Resistant Environments: Technologically Mediated Empowerment Networks in Extradisciplinary Performance

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Abstract

The proliferation in improvised performance of chance strategies, game-like scores, playful exercises, one-off collaborations, prepared, new and hacked instruments suggests a ubiquitous commitment to excavate unforeseen creative possibilities that exist beyond the edge of consciousness. Such strategies are deployed to resist mastery and bring forth the possibility for collision out of which fractures emanate allowing the unfamiliar to flow forth. In this research project I draw upon my experience of site-sufficient extradisciplinary performance to unpack the mechanisms at work in these strategies.

The proceeding theoretical discourse initially draws upon the interrelated notions of habitus and norm-circles to illuminate the manner in which dispositions to act are inculcated in the individual and conditioned by the socio-cultural environment to which they are exposed. The aesthetics of liminal phenomena reveal the theatre as a site in which to interrogate these habitual behaviours. This discourse is shown to be too narrow to account for embodied disciplinary-specific performance vocabularies, however, further insights are gained from contemporary cognitive science. The theory of autopoiesis specifies that the individual is fundamentally embodied, bringing forth meaning in the world through perceptually guided action. We see that the body permeates cognition, conditioning our understanding of the world. The notions of external scaffolding and epistemic action are introduced and express the way in which the environment is manipulated to empower the individual. The theory of affordances is subsequently deployed to articulate the perceptual and actional fields available to the individual with respect to their environment. Subsequently this discourse enriches our understanding of the way in which environments constitute networks of empowerment.

This theoretical discourse is exemplified in the practical experiments conducted during this research project. Performance technologies associated with electronic music are deployed to create environments for collaborative performance – sites that empower the individual as an extradisciplinary performer.

For Pearl Dunham and Iris Wormald

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It is my intention that this research project should address the way in which an electronic music-making practice can be reconciled with insights gained from my site-specific performance practice. As such, I have not aimed to create finished artworks per se, but rather to conduct a practice-led inquiry that is driven by questions and problems that arise through practical experiments whilst investigating this topic. As will become clear the experiments that I have conducted have been both technical and performative in equal measure yet, regardless of their nature, are always pressed into the service of the aim stated above. As such, the performance outputs that I have created throughout this project are to be considered as experiments that give rise to additional problems and insights and in doing so propel the project forward. I have, therefore, here used video documentation to present as concise a record as possible of the numerous and varied experiments that I have conducted. Whilst the audiences that were present at performances were not informed of the experimental nature of the work and the questions that I was seeking to answer (for reasons that I shall state explicitly in the conclusion to this thesis), I ask that the performances and indeed all of the events recorded in the video documentation be assessed according to their function with regard to the aims of the research project and not necessarily on their success or failure as artworks. To state this more explicitly: I consider the success or failure of performance outputs as artworks secondary to the insights gained through their creation and presentation.

Cross-References to the DVD Documentation Within the Written Thesis

I have given each of the films included on the DVD documentation a reference code. References made in the written thesis to specific moments of interest in the video documentation are indicated by square brackets and give the reference code of the film followed by a specific time-code (where appropriate). For example, a reference to the film *Reel Experiments Solo and Collaborative Investigation* is presented in the text as follows: [RE2, 00m12s – 00m46s].

The reference code for each film is stated in the DVD track listings above (page vii).

Introduction

The proliferation in improvised performance of chance strategies, game-like scores, playful exercises, one-off collaborations, prepared, new, and hacked instruments, props, and objects suggests a ubiquitous commitment to excavate unforeseen creative possibilities that exist beyond the edge of consciousness. One may state that these strategies are deployed to resist mastery and bring forth the possibility for collision and dissonance from out of which fractures emanate allowing the unfamiliar to flow forth, there to be encountered for the first time.

Another such strategy is site-specificity, a method that is occurs throughout my practice (particularly prominent in my work with Mona McCarthy and Paul Stapleton in the group *theybreakinpieces,* from 2004 to 2007). Together with likeminded artists who seek to exchange specialist disciplinary knowledge with one another through the creative act of improvisation, *theybreakinpieces* chose to perform in non-traditional performance sites – swimming baths, factories, car parks, nature reserves, derelict buildings and ruins. Each site is chosen for a topography that proffers the opportunity to interrogate those actions and behaviours consistent with specialist disciplines and, most importantly, to potentialise the possibility for multi-modal interactions through which one may observe, mimic, learn, and experiment to reveal new behaviours outside of the boundary of one's own specialist vocabulary.

Following a number of these site-specific performances it became apparent that whilst each location offered many unusual and unique opportunities for sonic and kinetic action, the finer nuances of these sites were being overlooked as a consequence of the equipment, materials, instruments and objects that the performers were importing into the site. These non-native materials (for example, public address systems, laptop computers with bespoke audio software, plastic sheets, synthetic surfaces on which to move, home-made instruments) provided familiar modes of interaction within the site that proved very hard to resist, subsequently drawing the performer's attention from unfamiliar nuances in the environment to more familiar areas in their established practice. As such, *theybreakinpieces* recognised an opportunity to modify the site-specific strategy so that the relation between the performers and their environment could be intensified.

A new site-*sufficient* strategy was devised. This is a strategy that encompasses site-specificity and also requires the performers to utilise *only* those materials indigenous to a chosen location. Site-sufficiency thus demands that the performers excavate all the creative possibilities that they can from the site itself and, in doing so, maximises their exposure to the nuances of the environment. Site-sufficiency thus foregrounds resourceful, explorative interactions and, further, increases the potential for unusual encounters and revelations in the form of emergent provisional knowledge that may be revisited in the future. By way of an example, I shall proceed with an account of *theybreakinpieces'* site-sufficient improvised performance on the Cinder Path, created during a residency at Cuerden Valley Park in 2005.

0.1 Site-Sufficient Improvisation On The Cinder Path[1]

Figure 1.1 *theybreakinpieces* perform on the Cinder Path.

In the first instance, the four performers agreed upon a score[2]: *progress from one end of the path to the other*. This simple instruction is typical of the many scores that

[1] Please view the film *theybreakinpieces Improvisation on the Cinder Path* [CP1].

theybreakinpieces employ to initiate collaborative improvisations in unfamiliar sites. The score used on the Cinder Path has a few notable characteristics: 1) It draws upon the original function of the site to move from point *A* to point *B* and instructs the group to travel, thus implying a linearity of direction that evokes progress and resists return. 2) No duration is specified in the score, therefore the improvisation lasts, simply, *as long as it takes*. 3) The score is primarily one of movement: this is not to say that sonic exploration does not occur, rather, it locates precedence of the kinetic over the sonic (implications such as this tend to characterise the consequent improvisation).

The Cinder Path runs along the length of the western side of Cuerden Valley Hall. It is unusually long, narrow and straight with imposing stone walls on either side. During the improvisation, the loose gravel surface of the path made every step uneasy, sliding the foot and twisting the ankle in unforeseen ways. The sliding foot, gaining momentum, would be brought unexpectedly to the wall where it was pressed into stillness. The walls themselves, up to seven feet high and barely an arm-span apart, formed a tight stone-corridor within which to move. This corridor constrained the size of each step and curtailed free flowing movement, imposing stillness on the dancing body. The prominent sound of the gravel path, rustling and grinding underfoot quickly instigated a tangible sonic accompaniment, punctuated by the outward breath of the performers as they moved. Moments of stillness were thus also moments of silence, however, the drone of the distant motorway drew one's senses outward, beyond the confines of the path before being enclosed once again into the tightness of the stone corridor and the confined-body in movement. These sonic and physical properties of the site imposed a tangible rhythm upon the improvisation. This rhythm emerged and permeated the group so that events began to occur in unison – in sympathy with one another - and as functions of an emergent counterpoint. Consequently, this sympathetic movement was maintained throughout the improvisation and determined the duration of the piece.

Lasting over sixty minutes, this was a physically demanding performance for all of the performers. However, the duration of the piece alone did not account for the physical demands made on the performer. The score's impetus on progression along the length

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[2] *theybreakinpieces* (Mona McCarthy (dancer), Paul Stapleton (musician) and Nick Williams (musician)) worked with associate artists throughout the residency at Cuerden Valley Park. Jon Aveyard, a musician and long-term collaborator of the company, was the associate artist working with us to create the performance on the Cinder Path.

of the path revealed subtle variations in the physicality of the site so that the path was felt to expand and contract unpredictably as the improvisation progressed. The cinder floor inclined, rising and falling under foot, and the textures of each surface shifted, seemingly sharpening and smoothing, upon touch. The drone of the traffic swelled and swirled through the path with the wind in sharp contrast with the intermittent immediacy of the gravel underfoot. Amongst all of this, one had to negotiate the presence of three other bodies and the sounds that they made, finding gaps through which to act. At the end of the improvisation our bodies were covered in dirt and moss from the walls, we had cobwebs in our hair, and our hands and arms were scratched, grazed and raw. Our clothes were torn and stretched. This was a performance that was more physically demanding than any that we had previously created.

The physicality of the site permeated the improvisation. The site seemed to resist one's body; a quality that was transposed to the interactions between the performers themselves who, in their actions, interjected and obstructed one another's actions. This quality was in stark contrast to the entrenched mode of response that had evolved amongst our group in previous collaborations. Traditionally we were sympathetic to one another, taking each others weight, lifting, and supporting each other, harmonizing with each other, creating a free flowing performance vocabulary. In contrast, during the performance on the Cinder Path we began to push and pull one another, removing support and purposefully colliding with each other. This resistance revealed new configurations of the body and brought fresh uncertainty into the group's performing-together that marked a new phase in our improvisational practice. Resistance emerged as a generative force capable of disturbing habitual response and moving improvisation once again into the unknown.

I shall return to this account of the performance on The Cinder Path in a moment, but first I will introduce the theoretical notion of *extradisciplinarity*, a concept that articulates the pedagogic impetus underpinning much of the *theybreakinpieces'* experimentation.

theybreakinpieces' notion of *extradisciplinary* performance, was collectively defined in 2005 for the Collision Symposium for Interarts and Interdisciplinary Performance as follows:

> Literally: *beyond disciplinary distinctions.* A mode of collaborating that does not limit performers to their predetermined disciplinary roles (i.e. a dancer no longer only dances, and a musician does more than make sound). This is a term that is more specific than the notion of interdisciplinarity, which allows for different disciplines to collaborate without losing their distinct identities. Extradisciplinarity implies a lack of boundaries, but does not imply a leveling process where specialist knowledge is lost. Rather, the extradisciplinary performer is required to exchange knowledge with practitioners outside of his/her discipline and apply this knowledge in performance.[3]

Extradisciplinarity is, therefore, innately pedagogic and so it is prerequisite that performers participate with this in mind. As is implied in the above quote, the aim of extradisciplinarity is not to impart a broad and standardised skillset in each of the performers but is rather to instantiate an economy of knowledge in which individual virtuosity is honoured whilst also providing an opportunity for both development and the acquisition of disciplinary specific skills outside of one's own specialist field. Improvisation is deployed as an appropriate mechanism that enables the exchange and acquisition of the tacit knowledge that is characteristically constituent of disciplines in the performing arts. The subsequent performances therefore potentialise heuristic exploration and, in doing so, afford manifold simultaneous modes of knowledge acquisition and exchange. To return to the performance on the Cinder Path for an example: whilst Mona McCarthy (a specialist in dance) used the unique physicality of the environment to reveal new movement qualities and to extend her existing vocabulary, I explored my own limited movement vocabulary by observing and mimicking her actions to guide me into unfamiliar terrain. Simultaneously, our moving-together, affected by the site itself, brought to the foreground a quality of movement (one of resistance and aggressive interjection) entirely new to both of us and revealed a lexicon of dance that has informed our moving-together ever since. This exemplifies the emergence of provisional knowledge in extradisciplinary performance, a phenomenon that reveals new creative possibilities for action and future exploration. One may state then that extradisciplinarity aims to overcome predetermined disciplinary boundaries yet maintains and embraces individual virtuosity whilst generating provisional knowledge that reveals new possibilities for creative action.

