retina on the cortex. Connections between the retina and the primary visual cortex are genetically determined, the necessary visual apparatus being present at birth. However, to be able to function at all this system needs to be exposed to the visual world. For whatever reason, if cells in the visual brain are deprived of this crucial exposure in the early period of life they become dysfunctional and are unable to fully respond to visual stimuli, if they can respond at all.

It would seem that the primary region concerned with colour is the V4 complex and it is located in the fusiform gyrus. Of course colour cannot be divorced from form, since there must be a border to distinguish colour, even if the brain processes both attributes separately.[39] Though colour is a property of the brain and not of the external world it is still dependent on a physical reality outside the brain; 'the science of colour is therefore a mental science' that also makes use of 'optics' and 'anatomy'.[40]

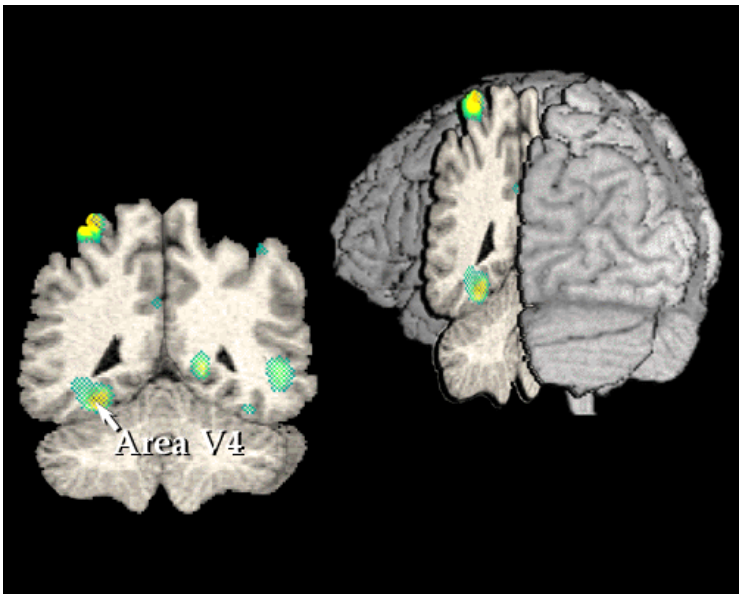

Fig 6: Area V4 of the brain. Photo Courtesy of Professor Semir Zeki.
From the Laboratory of Neurobiology at UCL, www.vislab.ucl.ac.uk

The key areas of the cortex that seem to be concerned with colour are specialized cells in V1, V2 and the colour centre V4, together with locations in the temporal lobe. Although it is possible to specify which features are demonstrated by individual visual areas it does not mean that they are the only attributes of those areas. For that matter, there may be no clear indication just what such features mean. For example, to know that V2 appears to have some concern with colour gives us no clear idea whether the neurons within this area allow us to see colour or merely draw the brain's awareness to what the colour actually looks like.[41]

What is known is that colour is perceived before form, that in turn is perceived before motion – the period of time between the perception of colour and motion of an object is approximately 80-100 milliseconds.[42] The consequence of this is that the brain over very short periods of time is unable to combine what happens in 'real time'; instead, it unifies the results of its own processing in a short duration combining all visual attributes to provide us with an integrated experience. Digital multilayered performances disrupt this perceived 'wholeness'.

Ever since Merleau-Ponty's analysis of the case of Schneider's 'psychic blindness', who, after being wounded during the first world war, was unable to spontaneously perform abstract tasks, although his practical behavior was still generally adequate,[43] it has been apparent how deep is the involvement of various regions of the brain with our ability to use our sense of vision to negotiate the world. This example raises the interesting question of whether there are mental 'disorders' which can yet seem to be enhancements of consciousness. The fusiform gyrus, as well as accommodating V4, is also adjacent to that which represents visual numbers. This has surprising repercussions for a certain subgroup of individuals who whilst being otherwise normal, experience sensations in modalities other than the modality that is being directly stimulated.[44] This mingling of the