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[3] theybreakinpieces, 'Extradisciplinary', Collision Interarts-Interdisciplinary-International Symposium Programme, University Of Victoria, Canada (2005), 50.

Whilst the site-sufficient strategy has proven effective for instantiating extradisciplinary modes of performance in many respects, it is not flawless and is the catalyst for an anxiety that has since motivated this present research project. As an artist who specialises in electronic music I am acutely aware that site-sufficiency necessarily prohibits the majority of actions that are consistent with my specialist performance vocabulary. Therefore, whilst I may benefit from the economy of knowledge that is instantiated in such performances, the lack of facilities that are constitutive of electronic music (for example, laptop computers, audio interfaces, power supplies) consequently marginalises my native vocabulary and limits the degree to which I may contribute to this economy. This, I propose, is symptomatic of any technologically mediated vocabulary in the context of site-sufficient performance.

From the outset of this research project it has been my intention to reconcile extradisciplinary performance with electronic music-making practice. I had hoped to unpack site-sufficiency to reveal the mechanisms in place that empower individuals as *extradisciplinary performers* and, further, use this knowledge to inform experiments with those performance technologies that are constitutive of electronic music practice. In doing so, I had hoped, ultimately, to further understand my own performance practice (a practice that, until now, had evolved primarily by way of intuition and informal discussions with my peers) so that it may continue to progress. I am an artist and this is an artist's research project, therefore, whilst my journey through, for example sociology or cognitive psychology may be unconventional, it is informed by many years of practical work. As such, I spent a lot of time, particularly in the early stages of this research project, reflecting upon past performances, trying to understand what exactly had been taking place. For this reason I have been drawn to those theories and discussions that resonate most closely with my own experiences, often finding texts that articulate phenomena for which I could never suitably find the words. Just as my practice is unique, so too is the proceeding milieu of theories and ideas: this was, perhaps, inevitable. However, I am confident that the discussion which follows will offer unique insights to anyone who is concerned with the nature of collaboration and, in particular, the environments in which collaboration occurs.

0.2 Situating the Practice

To situate my creative practice within one field or discipline is, perhaps, to deny its very nature. I approach the arts as something of a nomadic inquisitor, moving between projects, technologies and disciplines, and producing numerous forms of output such as audiovisual recordings, text, film, live performance, presentations, lectures, installations and software. Themes, ideas, problems and questions arise from within the practice and provoke appropriate methodologies for further inquiry. As such, associations with any one arts movement or performance community are elusive. However, as I reflect upon the development of my practice I can identify two lines of inquiry that have been consistent throughout and, furthermore, a number of practices and practitioners who have at one time or another been a significant influence or resource from which to gain insight.

The first of these lines of inquiry is in the field of interdisciplinary methods of collaboration. My work with *theybreakinpieces* has provided the main vehicle with which to gain insights in this field, indeed, the company was formed as a consequence of a collective dissatisfaction at the methods of collaboration we had each experienced in past projects. These projects, primarily consisting in collaborations between dancers and musicians whilst at the University of Central Lancashire (1998-2001), consistently specified the roles of each individual and confined their activity to these roles. As a company we identified an opportunity to instantiate collaborations in which a rich economy of knowledge could exist by enabling the artists to dismantle pre-conceived disciplinary distinctions and to share knowledge in the moment of creation and performance. Hence, following a long period of experimentation and gestation, the notion of extradisciplinarity in the terms outlined above came to fruition.

The history of twentieth century art and design is rife with practitioners who shared a similar desire to re-imagine disciplinary boundaries so that the artists and artforms may be freed from the shackles that they imposed. Perhaps the most violent example can be found in the writing of F.T. Marinetti and the principles he extolled in 'The Founding and Manifesto of Futurism' in which he states:

> We affirm that the world's magnificence has been enriched by a new beauty: the beauty of speed. A racing car whose hood is adorned with

> great pipes, like serpents of explosive breath – a roaring car that seems to ride on grapeshot is more beautiful than the *Victory of Samothrace.*[4]

Marinetti and his Italian Futurists sought to reinvigorate the arts by embracing the power and vitality of the industrial age. Whilst, on the one hand, I admire the vigour with which the Futurists proceeded to reconstitute disciplinary vocabularies by weaving the language of speed, power and industry into the fabric of their respective artforms, I find their uncompromising and violent rejection of established techniques, virtuosity and mastery in the arts disconcerting. Marinetti states:

> In truth I tell you that daily visits to museums, libraries, and academies (cemeteries of empty exertion, Calvaries of crucified dreams, registries of aborted beginnings!) are, for artists, as damaging as the prolonged supervision by parents of certain young people drunk with their talent and their ambitious wills. When the future is barred to them, the admirable past may be a solace for the ills of the moribund, the sickly, the prisoner… But we want no part of it, the past, we the young and strong *Futurists!*[5]

Such a rejection of the past is not consistent with the principle of extradisciplinarity that seeks not to set aside the individual's existing knowledge but instead to nurture it and press it into the service of the collaborative creative process. In this regard, I find a more satisfactory alignment with the principles of the Weimar Bauhaus under the direction of Walter Gropius who, in his 'Bauhaus Manifesto and Program', states:

> Architects, painters, and sculptors must recognize anew and learn to grasp the composite character of a building as an entity… Art is not a "profession." There is no essential difference between the artist and the craftsman… Together let us desire, conceive, and create the new structure of the future, which will embrace architecture and sculpture and painting in one unity and which will one day rise toward heaven from the hands of a million workers like the crystal symbol of a new faith.[6]

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[4] F.T.Marinetti, 'The Founding and Manifesto of Futurism', Italianfuturism.org, 1909, http://www.italianfuturism.org/manifestos/foundingmanifesto/ (4th March 2013).
[5] Ibid.
[6] Walter Gropius, 'Bauhaus Manifesto and Program', Thelearninglab.nl, 1919, http://www.thelearninglab.nl/resources/Bauhaus-manifesto.pdf (3rd March, 2013), 1.

By redrawing the boundary between the arts and crafts and uniting the students and masters under one roof where traditionally they had existed in disparate departments, Gropius hoped to instigate a rich exchange of knowledge that would see the arts and creativity excel in new directions. However, what is most interesting and relevant with regard to my practice is the way in which Gropius conceived of the role of the Bauhaus masters and the way in which the student's should learn their art, he states:

> Starting the Bauhaus as its responsible Director, I had come to the conclusion that an autocratic, subjective approach must block the innate budding expression of differently-gifted students, as the teacher, even with the best intention, imposes the results of his own thought and work on him. I convinced myself that a good teacher must abstain from handing out his personal vocabulary to his student, but should rather let him find his own way even via detours; that he should encourage the growth of independence in the student, and vigorously destroy his imitative reactions, or at least make him aware that he tries to harvest on foreign soil.[7]

The sentiment expressed in Gropius' words resonates with the method deployed by *theybreakinpieces* in which artists share specialist knowledge yet, whenever possible, do not prescribe its use. Instead, the individual is encouraged to explore new knowledge in terms that are meaningful to them through experimentation and exploration in performance. As a practitioner, therefore, my practice has become increasingly concerned with strategies for instantiating economies of knowledge between artists and creating performance environments (including appropriate scores, rules, and sites) in which heuristic experimentation can take place. In the description of *theybreakinpieces* site-sufficient strategy for performance I have shown one methodology for instantiating a space in which artists are free to interrogate knowledge and explore further possibilities in this way. This should indicate the manner in which improvisation became a central tenet of my practice; improvisation is a functional strategy within my practice, it is a vehicle for the emergence of provisional and tacit knowledge between individuals from disparate performance disciplines and is therefore appropriate for extradisciplinary performance.

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[7] Walter Gropius, and Howard Dearstyne, 'The Bauhaus Contribution', *Journal of Architectural Eduction (1947-1974)*, 18/1 (1963), 14-16.

The second line of inquiry that is consistent throughout my practice is a necessary continuation of the need to create suitable environments in which to facilitate extradisciplinary performance. I am interested in the many ways in which one's behavior is affected by both the environment and the objects we encounter. This work exists within a community of inquiry consisting in artists and designers who all manipulate the environment to potentialise new modes of behavior and insight through creative exploration and interaction. One such artist is James Turrell whose extraordinary lightworks bring forth to consciousness the viewer's own perceptual apparatus. In 2006 I experienced an exhibition of Turrell's work in Yorkshire Sculpture Park's Underground Galleries: One enters a gallery space in pitch darkness; as one's eyes adapt to the darkness a coloured oblong appears on a wall. This oblong appears to have structure and mass yet, upon approaching the image one becomes aware that the plain of colour is not solid. One may reach out and breach the surface and, in doing so, cross an infinite abyss revealing a depth that is contrary to the information one has perceived visually. This mis-perception creates a cognitive dissonance; a powerful moment of insight that illuminates the limitations of the perceptual apparatus of the body; an insight revealed through interaction and experience. Of his work, Turrell states: 'My art deals with light itself, not as the bearer of revelation, but as revelation itself',[8]

The capacity to gain insight through encounters with the environment is central to my work. Much of my practice both as an improvising musician and in interdisciplinary collaborations is focused upon the instantiation of ambiguous environments and unfamiliar objects and instruments that must be creatively negotiated in live performance. The performances themselves are offerings to audiences who are invited to witness the tense negotiation between performers as they interrogate their environment. As such, my role is often to establish rich and chaotic sites or to create instruments that resist mastery. In this respect, my work resonates strongly with design practitioners who seek to press their discipline into the service of playful interrogation rather than making work more efficient. One such designer is Bill Gaver who states:

[8] James Turrell, 2013. Available: http://www.ysp.co.uk/exhibitions/james-turrell (3rd March, 2013)

> Designing for Homo Ludens requires a new focus that seeks intrigue and delight at all levels of design, from the aesthetics of form and interaction, to functionality, to conceptual implications at psychological, social and cultural levels. Not only should technologies reinforce pleasures that people know, but should suggest new ones. The designer's role in this is not like that of a doctor, prescribing cures for people's ills; nor is the designer a kind of servant, developing technologies that people know they want. Instead, designers should be provocateurs, seeking out new possibilities for play and crafting technologies that entice people to explore them. In the end, designers themselves need to be Homo Ludens. They need to recognize that they are playful creatures, and that their work depends on their play.[9]

The notion that one's environment may provoke new behavior is quite common amongst artists within the improvisation community but is probably best articulated by the musician, technologist and designer John Bowers who has written extensively on the subject (I shall return to Bowers in the third chapter of this thesis). In a similar vein, Kristina Nierdderer is a designer who extolls the potential to instigate mindful social interaction through the use of carefully crafted 'performative objects',[10] stating 'Mindfulness as a state or awareness or consciousness implies my presence to the moment, where I look *at* my experience, rather than *through* it'.[11] Nierdderer continues:

> [We] need to break through established patterns of perception and experience (i.e., preconceptions) in order to achieve mindfulness in new situations. This raises the further question of how to break open established patterns or perception. The answer is that, whether deliberately or accidentally, this breakthrough to mindfulness usually seems facilitated through an external agent, and that this external agent must be capable of disrupting consciousness in order to break open common patterns of experience and preconceptions.[12]

In chapters two and three of this thesis I will attempt my own formulation of a theory of objects, environment and interaction. This ongoing research is located within the community of inquiry shared by Gaver, Bowers and Nierdderer as should be clear once you, the reader, reach the end of this document.