senses is known as synaesthesia (from the Greek *sun*: joining with, and *aisthesis*: sensation) and presents in a variety of ways; for example, some individuals visualize colours when they view numbers. Others see colours in response to a musical or non-musical tone. Various explanations have been given for this phenomenon, but recent evidence suggests that synaesthesia has genuine perceptual foundation.[45] According to Ramachandran and Hubbard, the number/colour or grapheme colour type of synaesthesia, the most common form of this condition, is most likely due to cross-activation or cross-wiring of both the colour and visual number regions within the fusiform gyrus in genetically predisposed individuals.[46] Recent studies have suggested links between synesthesia and creativity. An important effect is that it improves memory and recall. According to V.S Ramachandran, 'synesthesia is more common among artists, poets and novelists than the general population.'

To bring the narrative forward, digital performances, projecting an unusual and diverse range of media codes, arouse a need for the brain to attempt to find essentials and stability in order to make sense of the images before it, as in the former approach. However, due to the multilayered nature of much of this performance, the latter agnostic approach is followed through, which in the context of performance is now routinely designated (post-Brechtianly) as *defamiliarization*. And although there is a need to continually attempt to recognize and make sense of elements within the works, the audience is repeatedly frustrated by the juxtaposition of disparate elements and the concomitant lack of closure or resolution. Instead of a harmonious sense of well-being there is rather a tension between joy and sorrow, the delight of having an idea of the totality of feeling together with the pain of not being able to fully present an inner state equal to that idea, the inability to 'present the unpresentable'.[47] Thus some performance successfully intertwines the seemingly contradictory aesthetic paths of knowing and unknowing.

All works of art that conflict with our prior experience of visual reality, or frustrate our expectations of any clear resolution, are likely to activate the specific area of the frontal lobe which appears to deal with the resolution of perceptual/experiential conflict. [48]
It can be argued that artistic tendencies such as Surrealism and Abstract Expressionism played upon this line of stimulation. So, by implication, does the performance of *Dead East, Dead West* and the performances of Troika Ranch.

This neurological examination of perception, to a certain extent, supports aesthetic theorization of a more discursive kind. Even the most legislative turns such theorization has taken have essentially been inferred from conspicuously successful examples, the *Poetics* of Aristotle being a case in point. And of course the thinking of late antiquity, from Longinus, made room for quasi-aesthetic responses to which rule-satisfying was simply inapplicable, namely the sublime: unlimited, formless but nevertheless instantiating 'purposiveness without purpose' evading any guaranteeable judgement.[49] It is tempting to align this elusive concept with the above mentioned neurological region.

Talk of the sublime evokes its revivifier in modern thought. In Kantian tradition, pure reason, directed to the nature of understanding, and practical reason, relating to acting

within nature, are seen as separate spheres, with the aesthetic as an overlap zone straddling this divide. Although Kant himself criticized any notion of fixture and closure in his claim that 'the concept never stands within safe limits',[50] to all intents and purposes these two spheres have been since generally assumed to be distinct aspects of intellection. However, this assumed discreteness is brought into question by some neuroscientists, including Semir Zeki, who refute the notion that there could be in effect a 'master area' of the brain concerned with analysing its own understanding *per se*. For the latter, this notion is a 'logical and neurological problem', inasmuch as there would still be the question of 'who' it was that interpreted the presentations arrayed in the rest of the brain.[51] And this in turn would raise a new version of the old problem for philosophical idealists of previous generations, as to what constituted the subject-within-the-subject which examined the sense impressions alone founding our notion of reality.

For Zeki, vision is an active process, a search for constancies,[52] a certain assumption of the stability of physical properties being viewed. There is a need for us to be able to discount changes and variations in order to categorize objects and so to negotiate and empty them successfully. There is no actual colour as such, only wavelengths of light that our visual system makes sense of and as far as we know only primates, birds, reptiles and some insects have the ability to see colour at all. The wavelength composition of a leaf changes constantly depending on the light reflected from it. There is no unique 'code' for any colour yet the brain is still able to decide that a leaf is green whatever the time of day. This 'discounting of the illuminant' is an example of Helmholtz's notion of 'unconscious inference' where certain assumptions of hidden knowledge concerning what is seen can be elicited when an object is viewed. However, for Zeki,[53] Edwin Land's hypothesis in 'The Retinex Theory of Colour Vision' (1974) is closer to our perceptual experience. Zeki, following Land, posits that 'our capacity' for colour constancy 'is the result of a simple brain program, a computational process'.[54]