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[9] Bill Gaver, 'Designing for Homo Ludens, Gold.ac.uk, 2002, http://www.gold.ac.uk/media/46gaver-ludens-still.pdf (3rd March, 2013), 4.
[10] Kristina Niedderer, 'Designing Mindful Interaction: The category of performative Object', *Designing Issues*, 23/1 (2007), 3-17, 3.
[11] Ibid., 8.
[12] Ibid., 8.

Chapter 1. Habitual Behaviour and Antistructure

theybreakinpieces' site-sufficient strategy for performance evidently empowers individuals to interrogate and modify entrenched modes of behaviour. In order to understand the mechanisms in place that enable this to happen we must first consider the ways in which behaviours become entrenched in the first place. Only then can we begin to conceive of ways in which such behaviours may be interrogated and re-configured. To this end I shall first briefly consider the individual performance vocabulary of Mona McCarthy, my collaborator throughout the practical research conducted for this project (as shall be seen later in this thesis). I will then discuss the formation of such a vocabulary in the terms proposed by David Elder-Vass in his book *The Causal Power of Social Structures.*[13]

Mona McCarthy is a dancer and an aerial artist. At the core of her movement practice is the release-technique. That is to say that through her training in contemporary dance at particular institutions and with particular teachers she has learnt a discipline that allows her to "release" her body in accordance with its natural alignment and the flow of momentum through the limbs. This practice uses breathing to aid the generation and trajection of momentum from the body core to its extremities (exhalation) and vice versa (inhalation). Momentum tends to be carried from limb to limb in continuous circular trajectories. These trajectories may orbit the body, extending the limbs outward, or may be passed through the torso, legs, soles of the feet and top of the head. In training, much emphasis is placed upon developing core strength so that momentum may traverse the body smoothly without loss of balance.

"Release Technique", therefore, is not a lexicon of prescribed gestures or even a single technique but rather an aggregation of techniques that instantiate the *desired* free-flowing movement quality. In addition to this aggregation of techniques one may also include the associated terminology (for example core strength, momentum, extension, alignment), jargon (for example 'grounding', 'flow', 'energy'), key practitioners and performances, and training exercises as formative constituents of the concept of release-technique. One can see then that taxonomies such as this *prescribe* a boundary that

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[13] David Elder-Vass, *The Causal Power Of Social Structures* (Cambridge: Cambridge University Press, 2010).

enfolds a milieu of multi-modal elements. Therefore, one might say that McCarthy has, during the formative stages of her movement practice, *subscribed* to the multi-modal elements associated with release-technique and that this has subsequently informed her approach to and realisation of movement in performance ever since.

It is apparent to me that the acquisition of such disciplinary specific knowledge invariably occurs within a hierarchical social structure in which the role of teacher or master is either institutionally ordained (as is the case, for example, in the behaviourist model of teaching and learning propagated by B.F.Skinner in which the teacher is dominant, teaching only what she chooses at the bequest of a higher authority, and less totalitarian models such as that of Jean Piaget in which the teacher's role is as an enabler, instantiating challenging environments for the student to explore[14]) or bestowed by the learner themselves upon the authors of texts as is the case in self-guided study. Therefore, whilst the method of knowledge acquisition may vary greatly, the evaluation of knowledge acquired is undertaken with reference to an authoritatively prescribed lexicon; Phil Graham invokes the implications of such a notion:

> … the purpose of having a defined discipline is that basic evaluative assumptions of the discipline go unquestioned so that *the disciple* can gain the same worldview as *the master*. Here we find the essence of disciplinarity: *the disciple* is disciplined not to think beyond the evaluative *scope* of the discipline. The discipline thus hides its own evaluative biases from its disciples by inculcating them as presuppositions and raising the discipline's *significance* above all others.[15]

The individual may relate to such socially structured registers of experience with a degree of ambivalence: they at once aspire to internalise the disciplinary vocabulary to which they subscribe, whether that be release-technique, playing a violin or driving a vehicle - whilst simultaneously seeking creative possibilities, including responding to

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[14] For an overview of these (and other) models please see Peter Sutherland, *Cognitive Development Today: Piaget And His Critics* (London: Paul Chapman Publishing Ltd., 1992).

[15] Phil Graham, 'Critical discourse analysis and evaluative meaning: Interdisciplinarity as a critical turn' in Weiss, Gilbert and Wodak, Ruth (eds.), *Critical Discourse Analysis: Theory and Interdisciplinarity* (Hampshire: Palgrave Macmillan, 2007), 123.

the contingencies of any situation - that exist outside of the boundary that such a subscription prescribes.

One may think that this ambivalence should be easy to reconcile simply by doing things outside of the boundary of ones chosen vocabulary. Yet when presented with such an opportunity, for example, when an individual participates in an improvisation with other performers, it is common for that individual to implement actions that fall within a familiar prescribed boundary (unable to exceed the evaluative scope of the discipline as Graham suggests (above)). Such experiences manifest 'safe' performances during which the individual fails to leave their 'comfort zone'. Elder-Vass presents an ontological framework for such behavioural phenomena. This ontology accounts for the social mechanism that engenders internalised behavioural boundaries and, further, the causal power that such boundaries exert upon the individual as an agent who can act.

1.1 Ontology of Dispositions

Elder-Vass proposes a theory of the way in which the individual develops dispositions that determine their behaviour. He adopts an emergentist perspective that enables him to consolidate two previously polarised theories of the role of action and agency in the social world. On the one hand, the structurationists (most prominently Anthony Giddens and Pierre Bourdieu) 'see structure as something that resides at least in part *within* human individuals'.[16] Bourdieu's influential notion of *habitus* portrays the individual as one whose agency is subjugated to the social environment to which they are exposed. Habitus is the set of dispositions inculcated in each by the conditioning that follows from the opportunities, roles, and necessities inherent in our social position. This, he argues, tends to 'generate dispositions objectively compatible with these conditions and in a sense pre-adapted to their demands'.[17]

Initially it seems that Bourdieu's argument supports Graham's notion of disciplinarity as a socially prescribed boundary that mandates behaviour within an acceptable register of specified action. It is as though by subscribing to a discipline such as, for example, release-technique, the individual becomes the subject of a non-conscious conditioning

[16] Elder-Vass, *Causal*, 4.
[17] Pierre Bourdieu, *The Logic of Practice* (Cambridge: Polity Press, 1990), 54.

that internalises the *institution* of the discipline (its milieu of associated elements) and manifests dispositions toward particular behaviours consistent with this institution. This is clearly a difficult position to sustain because the individual, in Bourdieu's theory, is rendered as something akin to an automaton, non-consciously acquiring dispositions to act according to the social structures to which they are exposed. However, Bourdieu does, to some extent, acknowledge the role of *conscious deliberation* in determining behaviour although this is reserved *only* for those moments of crisis in the operation of the habitus when the outcome of behaviour does not match the expected or desired effect.[18] Nevertheless, the role of conscious deliberation and awareness in Bourdieu's formulation remains unclear, as Elder-Vass states:

> In the absence of a clear explanation of how dispositions produce practices, it is understandable that there is confusion about the apparent conflict between Bourdieu's stress on the unconscious operation of habitus and his insistence that it operates through active, creative, invention and improvisation.[19]

On the other hand, situated in opposition to the structurationist theory of habitus, are the post-structurationists (most prominently Nicos Mouzelis and Margaret Archer) who propose that structure and agency 'must be understood as analytically distinct: that structure exists *outside* individuals in some sense'.[20] This position locates conscious reflexive deliberation as the formative mechanism for the development of a personal and social identity that subsequently determines one's disposition to act. Regarding Archer's position Elder-Vass states:

> Such reflexivity, she argues, is a precursor to the development of a *personal identity* and a *social identity.* These senses of our identity – of who we are – depend upon us delineating what we care about (this defining our personal identity) and then relating this to our social context to develop projects based upon our ultimate concerns; projects that we use to guide the conduct of our lives (this defining our social identity).[21]

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[18] c.f. Elder-Vass, *Causal*, 101.
[19] Ibid., 102.
[20] Ibid., 4.
[21] Ibid., 102.

Elder-Vass observes that Archer 'rejects the implication that one's social position fully determines one's subjectivity or behaviour',[22] and yet she acknowledges that social structures and cultural systems maintain a causal power that 'rebounds upon us affecting the person we become'.[23]

Elder-Vass' own emergentist theory reframes the contrary views proposed by both structurationist and post-structurationist theoreticians and assimilates them into a cohesive unity whilst aligning them also with biological theories of cognition that acknowledge the role of neurological systems as equally constitutive in the determination of dispositions[24]. The subsequent middle ground that he establishes reconciles these positions in a manner that is arguably more productive for representing my experiences of extradisciplinary performance practice.

For Elder-Vass, the individual's disposition to act in a particular manner is a result of the constant dialogue between these modes of structure formation and agency. The resulting dual process (non-conscious and conscious) model of the determination of human behaviour is expressed in the following series of steps:

> 1.*experience:* as a result of our experience we develop beliefs and also sometimes unconsciously acquire dispositions to act in certain ways, which are implemented at the neural level as neural networks;
>
> 2. *decision making*: we possess the power to think consciously about our plans, beliefs and dispositions, and make decisions, which are co-determined causally by our thinking powers and the network of beliefs that they work upon;
>
> 3. *decision storage*: having made decisions, these are stored in our neural networks as new or modified dispositions (note that there may be multiple loops back to step 2 before an action actually occurs, including the 'last-minute' conscious review of some of our decisions); and

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[22] Ibid., 103.
[23] Ibid., 103.
[24] Elder-Vass' perspective of biological cognition is consistent with that of Jean Piaget's theory of development in which concepts are stored neurologically for future reference (schemata) and Humberto R. Maturana and Francisco Varela's theory of autopoiesis in which the living organism is structurally coupled to its environment, a relation that determines recurrent formations of neurons and subsequent biological mode of cognition (ontogenesis). We shall revisit these theories in some detail in Chapter 2.

> 4. *action implementation*: our actions are determined directly and immediately by non-conscious brain processes that use our beliefs, previous decisions and skills as inputs.[25]

This framework accounts for the non-conscious development of habitus (step 1) and the individual's capacity for conscious reflexive deliberation (step 2) that modifies the unconscious set of dispositions and beliefs. Dispositions are thus emergent phenomena consequent of the innate causal power of each of these mechanisms and these dispositions determine the behaviour to be actuated at the moment of action implementation. Elder-Vass agrees with Bourdieu that 'it is possible that some parts of our action may be determined more or less unconsciously'[26] and that conscious, rational decision making is invoked in moments of crisis when our neurally embedded dispositions do not adequately translate into behaviour suitable for the present situation. Nevertheless he states that these moments of conscious deliberation are 'radically more frequent than Bourdieu believed'[27] and also include moments when complex decisions need to be made (such as 'when we need to decide which way to turn *en route* to a place we have never visited before').[28] During a recent radio interview, Professor Daniel Kahneman (psychologist and Nobel Laureate) provides a concise example of such a phenomenon:

> Every one of us has that experience that there are some thoughts that just come to mind, so if I say "what's two plus two" something comes to your mind. And then there are thoughts that you've got to produce laboriously, so if I say "seventeen times twenty four", well, nothing comes to mind. You've got to produce that number by a set of rules, it takes effort and it takes time. And so there are really those two kinds of thinking. Then there are many blends of the two.[29]

Elder-Vass' theory sets forth a reasonable framework for the way in which the individual's dispositions to act are formulated. However, this does not yet account for

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[25] Ibid., 97.
[26] Ibid., 109.
[27] Ibid., 109.
[28] Ibid., 109.
[29] *All In The Mind.* Podcast. 'Daniel Kahneman & Conjoined twins with linked brains', *BBC.CO.UK*, 2011. http://www.bbc.co.uk/podcasts/series/medmatters (15th November, 2011). 2:15-2:38.