In his exploration of art and the brain, Zeki links the workings of the brain to visual arts; '*we see in order to acquire knowledge of the world*'.[55] Since the brain is only interested in acquiring knowledge from a world that is apparently constant this acquisition does not come easily; the world of appearances is continually changing and objects appear from different vantage points, distances, light and depth, yet the brain can still make sense of these objects. For Zeki, art, being an extension of the function of the visual brain is also a search for essentials and stability even when it appears at its most disruptive.

In relating the visual apparatus to the perception of art, there are surprising neurological differences between viewing naturally coloured objects that have definite shapes, such as: trees, plants, cars and buildings, and colour in the abstract - that is, colours that have no reference to any particular objects or scenes, such as found in the abstract paintings of Rothko or LeWitt. The larger implication is that when viewing colour in the abstract, 'automatic computation' takes place in certain areas of the brain. However, when viewing naturally coloured objects additional factors are used by the colour system, such as memory, learning and judgment.[56] A further and more important implication for digital art and performance practices is that activation of the middle frontal convolution[57] of the frontal lobe when viewing non-representational colour may not mean that this region is

exclusively devoted to non-representational colour perception but rather it responds to different elements of the unusual or 'irregular patterns' in general.[58] (An interesting confirmation of Kant's views that successful artworks both obey and subvert our expectations of 'regularity' and rule following).[59]

All works of art that conflict with our prior experience of visual reality or in other words frustrate our expectations of any clear resolution, such as the art of the Fauvists and the Surrealists and by implication digital practices, such as those of Jeremiah in *Blue Bloodshot Flowers* and Troika Ranch, are likely to activate this specific area of the frontal lobe which appears to deal with the resolution of perceptual/experiential conflict.[60]

As I have argued, Merleau-Ponty distinguishes between the 'lived' body or 'I' body from the objective body. He argues that the lived body is made of an elaborate network and contexts that make up the perceptual field whereas the objective body is merely a biological entity. The former is a cultural identity produced by perception, the latter an object which offers itself up to biology. However, for Merleau-Ponty, 'flesh in itself' is implicated in both: 'Is my body a thing, is it an idea? It is neither, being the measurement of the things'.[61] He posits the notion of 'massive flesh' as being incapable of rational thought or conceptualization but is rather a pre-subjective, prediscursive, elemental body, which exists before 'I' am there.[62]

The self, as well as being embodied, is also 'emotional' as can be seen in the above audience interaction with Jeremiah where the avatar is clearly emotionally appropriated, being viewed as an extension and modification of a human being. An emotional response can be measured by a device that monitors the galvanic skin response (GSR), which is fundamentally the change in skin resistance caused by perspiration. Surprisingly, our GSR does not only respond to events that directly affect us and our bodies, though of course there is a strong reaction when we are directly stimulated. It has been demonstrated that it also responds to events that affect objects that we have appropriated as being part of our body.[63] This may well go some way to explaining the mechanism of love where another identity is appropriated by our own and as such becomes literally part of our body.[64]

Certain technologically informed performances add a further dimension to this appropriation since the motions of a performer's body captured technologically results in a modified extension of that physical body; amply evidenced by Cunningham's avatars in *Biped* and by Troika Ranch's *16 [R]evolutions* (2006), where the body writes itself in performance and where innovative choreography and multimedia effects explore the similarities and differences between human and animal, and the evolutions that both go through in a single lifetime. The implication is that the embodied self, as any other aspect of the conscious self, is primary yet transitory, heterogeneous, indeterminate, reflexive, fragmented and has a certain shift-shape property; all the latter quintessential features of innovative digital performances.