the difficulty that individuals experience when they wish to extend the boundary of their behavioural vocabulary. Such a problematic would not exist if it were possible for the individual to freely modify their habitus, yet this is not the case. The beliefs, skills, and attitudes inculcated in the individual are *persistent* and *durable* and, as stated by Elder-Vass in step 2 of the above quote, co-determine the conscious decisions that one is able to make including those that act upon ones habitus. In this sense habitus is self-regulating. This reveals a theoretical foundation to underpin Graham's anxiety that the "the disciple is *disciplined* not to think beyond the evaluative scope of the discipline." Graham's choice of terminology is not insignificant, indeed Elder-Vass proposes that discipline is a core constituent of *norm circles*; common social structures characterised by the relations between a group of individuals that share a commitment to *endorse* and *enforce* a practice with each other.[30] This social structure produces *normative social practices* that are 'regularized practices encouraged by dispositions or beliefs about appropriate ways of behaving that are shared by a group of people'.[31]

I suggest that by subscribing to a discipline such as, for example, release-technique, the individual commits to the multi-modal taxonomy that constitutes its *institution*. In doing so the individual becomes a member of *norm circle,* a community of individuals who share a commitment to a common institution. The propagation of beliefs, skills, and knowledge consistent with the institution are inculcated in the individual (manifest as habitus) and, as such, produce *normative social practices* (for example, moving with the *desired* free-flowing quality of release-technique). Norm circles are self-regulated through the enforcement and endorsement of practices that specify the scope of behaviour acceptable within the discipline, Elder-Vass states:

> Normative compliance is not physically forced compliance but voluntary compliance; and hence it is *directly* caused, not by the *existence* in the present of normative pressures from the community, but by the individual's *internalization* of past pressures in the form of beliefs or dispositions. The effect of social institutions on behaviour is therefore a two-stage causal process – in the first stage the norm circle has a (downward) causal impact on the individual's motivations and in the second these motivations affect their behaviour.[32]

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[30] c.f. Elder-Vass, *Causal*, 123.
[31] Ibid., 116.
[32] Ibid., 125.

The limitation that the causal powers of norm circles have upon the individual's ability to act resonates with Freud's notion of the Superego, the source of conscientiousness that mediates the will of the individual and enforces that of the authority figure (for example, father, teacher, government). The superego constrains the individual's disposition to act so that only those behaviours consistent with the embodied and internalised belief system may be executed, in spite of all of the alternative possibilities for action available. Augusto Boal (theatre director and originator of the Theatre of the Oppressed) conceived of a similar idea, the 'Cop in the Head'[33] and, of significance to the present discussion, devised a method to interrogate the Cop.

1.2 The Cop in the Head: Theatre, Crisis and Anti-Structure

> "The Cop in the Head," part of a more general concept within the framework of the theatre of the oppressed, concerns those oppressions that have been internalized.
>
> We usually work on the boundaries of politics, using theatre of the oppressed techniques to study specific events such as how to organize a strike. There are many people who dare not participate in a strike or other political actions. Why: Because they have cops in their heads. They have internalized their oppressions.[34]

In his book *The Rainbow of Desire*, Boal proposes that theatre exists when the human being realises that it can observe itself, and in this act 'it can see *itself* – see itself *in situ*: see itself seeing',[35] he states:

> Observing itself, the human being perceives what it is, discovers what it is not and imagines what it could become. It perceives where it is and where it is not, and imagines where it could go. A triad comes into being. The observing-I, the I-*in-situ,* and the not-I, that is, the other. The human being alone possesses this faculty for self–observation in an imaginary mirror… The 'aesthetic space'…offers this imaginary mirror.[36]

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[33] Augusto Boal, *The Rainbow of Desire* (London: Routledge, 1995).
[34] Augusto Boal and Susana Epstein, 'The cop in the head: Three hypotheses', TDR (1988-), 34/3 (1990), 35.
[35] Boal, *Rainbow*, 13.
[36] Ibid., 13.

Theatre, for Boal, is an aesthetic space in which all combinations are possible, a space with the plasticity of dreams in which night becomes day, time is elastic, physical dimensions are re-imagined and social structures are re-configured.[37] In this space the everyday can be interrogated without immediate consequence in the real world yet the knowledge that emerges from observing oneself in this oneiric dimension may be carried forth into the reality of quotidian life. As such, Boal famously deploys theatre as a therapeutic tool and invites participants to re-enact problematic moments that are transposed from their real-lives into this dis-located environment. The spectators of this exercise are invited to intervene in the re-enacted scenes, sometimes even replacing the protagonist on stage so that they may experience alternative modes of behaviour that may change the course of the re-imagined real-life event. The protagonists' entrenched modes of behaviour – their habitus – is thrown into crisis, they observe the I-in-situ and the not-I, and unforeseen possibilities for action are both revealed to, and *lived* by them. In this way the unconscious moderator – The Cop in the Head – is brought to the foreground of consciousness for interrogation.

> On stage, we continue to see the world as we have always seen it, but now we also see it as others see it: we see ourselves as we see ourselves, *and* we see ourselves as we are seen… In daily life we see the situation; on stage, we see ourselves and we see the situation we are in.[38]

Boal's method, expressed in the Theatre of the Oppressed, deploys theatre to instantiate an aesthetic site in which the subject may, for the first time, perceive the cop in their head. This revelation catalyzes change; it illuminates the mechanism that has been unknowingly mediating the subject's behaviour and, in doing so, allows them access to ways of thinking about a situation that have previously remained hidden. In this way the Theatre of the Oppressed invokes the crisis that Bourdieu recognised as the Achilles heel of the individual's entrenched ways of behaving in the world.

Boal's Cop in the Head method aligns closely with Victor Turner's notion of liminal phenomena, a theory that he himself emphatically associates with the aesthetics of theatre. What is perhaps most useful about Turner's anthropological perspective for the present discussion is that it articulates the underlying sociological causal power of

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[37] c.f. Boal, *Rainbow,* 20.
[38] Boal, *Rainbow,* 26.

liminal phenomena rather than outlining a methodology for its enactment. Therefore, Turner's theory is more portable than Boal's and provides a vocabulary with which to talk about such phenomena.

Turner's discussion is posited from a position that may be very closely aligned with Bourdieu's notion of socially conditioned habitus and Elder-Vass' norm circles. He states:

> In people's social structural relationships they are by various abstract processes generalized and segmentalized into roles, statuses, classes, cultural sexes, conventional age-divisions, ethnic affiliations, etc. In different types of social situations they have been conditioned to play specific social roles. It does not matter how well or badly as long as they "make like" they are obedient to the norm-sets that control different compartments of the complex model known as the "social structure."…And, to some extent, the authentic human essence gets involved here, for every role-definition takes into account some basic human attribute or capacity, and willy-nilly, human beings *play* their roles in human ways. But *full* human capacity is locked out of these somewhat narrow, stuffy rooms.[39]

In this quote Turner alludes to the causal power of norm circles to condition the individual's disposition to act (habitus) according to normative patterns of behaviour. Normative socialised behaviour is thus a play in masks that hides "full human capacity" from view. Here, again, we may align this play within masks with the superego or the Cop in the Head. Similarly, Turner shows that it takes moments of crisis in which normative conditions are suspended to remove these masks so that the individual may reveal and interact with their whole being. These fractures in quotidian life – *margins of limen* – have the capacity to instigate change. To clarify the true character of liminality it is useful to join Turner's discussion as he reflects upon Arnold van Gennep's *Rites de Passage,* published in 1908, in which he identifies liminality as a ubiquitous phenomenon occurring - albeit, in varying degrees - in all tribal and agrarian rituals. Such rites of passage are characterised by three phases:

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[39] Turner, Victor, *From Ritual to Theatre: The Human Seriousness of Play* (New York: PAJ Publications, 1982), 46.

> Separation: in which sacred space and time is clearly demarcated from profane, quotidian space and time
>
> Transition: during which the subjects of the rite 'pass through a period and area of ambiguity'.[40]
>
> Incorporation: in which the subject, through symbolic action, is returned, in some way transformed, to profane space and time.

Turner locates liminality within the *transitional* phase, in which the normative elements of quotidian life – identity, status, social order, rights and obligations, etc. – are suspended, inverted, and re-configured by, amongst other things, 'subversive and ludic (or *playful*) events'.[41] He adds, 'to my mind it is the analysis of culture into factors and their free or "ludic" recombination in any or every possible pattern, however weird, that is of the essence of liminality, liminality par excellence'.[42]

It is the *intrusion* of form elements[43] upon liminal phenomena that necessitates Turner to bind the term liminal only to rites of passage within tribal, agrarian, preliterate civilisations, civilisations in which the '…rules underlying the generation of cultural patterns tend to seek out the binary "yin-yang" forms suggested by simple "natural" oppositions…. sky/earth, male /female, plenty/scarcity'.[44] Further, that the main cultural and social structures in these civilisations 'tend to become modeled on these and similar cosmological principals'.[45] These implicit principals intrude upon liminality: 'Thus the symbols found in rites of passage in these societies, though subject to permutations and transformations of their relationships, are only involved in these *within* relatively stable, cyclical, and repetitive systems'.[46] Here, then, play is curtailed, 'pressed into the service of the ultimate aim of the ritual'.[47]

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[40] Ibid., 24.
[41] Ibid., 20.
[42] Ibid., 28.
[43] George Seward describes the function of form elements as 'Reducing the number of possible activities which are permissible; limiting the number of situations that can possibly arise; allowing the character of the situation to be foreseen so that methods for dealing with them can be decided in advance of their occurrence; and regulating the choice of means to deal with a situation.' George Seward, 'Play as art', *The Journal Of Philosophy*, 41/7 (1944), 183.
[44] Turner, *Ritual, 29.*
[45] Ibid., 29.
[46] Ibid., 29.
[47] Ibid., 32.

In post-industrial, modern civilisations cosmological principals no longer maintain a grip on liminal phenomena. Turner talks of the many freedoms afforded by *leisure* time - clearly distinct from *work* time and arbitrarily demarcated according to technological and bureaucratic organisation - including 'freedom from institutional obligations; forced, chronologically regulated rhythms of factory and office; freedom to generate new symbolic worlds; and freedom to transcend social structural limitations, freedom to play'.[48] He therefore draws a distinction between the liminal phenomena of pre-industrial, tribal civilisations in which freedom to play is curtailed and *pressed into the service* of broader quotidian narratives, and the *liminoid* phenomena of post-industrial society that has the capacity for *free*-play, or play without masks. Turner illustrates the implications of such free-play as follows:

> Sociocultural systems drive so steadily towards consistency that human individuals only get off these normative hooks in rare situations in small-scale societies, and not too frequently in large-scale ones. Nevertheless, the exigencies of structuration itself, the process of containing new growth in orderly patterns or schemata, has an Achilles heel. This is the fact that when persons, groups, sets of ideas, etc., move from one level or style of organization or regulation of the interdependence of their parts or elements to another level, there has to be an interfacial region or, to change the metaphor, an interval, however brief, or *margin* or *limen,* when the past is momentarily negated, suspended, or abrogated, and the future has not yet begun, an instant of pure potentiality when everything, as it were, trembles in the balance.[49]

It is in these margins that individuals may engage with one another in wholly unique way: thus Turner brings to the fore the notion of communitas:

> "[A] direct, immediate and total confrontation of human identities," a deep rather than intense style of personal interaction. "It has something 'magical' about it. Subjectively there is in it a feeling of endless power." Is there any of us who has not known this moment when compatible people – friends, congeners – obtain a flash of lucid mutual understanding on the existential level, when they feel that all problems, not just their problems, could be resolved, whether emotional or

[48] Ibid., 37.
[49] Ibid., 44.