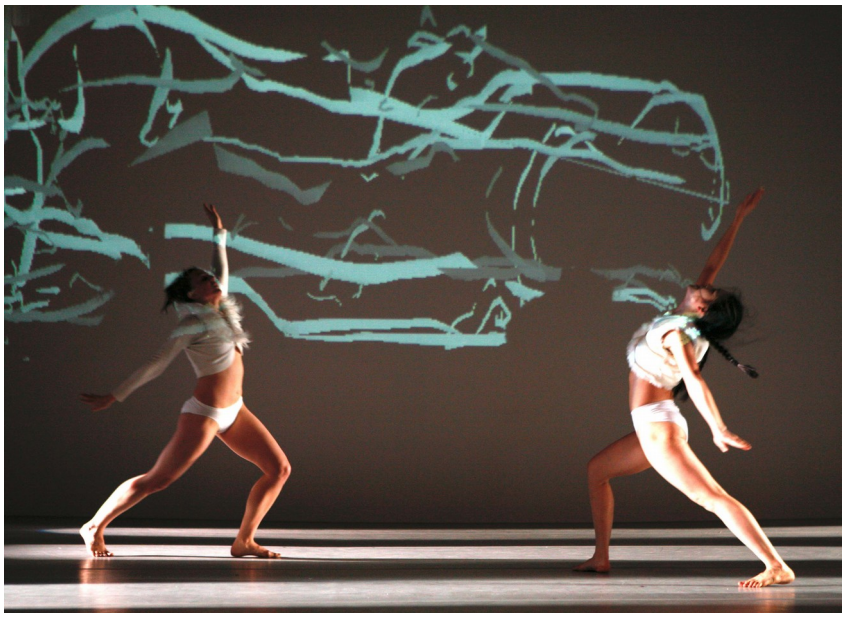

Fig 7: Motion tracking leaves three-dimensional traces of the performers' movements in Troika Ranch's 16 [R]evolutions, 2005. Performers: Johanna Levy & Lucia Tong Photo: Richard Termine

Conclusion.

To conclude, the embodied self is central to digitally informed art and performance practices. However, its boundaries are not fixed.[65] The above developments in neurological research suggest that this embodiment cannot be explained by a proprietorial relationship between seat of consciousness and *res extensa*, to use Descartes' terms, still less by re-invoking his incorporeal *res cogitans* (as enunciated through the first four 'Meditations').[66] It appears that embodiment is reflected in the distributed and quasi-communal (nowadays often called 'modularised') nature of what constitute the requisite zones within the brain to produce consciousness.

Technological enhancement does not offer an extension of our affective epidermis, so to speak, which we do not already feel when we display emotions on behalf of others to whom we are 'close'. Rather, this empathy is a necessary condition for the effects such technological employments have on us. We are disposed to respond to events that affect objects that we have appropriated as being part of our body,[67] and when we love, it seems that another identity is appropriated by our own and becomes part of it.[68] Hume's notion of 'the double relation' explaining emotional attachments, can be seen as a distant anticipation of this.[69]

Finally, it appears that consciousness itself cannot be reduced to a single layer of process or functioning. It is of its nature multi-layered and multi-faceted. It seems that the brain has an internal system of referring whichever confusing or even downright aporetic matter for further review. This, obviously, has an extrinsic reflection in the faculties engaged by much performance practice. When a performance 'works' or seems right, and we are quite incapable of articulating just *why* this is so for us, then we do not necessarily

need to have recourse to either extreme of formalistic legalism or blind intuitionism. The justification may lie in our neurons, of which our knowledge is still limited. These might well afford the physiological underpinnings of Merleau-Ponty's resonant notion of the 'incarnate mind'.