> cognitive, if only the group which is felt (in the first person) as "essentially us" could sustain its intersubjective illumination.[50]

Turner thus reveals both the full potential of this margin of limen and yet talks of the difficulty in sustaining such phenomena. The liminoid is antistructural, an aesthetic site in which normative quotidian structures, roles, modes of behaviour are turned on their head, re-configured, interrogated and recombined, changes actuated by the emergence of communitas in which individuals are capable of interacting without masks or obligation to one another. Yet the desire to retain such experiences instigates structuration, norm circles once again emerge that endorse and enforce form elements to condition behaviour and normalise action; as Turner states:

> We thus encounter the paradox that the *experience* of communitas becomes the *memory* of communitas, with the result that communitas itself in striving to replicate itself historically develops a social structure, in which initially free and innovative relationships between individuals are converted into norm-governed relationships between social *personae.*[51]

At this stage we can clarify and surmise the discussion so far. The problem that I introduce at the beginning of this chapter is that the individual artist is faced with a paradox founded upon their ambivalence toward gaining mastery over specific disciplinary vocabularies. These vocabularies are voluntarily subscribed to, yet specified according to authoritatively prescribed multi-modal elements. The individual thus subscribes to a norm circle that communally endorses and enforces normative modes of behaviour according to what is deemed consistent with the vocabulary. This social pressure conditions the individual and re-enforces a Cop in the Head or Superego that mediates their behaviour, regardless of all of the other possibilities for action available to them. This may be un-problematic for those individuals that do not aspire to experiment and discover further possibilities. For those who do, however, there are mechanisms in place to instantiate margins of limen, aesthetic sites within which the individual may set aside momentarily their societal masks and overcome the Cop in the Head. This margin is *antistructural,* a fracture in the normality of quotidian life, and potentialises change by revealing new configurations and re-combinations of the

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[50] Ibid., 47-48. (Quoting himself).
[51] Ibid., 47.

everyday. However this antistructural phenomenon is susceptible to structuration once again, with communities forming around these new structures, endorsing and enforcing their conditions once again, conditioning behaviour accordingly.

Chapter 2. Embodiment, Enaction and Empowerment Networks

In the previous chapter I have discussed the way in which the socio-cultural environment affects behaviour. We saw that norm circles manifest regularised practices by endorsing and enforcing beliefs and attitudes that are shared by a group of people. Bourdieu's notion of habitus was shown to express the way in which the individual inculcates these normalised beliefs and attitudes, and Elder-Vass' dual-process model of action illustrated the way in which this manifest dispositions that directly specify behaviour. The aesthetics of liminoid phenomena were subsequently introduced and shown to potentialise a space in which the socio-cultural structures that govern quotidian life can be reconfigured thus empowering the individual to interrogate their entrenched beliefs, attitudes and, ultimately, behaviour. Finally, I deployed Boal's Theatre of the Oppressed as an example of the way in which liminoid phenomena may be instantiated in practical terms to empower individuals to overcome the constraints imposed by their real-world social status and role.

However, to return our attention to the aim of this research project, it is my intention to explore the possible ways in which electronic music and its technologies may be deployed to empower individuals as extradisciplinary performers or, to state it more explicitly, to instantiate a space in which artists may interact with, and learn from each other in such a way that they are exposed to skills, techniques and knowledge that may be applied and explored in performance. It is clear that a score may be deployed to instantiate a space that is distinct from quotidian life, indeed it is fair to state that Boal's method of the Theatre of the Oppressed is itself a set of form elements that could be understood in terms of a score, for example, the roles of objects and individuals may be specified by the chosen protagonist; the action proceeds according to the experience of the protagonist and may be interrupted by the observers; alternative narratives and behaviours may be instigated to explore alternative outcomes; the Theatre of the Oppressed will take place in a private space. These rules, I would argue, constitute a score and instantiate a space in which the behaviour of participants has no immediate consequence in the real world (it demonstrates liminoid phenomena) and therefore functions to interrogate real world problems. However, it is clear that other performance strategies such as prepared instruments and site-sufficiency only partially rely upon a score in the sense that whilst individuals may commit to certain rules that create a space for experimental behaviour such as, for example, "we shall perform together in 'X'

space at 'X' time", the mechanisms that afford such experimental behaviour are the prepared instruments or physicality of the chosen site. I postulate, then, that to empower individuals as extradisciplinary performers one can manipulate both the socio-cultural *and* physical environment.

Such a claim is not contentious. We are all aware that our physical environment affects our behaviour, for example, if pieces of metal are inserted between the strings of a violin the player will no longer execute standard practices but instead will respond to the contingencies that emerge from such a configuration. Yet the role of the material in action is commonly overlooked, perhaps precisely because it appears to require no further analysis. However, my research in this area reveals a body of work that clearly defines the role that the physical world has for both the way in which we perceive the world and the formation of dispositions that, as we have seen, determine the way in which we act. In short, this body of research shows precisely how the physical world affects agency. This research trajectory may initially appear superfluous yet the insights that emerge from this discussion have significant practical applications both in terms of the way in which the environment may be manipulated at socio-cultural and material levels, and the way in which one might analyze and articulate the environment in terms of the perceptual and actional fields available to agents.

As we shall see in Chapter 3, the practical research undertaken as part of this research project explores the ways in which performance technologies may be employed to create synthesised environments. The three phases of practical research, *Reel Experiments*, *Terrain* and *SynSite* each demonstrate many ways in which to manipulate the perceptual and actional fields available to the performer. *Reel Experiments* and *Terrain* use audiotape to create a physical boundary around the performers and also provokes behaviour through the resistant force that the tape creates against the body. *SynSite*, on the other hand, utilises motion tracking technologies and virtual physical models to create an environment that provokes action through the resistant behaviour of the digital system. The proceeding discussion provides a thorough theoretical framework and a lexicon with which to analyze this practical research. Further, this theoretical framework is portable and prescribes a lens through which any performance, event, indeed, any interaction may be considered in terms of *agency*.

This discussion begins with an exegesis of Humberto R. Maturana and Francisco J. Varela's theory of autopoiesis. The reasons for this are manifold: firstly, autopoiesis expresses agency at a biological level and shows it to be the fundamental characteristic that distinguishes *living* systems from all other types of system. Maturana and Varela demonstrate that all higher forms of agency, for example, at the level of the *self-aware* living system, emerge *consequent* to this fundamental biological phenomenon, in short, that human beings are embodied. We will see that this embodiment is inextricably linked to the way in which we perceive and act in the world and that autopoiesis therefore provides empirical evidence to support the notions of *the lived body* and *operational intentionality* that arise in the work of the phenomenologists Drew Leder and Maurice Merleau-Ponty. Secondly, autopoiesis explicitly demonstrates the way in which living systems interact with the environment (both socio-cultural and physical) and therefore embellishes our understanding of the development and function of habitus (introduced in Chapter 1). Thirdly, autopoiesis clearly specifies the principles that govern the way in which living systems may interact and, in doing so, sets forth a path for an analysis of the way in which the environment may empower/disempower the individual.

2.1 The Fundamental Principles Of Autopoiesis

Maturana and Varela set out to discover the fundamental characteristics that distinguish *living* systems from all other types of system. To begin they recognised that a living entity is a self-contained autonomous unity made up of component parts. They posit that it is the relations between the components of a unity that specify its identity as a system of a particular class. Maturana and Varela refer to this domain of relations as the system's *organisation,* to be differentiated from the systems *structure* as follows:

> [Organization] refers to the relations between components that define and specify a system as a composite unity of a particular class, and determine its properties as such a unity… by specifying a domain in which it can interact as an unanalyzable whole endowed with constitutive properties.
>
> [Structure] refers to the actual components and the actual relations that these must satisfy in their participation in the constitution of a given composite unity that can be perturbed through the interactions of its

> components, but the structure does not determine its properties as a unity.[52]

One may consider the system's structure to be the physical embodiment of its organisation. By making the distinction between organisation and structure, Maturana and Varela show us that a single class of organisation can be realised in many different structural configurations. To provide an example: the organisation of the human being is constituted by the essential digestive, respiratory, cardiovascular, urogenital and endocrine systems in addition to the motor and sensory surfaces, nervous system, skeleton and membrane (skin). The spatial configuration of the external features may vary; indeed, we are all familiar with the extent of structural mutation that may occur. Yet, regardless of the infinite structural variations of the human form, the essential organisation remains and is identifiable as *human.* To further this example, consider an individual who has had a leg removed, we would never say that this amputee was not human.

The term autopoiesis (literally: self-producing) reflects that living systems are self-referential with a circular operation. That is to say that the *only* project of the autopoietic system is to synthesise and/or maintain the security of the components and their relations that constitute the organisation. Failure to do so results in a catastrophic loss of identity and the disintegration of the system. To return to the previous example, the individual's (now amputated) leg is a component that may be included in descriptions of the human being's structure but cannot be included in descriptions of the organisation. If the leg was a component of the system's organisation then its removal would constitute a catastrophic failure of the autopoietic process and the system would either have to be classed as something else, or cease to exist entirely. Autopoietic systems are, therefore, *organisationally closed.* John Mingers states:

> A system is organizationally closed if all its possible states of activity must always lead to or generate further activity within itself. In an autopoietic system, all activity must maintain the autopoiesis or else the

[52] Humberto R. Maturana, 'Biology of Language: The Epistemology of Reality' in Miller, George A., and Lenneberg, Elizabeth (eds.), *Psychology and Biology of Language and Thought* (New York: Academic Press, 1978), 32.

> system will disintegrate. All processes are processes of self-production; the system's activity closes in on itself.[53]

This is not to say, however, that the system does not in some way interact with its external environment. Autopoietic systems (internal) are distinguished from their external environment through the production of a physical boundary such as a cell membrane or the skin of a human being. These boundaries are permeable and so, whilst the system is organisationally closed, it is materially and energetically, rather *interactionally* open.[54] This permeability enables autopoietic systems to interact with the elements that they encounter in the environment.

It is important to recognise that, whilst the system can interact with the environment, any changes to the system are determined by the system itself. That is to say that the external environment can *only* perturb the equilibrium of the system, the latter must then compensate to restore this equilibrium according to its autopoietic project. Paraphrasing Maturana, Mingers states:

> Changes occur in response both to internal dynamics and to interactions with external systems, but even in external interactions the resulting change is determined internally; it is only *triggered* by the environment. This is a very important conclusion, for it means that there can be no "instructive interactions."[55]

This principle of self-determination means that autopoietic systems demonstrate an innate standard for distinguishing between the *values* of elements in the environment (*input values*): the autopoietic system is attracted to elements that are positive with regard to the sustenance of its organisation and repelled by those that are not. By way of an example consider the single cell organism that adapts to the chemical makeup of its surroundings. Such an organism allows the nutritional elements that it encounters in the environment to permeate the cell membrane whilst keeping those that are poisonous out thus maintaining the equilibrium of its organisation. This adaptation is determined according to the chemical requirements of the cell with respect to its autopoietic project

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[53] John Mingers, *Self-Producing Systems: Implications and Applications of Autopoiesis* (New York: Plenum Press, 1995), 32.
[54] cf. Ibid., 33.
[55] Ibid., 30.

and so the input value of external elements is specified by its internal organisation and not by the environment. These findings lead Maturana and Varela to conclude:

> A cognitive system is a system whose organization defines a domain of interactions in which it can act with relevance to the maintenance of itself, and the process of cognition is the actual (inductive) acting or behaving in this domain. *Living systems are cognitive systems, and living as a process is a process of cognition*. This statement is valid for all organisms, with and without a nervous system.[56]

Here, then, we arrive at the fundamental principal of Maturana and Varela's theory: that the process of cognition distinguishes living systems from all other types of system. This biological form of agency arises from the system's autopoietic project to maintain the integrity of its organisation. Henrik Bruun and Richard Langlais refer to this biological mode of agency as the autopoietic system's 'singularity';[57] this is more suitable than terms such as 'perspective' and 'subjective' which are reserved for higher-level conscious phenomena. Before I proceed to show the way in which Maturana and Varela's theory demonstrates the emergence of self-awareness in more complex autopoietic systems we must first understand a second important principle – *structural determinism*.

2.2 Structural Determinism

We have seen that the system's structure is its actual components and the actual relations between them. Therefore, whilst the organisation of the system specifies a domain of interactions, these interactions are mediated by the physical structure within which the former is realised. Therefore the physical structure of the system determines what interactions the system can *actually* engage in. Maturana and Varela therefore state that autopoietic systems are structurally determined.

Many autopoietic systems demonstrate structural plasticity. This plasticity allows it to adapt by selecting a suitable structure with which to interact with the external

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[56] Humberto R. Maturana and Francisco J. Varela, *Autopoiesis and Cognition: The Realization of the Living* (Holland: D. Reidel Publishing Company, 1980), 13.
[57] Henrik Bruun, and Richard Langlais, 'On The Embodied Nature Of Action', *Acta Sociologica*, 46/1 (2003), 37.

environment so as to sustain the continuance of its autopoietic project of self-production, Mingers states:

> In total, the structure at any point in time determines
>
> 1. all possible structural changes within the system that maintain the current organization, as well as those that do not, and
>
> 2. all possible states of the environment that could trigger changes of state and whether such changes would maintain or destroy the current organization.[58]

This may at first be difficult to comprehend because, as observers of a system, it would appear that organisms are so well adapted to their environment that the environment must have led to appropriate changes in the organism. If this were true it would counter the ideas of operational closure and biological cognition that have been presented above. This problem is resolved with Maturana and Varela's notion of *structural coupling*:

> [The] plastic structure exists within an environment that perturbs it and can trigger changes. The environment *does not determine* the changes, but it can be said to select states from among those *made possible* at any instant by the system's structure. In an environment characterized by recurring states (and an actual autopoietic system will require, for example, a continual availability of energy), continued autopoiesis will lead to selection in the organism of a structure suitable for that environment. The organism becomes structurally coupled to its environment and, indeed, to other organisms within that environment. Structural coupling is a reformulation of the idea of adaption, but with the important proviso that *the environment does not specify the adaptive changes that will occur.* They either will occur, and thus maintain autopoiesis, or they will not, and the system will disintegrate.[59]

The implications of structural coupling are such that elements of the environment can be considered along the axis of constitutive/non-constitutive. That is to say that those elements to which the autopoietic system becomes structurally coupled through recurrent interaction are recognised as crucial to the autopoietic project to sustain the

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[58] Mingers, *Self-Producing*, 30.
[59] Ibid., 35.

organisation. Bruun and Langlais deploy the term 'constitutive environment'[60] to refer to such external elements. Constitutive environments are an essential component of Bruun and Langlais' formulation of action analysis that we will return to later in this chapter.

Up to this point I have outlined the fundamental principles of autopoiesis. This has not yet said anything about the living system's fundamental embodiment, a fact that has significant implications for the analysis of action. In order to advance in this direction we must delve deeper into Maturana and Varela's theory and examine the way in which higher levels of cognition emerge, specifically, that of the self-aware living system.

2.3 Self-Awareness and Embodiment

In human beings it is the structural complexity of the nervous system and its unique operation that makes possible the emergence of the observer, the self-aware living being. The nervous system is constituted by neurons – specialisations of ordinary cells. Neurons are unique, firstly, as they have extensions called dendrites that connect to many other, often distant, cells. This distant connection separates the sensory from the effector (motor) sites of the cell and makes possible the transmission of perturbations throughout the organism. Secondly, neurons have a generalised response – electrical impulses - to the sensory surfaces (as opposed to the physico-chemical response of other cells). Regarding the significance of this mode of response, Mingers states:

> This has two vital consequences: the establishment of a universal medium (electrical activity) into which all the differing sensory/effector interactions can be translated and the development of internal neurons which connect only to other neurons, responding to this electrical activity. These *interneurons* are particularly important as they sever the direct relationship between sensor and effector and vastly expand the realm of possible behaviors of an organism.[61]

The neuron's method of connection is the synapse, a point of near contact between dendrites and other cells through which chemicals called *neurotransmitters* flow. This

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[60] Bruun and Langlais, *Action, 38.*
[61] Mingers, *Self-Producing*, 69.

flow stimulates electrical exchange between disparate cells and neurons. Each neuron has thousands of synapses, each contributing a small amount to the cell's overall activity.[62]

Maturana and Varela propose that the function of the nervous system is exactly as that of the autopoietic operation of simpler single cell organisms: the nervous system is operationally closed and acts to sustain or restore internal correlations between sensory and effector surfaces, for example:

> Touching a hot plate stimulates certain sensory neurons. These trigger motor neurons, leading to the contraction of a muscle. This in turn results in withdrawal of the hand and removal of the sensory stimulation. Internal balance is restored.[63]

Just as the singularity of a single-celled organism is continuous and its interaction with the environment is structurally determined so too is that of the nervous system: its autopoietic function is continuous and the present state of its components determines the possible future state:

> Its possible and actual changes of state depend on its own structure at a point in time, not on some outside agency. At most, such an agency can only act as a trigger or source of perturbation. It cannot determine the reaction of the nervous system. This can easily be shown by recognizing that it is the structure itself that determines what can be a trigger for it. For instance, only systems with light-sensitive neurons can be affected by changes in light.[64]

Likewise, the nervous system demonstrates plasticity that enables it to adapt. However, where a single-celled organism undergoes structural changes, adaptation in the nervous system occurs primarily at the level of its patterns of synaptic response. The interneurons, having severed the connection between the sensory and effector surfaces and their one-to-one relations, vastly increase the amount of possible states open to the organism. Therefore, when talking of adaptation in the nervous system we are referring

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[62] c.f. Ibid., 69.
[63] Ibid., 70.
[64] Ibid., 70.

to the emergent patterns of synaptic response and not physical reconfigurations. Patterns of synaptic response affect behaviour and therefore adaptations at this level affect changes of behaviour 'including that which we call *learning*'.[65]

Further, the network organisation of neurons and the severance between sensory and effector surfaces mean that the nervous system responds to activity at these surfaces in a generalised manner, responding to the relations between events rather than individual events themselves. Patterns of synaptic response do not only occur due to external interactions; the nervous system also responds according to its own relative changes of state, it is itself an object of interaction. Indeed, the brain is known to be far more responsive to it own internal structures than to external interaction at the sensory and effector surfaces. The complexity of the nervous system means that it can project itself onto itself recursively, and it is from this constant recursive interaction that the *cognitive-self* emerges:

> The nervous system, by expanding the domain of interactions of the organism, has transformed the unit of interactions and has subjected acting and interacting in the domain of 'pure relations' to the process of evolution. As a consequence there are organisms that include as a subset of their possible interactions, interactions with their own internal states (as states resulting from external and internal interactions) as if these were independent entities, generating the apparent paradox of including their cognitive domain within their cognitive domain. In us this paradox is resolved by what we call 'abstract thinking', another expansion of the cognitive domain.[66]

We see then that the organisationally closed nervous system – a distributed network of interconnected neurons - gives rise to self-awareness without a top down structure or central controller. Rather, cognition at the level of self-awareness is governed by the same principles of autopoiesis – organisational closure, interactional openness, structural coupling, and singularity - that give rise to cognition at the lower biological level: 'The cognitive self *is* its own implementation: its history and its actions are of one piece'.[67] The self-aware living system, in a continuance of this operation, is capable of

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[65] Ibid., 71.
[66] Maturana and Varela, *Autopoiesis,* 13.
[67] Francisco J. Varela, 'Organism: A Meshwork Of Selfless Selves' in Tauber, Alfred (ed.), *Organism And The Origins Of Self* (Netherlands: Kluwer Academic, 1991), 96.

interacting with its own cognitive-self recursively and so can describe himself describing himself describing himself *ad infinitum,* Mingers concludes:

> As with the cell…[t]he nervous system, in a body, has interactions with an environment through both its sensors and effectors and generates a similar (structural) coupling. But, equally, the cognitive self is also situated, and has a perspective, and thus generates a world of signification. It bestows meaning on the events that have significance for it, and environmental events and characteristics become disclosed only in this manner through the intentionality of the cognitive self. Thus, the cognitive self gains identity only through its situation within a body (its *embodiment*) interacting within an environment, and, as it does so, it constitutes a world of significance in respect to its own self-continuance.[68]

We see now the way in which Maturana and Varela specify the individual as essentially *embodied*. Further, that the significance of elements in the external environment (including the social environment) can only be considered in respect of this fact, 'perception and action are fundamentally inseparable in lived cognition'.[69] In this respect, the individual's perception of the world and its significance to them is specified according to their present state and the singularity that drives them forth. Actions result in internal changes of state and *quid pro quo* changes in the significance of elements in the external environment.

To summarise the discussion so far, autopoiesis demonstrates that living systems are operationally closed yet materially and energetically open. This openness allows for adaptation to and interaction with the external environment so that the essential organisational integrity of the system may be maintained. The input values of elements in the external environment are specified not by the environment but by the organisation of the system itself and this is conceptualised as the system's fundamental agency or singularity. Systems that demonstrate such agency are specified as *living* – agency is the fundamental characteristic of life. Whilst the organisation of the system specifies a domain of interactions it is the physical embodiment of the organisation – the system's structure – that determines which interactions may actually occur. The system,

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[68] Mingers, *Self-Producing*, 197.
[69] Francisco J. Varela, Evan Thompson, and Eleanor Rosch, *The Embodied Mind: Cognitive Science And Human Experience* (Massachusetts: MIT Press, 1993), 173.

therefore, is structurally determined and becomes coupled to elements in the environment that play a constitutive role for its autopoietic project. These fundamental principles apply at all levels of cognition, for example, at the level of the cognitive-self. The complexity of the human being's nervous system – a distributed network of interneuronal connections – is also organisationally closed but allows for recurrent inter-system interactions from out of which self-awareness emerges. Self-awareness is therefore an emergent phenomenon of the fundamental physiological processes of the organism. In this sense self-awareness is embodied.

Maturana and Varela's theory of autopoiesis presents a significant paradigm shift from the traditional input-output model of cognition. This latter model posits the brain as an information-processing device. In such models information is a prespecified quantity that exists independently in the world and acts as input to the cognitive system that, in turn, produces an output in the form of behaviour. The body's physiological processes are framed in apposition[70] to the cognitive processing of input and consequent behavioural output. Susan Hurley refers to the input-output model of cognition as The Classical Sandwich and outlines its three main aspects as follows:

> First, perception and action are seen as separate from each other and as peripheral.
>
> Second, thought or cognition is seen as the central core of the mind. The mind decomposes vertically into modules: cognition interfaces between perception and action. Perception and action are not just separate from one another, but also separate from the higher processes of cognition. The mind is a kind of sandwich, and cognition is the filling.
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> Third, not only is cognition central and distinct from peripheral sensorimotor processes, but the center is classical 'at the right level of description'. A cluster of related properties of cognition – compositionality, systematicity, productivity, binding, etc. – are to be explained classically: in terms of processes involving symbols and recombinant syntactic structure. The subpersonal processes that explain the conceptual structure of thought mirror that structure syntactically.[71]

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[70] "Apposition": 'The placing of things in close superficial contact; the putting of distinct things side by side in close proximity' ("Apposition, n." *The Oxford English Dictionary*. 2nd ed. 1989, http://www.oed.com/viewdictionaryentry/Entry/9765 (1st April, 2012).

[71] Susan Hurley, 'Perception and Action: Alternative Views', *Bristol.ac.uk*, 2001, http://www.bristol.ac.uk/philosophy/hurley/papers/pa.pdf (1st March, 2012), 1.