[1] Francis Crick, *The Astonishing Hypothesis* (London: Simon & Schuster Ltd, 1994) 84.
[2] 'In understanding the world, Being-in is always understood along with it, while understanding of existence, as such, is always an understanding of the world'. Martin Heidegger, *Being and Time*, trans. John Macquarrie and Edward Robinson (Oxford: Basil Blackwell, 1978) 186.
[3] Susan Broadhurst, *Liminal Acts: A Critical Overview of Contemporary Performance and Theory* (London: Cassell/New York: Continuum, 1999) and *Digital Practices: Aesthetic and Neuroesthetic Approaches to Performance and Technology* (London: Palgrave Macmillan, 2007).
[4] 'The term alone suggests a field of study that is pregnant and full of promise. It is a large field of study uniting concepts and techniques from many disciplines … a science of information processing' Thomas D. Albrecht and Helen J. Neville, 'Neurosciences', in Robert Wilson and Frank Keil ed., *The MIT Encyclopedia of The Cognitive Sciences,* li – lxxii (Cambridge, Mass: The MIT Press, 2001) li.
[5] Semir Zeki, *Inner Vision: An Exploration of Art and the Brain* (Oxford: Oxford University Press, 1999) 2.
[6] Maurice Merleau-Ponty, 'Cézanne's Doubt', in trans., Hubert L. Dreyfus and Patricia A. Dreyfus, *Sense and Non-sense*, 9-25, Evanston: Northwestern University Press, 1964) 14.
[7] Maurice Merleau-Ponty, 'Eye and Mind', trans. Carlton Dallery, in John O'Neill, ed., *Phenomenology, Language and Sociology: Selected essays of Maurice Merleau-Ponty,* 280-331 (London: Heinemann, 1974) 292.
[8] Maurice Merleau-Ponty, *The Visible and the Invisible*, trans. Alphonso Lingis, ed. Claude Lefort (Evanston: Northwestern University Press, 2000) 209.
[9] Maurice Merleau-Ponty, *Phenomenology of Perception,* trans. Colin Smith (London: Routledge, 1962) 148.
[10] Merleau-Ponty, *Phenomenology of Perception*, 137.
[11] Merleau-Ponty, *Phenomenology of Perception*, 150-51.
[12] Maurice Merleau-Ponty, 'The Primacy of Perception', trans. James M. Edie, in John O'Neill ed., *Phenomenology, Language and Sociology: Selected essays of Maurice Merleau-Ponty*, 196-226 (London: Heinemann, 1974) 209
[13] Marta de Menezes, Website, 2012, accessed 15 February 2014 <http://www.martademenezes.com/>
[14] Merleau-Ponty, 'Eye and Mind', 283.
[15] Merleau-Ponty, *The Visible and the Invisible*, 248.
[16] Merleau-Ponty, *The Visible and the Invisible*), 249.
[17] Susan Kozel, *Closer* (Massachusetts: MIT Press, 2007) 40-41.
[18] Merleau-Ponty, *The Visible and the Invisible,* 136.
[19] Merleau-Ponty, *Phenomenology of Perception*, 146
[20] Merleau-Ponty, *Phenomenology of Perception*, 143.
[21] Merleau-Ponty, *Phenomenology of Perception*, 138.
[22] Merleau-Ponty, *Phenomenology of Perception*, 25.
[23] Kozel, *Closer*, 230.
[24] Kozel, *Closer*, 239.
[25] Merce Cunningham, chor., *Biped*, computer-enhanced graphics: Paul Kaiser and Shelley Eshkar, music: Gavin Bryars, costume designer: Suzanne Gall (Barbican Centre, London, October 11, 2000).
[26] Open Sound Control was created by the Center for New Media and Audio Technologies (CNMAT) at the University of California, Berkeley in the 1990s.
[27] Stelarc, *Muscle Machine,* A collaboration involving the Digital Research Unit, Nottingham Trent University and the Evolutionary and Adaptive Systems Group, COGS at Sussex University, project co-ordinator: Barry Smith, Performance Premiere (291 Gallery, East London 1 July, 2003).
[28] Susan Broadhurst, dir., *Blue Bloodshot Flowers*, performer Elodie Berland, music by David Bessell, technology provided by Richard Bowden, University of Surrey (Brunel University (June); The