Varela, Thompson and Rosch recognise that this model is consistent with representationist thinking that specifies that '(1) the world is pregiven; (2) our cognition is of this world – even if only to a partial extent, and (3) the way in which we cognise this pregiven world is to represent its features and then act on the basis of these representations'.[72] The mind, for the representationist, is therefore a mirror of the world. Viewed in these terms, the agent is, in a sense, *endowed* with a map and learns how to act on the basis of this map. In contrast, we have seen that autopoiesis specifies living systems as organisationally closed yet materially and energetically open (interactionally open). The external environment can only perturb the system that in turn responds to its own internal states so that it may return to equilibrium. The living system, therefore, is not subject to instrumental interaction from the external environment but instead acts according to the values that it discerns in the external world with regard to its autopoietic project of survival. Varela and his colleagues conclude:

> The key point is that such systems do not operate by representation. Instead of *representing* an independent world, they *enact* a world as a domain of distinctions that is inseparable from the structure embodied by the cognitive system.[73]

This is not to deny the existence of an objective world by stating that the external world does not exist in the absence of a living system. Rather, the external world is a background noise from which the living system brings forth – *enacts* - meaning with respect to the latter's singularity and structural determinism. In this regard representation is neither used to recover what is outer (realism), nor project some inner model of the world (idealism).

Through the evolutionary process our bodies have developed an extraordinary array of apparatus that has given us the capacity to couple to the environment in numerous complex ways so that we can, for example, discriminate between the frequencies of electromagnetic radiation in the environment that enables meaningful vision. What is perhaps even more astonishing is the way in which this apparatus recedes into the background. The physiological processes – our visceral motility - that are *internal* to the

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[72] Varela et al., *Embodied,* 135.
[73] Ibid., 140.

process of enacting a world are normally absent from consciousness, only appearing in awareness when there is pain, discomfort or malfunction. Therefore, whilst our bodies are inextricably bound to the process by which we enact a world, they remain hidden from consciousness so that we can exceed the boundary of our body and project forth into the world with a sense that we are prepared for, or attuned to our environment. Maturana and Varela's assertion that our cognitive domain is stratified provides empirical evidence for the way in which the body recedes into the background and thus provides empirical evidence for the notion of the absent body that has arisen in phenomenological discourse. The absent body is not entirely removed from experience, rather it presents itself indirectly by 'making the experience of being both physically and existentially situated in the world'.[74] Drew Leder expresses the sense of projecting outward from an embodied situatedness with the term *ecstasis:*

> [Ecstasis] describes the operation of the lived body. The body always has a determinate stance – it is that whereby we are located and defined. But the very nature of the body is to project outward from its place of standing. From the 'here' arises a perceptual world of near and far distances. From the 'now' we inhabit a meaningful past and a futural realm of projects and goals.[75]

Likewise, Maurice Merleau-Ponty expresses a similar idea with the notion of *operative intentionality*. Operative intentionality touches upon the singularity implied by Maturana and Varela's description of embodiment stating that embodied living is to be 'carried forward by lines of intentionality at least the style of what is to come',[76] Bruun and Langlais state:

> In the human case, operative intentionality brings the world forth as perceptual and actional fields − as indeterminate horizons of experience and as actional projections into the future: the things, shades, forms, etc. that we can see with our eyes and the futures we can grasp with our limbs.[77]

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[74] Bruun and Langlais, *Action,* 34.
[75] Drew Leder, *The Absent Body* (Chicago: University Of Chicago Press, 1990), 21-22.
[76] Maurice Merleau-Ponty, *Phenomenology of Perception* (C. Smith,Trans.) (London: Routledge & Kegan Paul, 1962), 416.
[77] Bruun and Langlais, *Action, 35.*

We see then that our embodiment generates the 'I can' of the body, a combination of our preparedness for the activities and interactions that we attend to in the world, and our embodied situatedness from which we project – our embodied perspective. It is worth taking a closer look at the process of enaction – the bringing forth of meaning in the world – to reveal the way in which it generates lasting cognitive content. In doing so we shall reveal the way in which our embodiment permeates our perceptions and actions, the mechanism that allows our body to recede into the background, and, most significantly, the validation for embodied cognition's greatest claim: that being involved is *essential* to acquiring the concepts in activity.

2.4 Enactive Cognition

Varela, Thompson and Rosch state that enactive cognition consists in two principles:

> 1) perception consists in perceptually guided action and
>
> 2) cognitive structures emerge from the recurrent sensorimotor patterns that enable action to be perceptually guided.[78]

The first principle foregrounds the autopoietic embodiment of the perceiver and the very fact that this cannot be overlooked when considering the way in which perceptions of the external environment are formed. This first principle is best expressed in the visionary writing (as it was authored some thirty years prior to Varela and his colleagues' research in the field) by Maurice Merleau-Ponty:

> The organism cannot properly be compared to a keyboard on which the external stimuli would play and in which their proper form would be delineated for the simple reason that the organism contributes to the constitution of that form… "the properties of the object and the intentions of the subject… are not only intermingled; they also constitute a new whole." When the eye and the ear follow and animal in flight, it is impossible to say "which started first" in the exchange of stimuli and responses. Since all the movements of the organism are always conditioned by external influences, one can, if one wishes, readily treat behavior as an effect of the milieu. But in the same way, since all the stimulations which the organism receives have in turn been possible only

[78] Varela et al, *Embodied, 173.*

> by its preceding movements which have culminated in exposing the receptor organ to external influences, one could also say that *behaviour is the first cause of all the stimulations.*
>
> Thus the form of the excitant is *created by* the organism itself, by its proper manner of offering itself to actions from the outside. Doubtless, in order to be able to subsist, it must encounter a certain number of physical and chemical agents in its surroundings. But it is the organism itself – according to the proper nature of its receptors, the thresholds of its nerve centers and the movements of the organs – *which chooses the stimuli in the physical world to which it will be sensitive*. "The environment (Umwelt) emerges from the world through the actualization or the being of the organism - [granted that] an organism can exist only if it succeeds in finding in the world an adequate environment." This would be a keyboard which moves itself in such a way as to offer – and according to variable rhythms – such or such of its keys to the in itself monotonous action of an external hammer.[79]

The proposition that perception consists in perceptually guided action can be most elegantly evidenced with reference to Held and Hein's study of action and perception in kittens.[80] Held and Hein raised two groups of kittens ('A' and 'P') in the dark, exposing them to light only in controlled conditions. The kittens in group A were allowed to move around normally; however each of them was harnessed to a carriage containing one of the group P kittens. Therefore, whilst all of the kittens, both group A and P, shared the same visual experience, the group P kittens were passive. Upon release after a few weeks of this treatment the kittens in group A behaved normally whilst the kittens in group P behaved as if they were blind, bumping into objects and falling off edges. This led Held and Hein to conclude:

> The results are consistent with our thesis that self-produced movement with its current visual feedback is necessary for the development of visually-guided behaviour. Equivalent, and even greatly increased variation in visual stimulation produced by other means is not sufficient.[81]

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[79] [Italics added] Maurice Merleau-Ponty, *The Structure Of Behaviour* (A.Fisher. Trans.) (Boston: Beacon Press, 1963), 13.
[80] Alan Hein, and Richard Held, 'Movement-produced stimulation in the development of visually guided behavior', *Journal Of Comparative And Physiological Psychology*, 56/5 (1963), 872-876.
[81] Ibid., 175.

The results of this study problematise the input-output model of cognition by showing that visual input alone is not sufficient to correlate to an adequate behavioural output. There are many studies that provide further evidence to support this claim.[82] Such evidence suggests that Varela and his colleagues are correct to state that perception is not a matter of representation; there is no innate map to which the individual must refer. Nor do external inputs specify a correlating output. Rather, perceptual content depends on the individual's structure – their embodied capacity for action. Our actions produce meaningful perceptual content that, in turn, enable us to behave in a meaningful manner in the world (for example, in such a way that we are able to accurately perceive, adjust to and interact with objects and obstacles in the environment).

Now let us consider the second principle of enactive cognition: cognitive structures emerge from the recurrent sensorimotor patterns that enable action to be perceptually guided. Previously I discussed the way in which the nervous system produces patterns of synaptic response between neurons. Research shows that such patterns, or *schemas*, become increasingly frequent and refined according to the success of their subsequent behavioural outcome in respect of the autopoietic project of the living system. In this way the schemas attune the body to the contingencies that it encounters in the environment and catalyzes plans for perceptually guided action (as such, schemas demonstrate the nervous system's structural adaptation or *structural coupling* to the environment). Our interaction with schemas are manifest simultaneously at both pre-conscious and conscious levels of cognition.[83]

A greater understanding of the formation and function of schemas reveals the fundamental role of embodiment (in the terms set forth by Maturana and Varela) in our ability to meaningfully encounter the world. In the work of George Lakoff and Mark Johnson[84] we shall see the way in which embodiment is inextricably bound to high-

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[82] For numerous accounts in which action and perception are shown to be necessarily interdependent in human beings see Varela et al, *Embodied*, 175; Susan Hurley, C*onsciousness in Action* (Massachusetts: Harvard University Press, 1998); and Ami Klin et al, 'The enactive mind, or from actions to cognition: Lessons from autism', *Philosophical Transactions: Biological Sciences*, 358/1430 (2003), 345-360.

[83] For an introduction to the many types of schema see Michael A. Arbib, 'Schema Theory', *Geza.Kzoo.edu*, 2003, http://geza.kzoo.edu/~erdi/cns/schema.pdf (3rd March 2012).

[84] George Lakoff and Mark Johnson, *Philosophy in the Flesh: The Embodied Mind and its Challenge to Western Thought* (New York: Basic Books, 1999).

level concept-formation and the human being's capacity for reason through the essential metaphors of the body that permeate our knowledge of the world.

The primary resource in the field of cognitive development is the work of the famous Swiss developmental psychologist Jean Piaget. Piaget's notion of *adapted intelligence* posits that schemas are developed and refined through the reciprocal processes of assimilation and accommodation. In brief, Piaget states that the individual in-gathers information through encounters in the world that either validates or contradicts existing schemas. If new experiences are consistent with known experience (for which schemas already exist) then it is *assimilated* into the existing structure by strengthening the patterns of synaptic response. However, if this is not the case then the existing schemas are modified to *accommodate* the new experience. Piaget consistently stated that the ingathering of information in experience is inextricably bound to our embodied interactions in the world:

> I think that human knowledge is essentially active. To know is to assimilate reality into systems of transformations. To know is to transform reality… To my way of thinking, knowing an object does not mean copying it – it means acting upon it.[85]
>
> To know an object… is to act on it so as to transform it.[86]
>
> Nothing is knowable unless the subject acts in one way or another on the surrounding world.[87]

Piaget's research was primarily concerned with cognitive development in children. He showed that the newborn infant recognises objects in world *only* in respect of its own activity. From these tentative interactions the infant begins to understand the phenomenal world with all its laws and logic. This exemplifies adapted intelligence: recurrent patterns of sensorimotor activity produce and strengthen patterns of neurological response or schemas.

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[85] Jean Piaget, 'Genetic epistemology', Marxists.org, 1968, http://www.marxists.org/reference/subject/philosophy/works/fr/piaget.htm (5th March, 2012)
[86] Jean Piaget, 'The role of action in the development of thinking' in Overton, Willis F. & Gallagher, Jeanette M. (eds.), Knowledge and Development (New York: Plenum, 1977), 30.
[87] Jean Piaget, *Adaptation and Intelligence: Organic Selection and Phenocopy* (Chicago: The University of Chicago Press, 1980), 43.