291Gallery, London (August), 2001).
[29] Richard L. Gregory, *Eye and Brain: The Psychology of Seeing*, 5th edition (Oxford: Oxford University Press, 1998) 2.
[30] Martin Jay, *Downcast Eyes: The Denigration of Vision in Twentieth-Century French Thought* (Berkeley: University of California Press, 1993) 319.
[31] *Dead East/Dead West premiered* at the Institute of Contemporary Arts in London, August 2003). This project involved a collaboration with Jeffrey Longstaff, a choreographer from the Laban Centre, London, Martin Dupras, Jez Hattosh-Nemeth, and Paul Verity Smith, digital interactive artists from the University of the West of England, and 3D filmmaker Brian McClave.
[32] Crick, *The Astonishing Hypothesis, 24*.
[33] René Descartes, *Discourse on Method and The Meditations*, trans. F. E. Sutcliffe (Middlesex: Penguin, 1977) 97.
[34] Stephen M. Kosslyn and Oliver Koenig, *Wet Mind: The New Cognitive Neuroscience* (New York: Macmillan, 1992) 129.
[35] Stephen M. Kosslyn, William L. Thompson and Georgio Ganis, *The Case for Mental Imagery* (Oxford: Oxford University Press, 2010) 4.
[36] Edward E. Smith and Stephen M. Kosslyn, *Cognitive Psychology: Mind and Brain* (New Jersey: Pearson Prentice Hall, 2009) 16.
[37] Coniglio, Mark and Dawn Stoppiello. 2014. Troika Ranch Website. <www.troikaranch.org/>, accessed 15 February 2014.
[38] Zeki, *Inner Vision*, 15.
[39] Zeki, *Inner Vision*, 195.
[40] James Clerk Maxwell ('On Colour Vision'. *Proc. Roy. Inst. Gt. Brit*. 6,1872: 260-9), quoted by Zeki, *Inner Vision,*186.
[41] Crick, *The Astonishing Hypothesis,*146.
[42] Semir Zeki, *Splendours and Miseries of the Brain: Love, Creativity, and the Quest for Human Happiness* (Oxford: Wiley-Blackwell, 2009), 37-38.
[43] Merleau-Ponty, *Phenomenology of Perception* pp. 110-12.
[44] V.S. Ramachandran, and Edward M. Hubbard, 'Synaesthesia: A Window into Perception, Thought and Language', *Journal of Consciousness Studies* 8, 2001, 3-34: 4.
[45] Ramachandran and Hubbard, *Synaesthesia,* 3.
[46] Ramachandran and Hubbard, *Synaesthesia,* 9.
[47] Immanuel Kant, *The Critique of Judgment,* trans. James Creed Meredith (Oxford: Clarendon Press, 1978) 35.
[48] Zeki, *Splendours and Miseries*, 207-8.
[49] Kant, *The Critique of Judgement* pp. 42-69.
[50] Immanuel Kant, *Critique of Pure Reason,* trans. Max Müller (London: MacMillan & Co. Ltd, 1911) 584-85.
[51] Zeki, *Inner Vision,* 65.
[52] Zeki, *Splendours and Miseries*, 28-29.
[53] Zeki, *Splendours and Miseries*, 29.
[54] Zeki, *Splendours and Miseries*, 29.
[55] Zeki, *Inner Vision,* 4.
[56] Zeki, *Inner Vision,* 16.
[57] One of the convex folds of the surface of the brain.
[58] Zeki, *Splendours and Miseries*, 16.
[59] Susan Broadhurst, *Liminal Acts: A Critical Overview of Contemporary Performance and Theory* (London: Cassell, New York: Continuum, 1999) 19.
[60] Zeki, *Splendours and Miseries*, 43.

[61] Merleau-Ponty, *The Visible and the Invisible,* 152.
[62] Merleau-Ponty, *The Visible and the Invisible,* 139.
[63] V.S Ramachandran and Sandra Blakeslee, *Phantoms In The Brain.* New York: Quill, 1999) 61-62,
[64] Ramachandran and Blakeslee, *Phantoms*, 250.
[65] The self as well as being embodied is also emotional and in a given situation decides what if any is the most appropriate response. Emotional responses include, anger, love, fear, in fact, all the basic feelings that we as humans easily recognize and share. An emotional response can be measured by a device that monitors the galvanic skin response (GSR), which is fundamentally the change in skin resistance caused by perspiration.
[66] Descartes, *Discourse*, 95-132
[67] See Ramachandran and Blakeslee, *Phantoms,* 61-62, for an account of research methodologies and outcomes.
[68] Ramachandran and Blakeslee, *Phantoms*, 250.
[69] David Hume, A Treatise of Human Nature, Second Edition, P. H. Nidditch (Oxford: Oxford UP, 1980) 385.