The schemas formed during the formative years of a human life subsequently condition the much more highly complex schemas that develop into adulthood. Further, complex schemas overtly demonstrate their origins in embodied action. The research of Lakoff and Johnson[88] provides an exceptional account of the way in which this phenomenon is manifest. Lakoff and Johnson posit 'human capacities grow out of animal capacities'.[89] They turn to cognitive science to answer the question *what is real and how can we know it?* in answer to which they state:

> Our sense of what is real begins with and depends crucially upon our bodies, especially our sensorimotor apparatus, which enables us to perceive, move, and manipulate, and the detailed structures of our brains, which have been shaped by both evolution and experience.[90]

One of the most fundamental cognitive activities any organism can perform is categorisation. In accordance with the theory of autopoiesis Lakoff and Johnson state that even the amoeba, the most fundamental organism 'categorizes the things it encounters into food or non-food…The amoeba cannot choose whether to categorize; it just does'.[91] They argue that human beings interact primarily at a *basic* level of categorisation. The category *chair* is an example of a basic level category. It is situated in the middle of the category hierarchy *furniture-chair-rocking chair* (named by Lakoff and Johnson as superordinate, basic and subordinate categories respectively). Basic level categories have attained a 'cognitive priority'[92] over superordinate and subordinate categories and, as such, are the primary operational referent in our normal day-to-day interactions. As such, the complexity of our experience in the world is transformed into the more limited set of learned basic level categories.

We must be careful here to distinguish Lakoff and Johnson's notion of categorisation from the representationist models of idealism and realism. The individual possesses no innate map of the world; rather categorisation is a product of enactive cognition. Basic

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[88] Lakoff and Johnson, *Flesh.*
[89] Ibid., 17.
[90] Ibid., 17.
[91] Ibid., 17.
[92] Ibid., 27.

level categories are the most inclusive level at which category members (for example, the chair that you are sitting on)

> (1) are used, or interacted with, by similar motor category members, (2) have similar perceived shapes and can be imaged, (3) have identifiable humanly meaningful attributes, (4) are categorized by young children, and (5) have linguistic primacy (in several senses).[93]

This leads Varela and his colleagues to conclude, 'The basic level of categorization, thus, appears to be the point at which cognition and environment become simultaneously enacted.'[94] Lakoff and Johnson propose that there are generalised basic level categorisations that originate in bodily experience and our concepts of spatial-relations that have structural elements and internal logic that we project metaphorically to give structure to a wide variety of cognitive domains. These *kinesthetic image schemas* include, for example, the *container schemas* that have the structure *inside-boundary-outside* and an implicit logic that states: 'Given two containers, *A* and *B*, and an object, *X*, if *A* is *in B* and *X* is *in A*, then *X* is *in B*'.[95] We commonly project these container schemas metaphorically to structure our conceptualisation of the visual field (things go in and out of sight), personal relationships (one gets in or out of relationships), emotions (one gets in a bad mood), etc. Lakoff and Johnson state:

> Container schemas, like other image schemas, are cross-modal. We can impose a conceptual container schema on a visual scene. We can impose a container schema on something we hear, as when we conceptually separate out one part of a piece of music from another. We can also impose container schemas on our motor movements, as when a baseball coach breaks down a batter's swing into component parts and discusses what goes on "inside' each part.[96]

Other kinesthetic image schemas include the *source-path-goal schemas, part-whole schemas,* and the *centre-periphery schemas,* to name but a few, each with their own structural elements and internal logic. These schemas originate in our bodily structures

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[93] Varela et al, *Embodied*, 177.
[94] Ibid., 177.
[95] Lakoff and Johnson, *Flesh,* 31.
[96] Ibid., 32.

and our embodied interaction with the world and provide a primary cognitive mechanism for understanding experience.

The schemas that I have discussed so far all function at the level of consciousness, however, there are pre-conscious level schemas that are crucially important for our capacity to act in and perceive the world. At the pre-conscious level, the most significant instance relevant to action is that of the *body schema.* Body schema does not require conscious, reflexive access to be known, rather it is manifest as an innate sense of the body, and the position and of its limbs. Shaun Gallagher and Jonathan Cole state:

> [A] *body schema* involves a system of motor capacities, abilities, and habits that enable movement and the maintenance of posture. The body schema is not a perception, a belief, or an attitude. Rather, it is a system of motor and postural functions that operate below the level of self-referential intentionality, although such functions can enter into and support intentional activity. The preconscious, subpersonal processes carried out by the body-schema system are tacitly keyed into the environment and play a dynamic role in governing posture and movement. Although the body-schema system can have specific effects on cognitive experience… it does not have the status of a conscious representation or belief.[97]

Body schema is not be confused with body image (a conscious level schema). Body image emerges from conscious reflexive thought and consists of mental representations, intentional states, and emotional attitudes toward the body that are conditioned culturally and socially. Body schema, on the other hand, is an emergent cognitive structure that provides information about body that is directly and immediately known. This immediate knowledge is attributed to the individual's *proprioceptive* capacity, a mechanism that accounts for the way in which the body recedes into the background of experience (as was expressed previously in Leder's account of the absent body).

In his article 'Proprioception As Basic Knowledge Of The Body' Andy Hamilton provides a useful explanation of proprioception. Central to the concept is the supposition that proprioception exhibits the phenomenon of immunity to error through

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[97] Shaun Gallagher and Jonathan Cole, 'Body image and body schema in a deafferented subject', in Welton, Donn (ed.), *Body And Flesh: A Philosophical Reader* (Oxford: Blackwell, 1998), 132.

misidentification (IEM). As such, proprioception evinces accurate and immediate knowledge of the state of the body as "just known"; a knowledge that is immediately gained without conscious reference to schemas or sensory-action, Hamilton states:

> This knowledge is immediate not just in the sense that it is non-inferential but also in the sense that the subject never has to do anything to acquire it. Indeed, I do not really "acquire" it at all; immediate knowledge is knowledge which I do not have to do anything in order to have; I "just know", for instance, that my legs are crossed when they are. So proprioception differs both from knowledge based on bodily sensation, and from perception of the body by the five senses. Other varieties of proprioceptive knowledge such as awareness of fatigue and temperature must be distinguished from avowals of bodily sensation.[98]

The proprioceptive awareness of body schema is essential to the human being's ability to perceive and act in the world. This is evidenced by Gallagher and Cole's account of IW, a patient who suffers from an acute sensory neuropathy in which large fibres below the neck have been damaged by illness:

> As a result IW has no proprioceptive function and no sense of touch below the neck. He is still capable of movement and he experiences hot, cold, pain, and muscle fatigue, but he has no proprioceptive sense of posture of limb location. Prior to the neuropathy he had normal posture and was capable of normal movement. At the onset of the neuropathy IW's initial experience was of complete loss of control of posture and movement. He could not sit up or move his limbs in any controllable way. For the first three months, even with a visual perception of the location of his limbs, he could not control his movement. In the course of the following two years, while in a rehabilitation hospital, he gained sufficient motor control to feed himself, write, and walk. He went on to master everyday motor tasks of personal care, housekeeping and those movements required to work in an office setting.[99]

What transpires to be so unique about IW's recovery is that he has necessarily learnt to compensate for his lack of proprioception with his body image. In the early stages of rehabilitation IW must keep parts of his body in his visual field, further, he must also

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[98] Andy Hamilton, 'Proprioception As Basic Knowledge Of The Body', AndyHamilton.org, 2005, http://www.andyhamilton.org.uk/andy_pdfs/Proprioception_as_Basic_Knowledge_of_the_Body.pdf (16th February, 2012), 5.
[99] Gallagher and Cole, *Body Schema,* 134-135.

conceptualise his posture and movement. Should IW have been distracted whilst executing a movement he would, for example, lose his balance and fall or perhaps drop an object that was in his grasp. IW had to concentrate on his body in order to execute movement. The mastery that IW gained over basic tasks during his rehabilitation led Cole and Gallagher to conclude:

> That proprioception is a major source of information for the maintenance of posture and the governance of movement – that is, for the normal functioning of the body schema – is clear from IW's experience. But proprioception is not the only source. IW, as a result of extreme effort and hard work, recovered control over his movement and regained a close-to-normal life. He did not do this by recovering proprioceptive sense, but by rebuilding a partial body schema and by using body image to help control movement.[100]

I would like now to present an example that I hope will clarify the way in which cognitive structures are manifest in everyday life and the codependence between conscious personal-level and pre-conscious sub-personal level schemas. Consider an adult who has never ridden a bicycle. This individual may grasp the concept of riding-a-bike, know which way around they are supposed to sit on the saddle, to use the handlebars to steer, to use the brakes to slow down and the pedals to speed up; they may even know that they must continually shift their weight in order to remain balanced. Yet, even with all of this preparatory knowledge, it is fair to state that that they will likely fall off upon attempting to ride the bicycle for the first time. Indeed, we would not judge them too harshly if they should fall off numerous times before they develop the ability – the body schema – sufficient for bike-riding. The point here is fundamental to the notion of enactive cognition: in order to generate meaningful perceptions (in the sense that they allow for further meaningful interactions) there must be sufficient interaction between personal and subpersonal processes and, further, that subpersonal processes such as body schema require action to be sufficiently developed. The evidence presented here supports Varela and his colleagues' claim that 'perception and action are fundamentally inseparable in lived cognition'.

Further, the function of proprioception accounts for the way in which the body is effaced in action. Unlike patient IW in Cole and Gallagher's study, normal motor

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[100] Ibid., 135.

actions such as reaching for a book on a high shelf do not usually require the individual to be conscious of the subtle shifts in weight from left leg to right, rather this is taken care of by the body schema freeing the individual to consciously attend to the intended outcome of the action e.g. getting the book. Likewise, one's visceral motility (the processes of the digestive, respiratory, cardiovascular, urogenital and endocrine systems) almost permanently recedes into the background during normal action and perception, only coming to the foreground of consciousness when one experience pain or discomfort. Also, the sensory surfaces necessarily recede to allow for perception, Leder states:

> Insofar as I perceive through an organ, it necessarily recedes from the perceptual field it discloses. I do not smell my nasal tissue, hear my ear, or taste my taste buds but perceive with and through such organs.[101]

It is this effacement of organs, limbs and processes that allow the human being to exceed the boundary of the body. Yet our innate and persistent proprioceptive capacity means that we are acutely aware of our embodiment: we are situated in a body and 'project outward from its place of standing'. Merleau-Ponty's sense of preparedness may also be attributed to proprioception; autopoiesis has shown that the body adapts to the environment, becoming structurally coupled through recurrent interactions that sustain the living systems project of self-production. As such, we feel attuned to our environment, proprioceptively aware of our body's capabilities and condition at any given moment, capabilities that are refined through the adaptive process during which it *has* become attuned to the environment in which it exists.

2.5 Forsythe's Improvisation Technologies

I would now like to draw attention to Williams Forsythe's *Improvisation Technologies: A Tool For The Analytical Dance Eye.*[102] Forsythe, a world-renowned dancer and choreographer, produced *Improvisation Technologies* originally as an instructional tool

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[101] Leder, *Absent,* 14-15.
[102] William Forsythe, *Improvisation Technologies: A tool for the Analytical Dance Eye* (special issue second edition), CD-ROM (Germany: Hatje Cantz Publishers, 1999).

for the dancers of the Frankfurt Ballet for whom he was choreographer from 1984 to 2004. *Improvisation Technologies* is a CD-ROM that contains, amongst other things, a large number of exercises designed to introduce the dancers of the Frankfurt Ballet to Forsythe's methods for devising new choreography. Each exercise is presented in the form of short instructional video. In each video Forsythe talks through the exercise whilst demonstrating with his body. What is most unusual about each of these short videos is that simple graphics are overlaid onto the film to vividly demonstrate the concepts in the exercise. Let us now look at one of the instructional exercises in detail.

The Room Writing exercise is typical of the kind of processes Forsythe deploys to generate new movement in *Improvisation Technologies*. Here is Forsythe's introduction to the exercise transcribed from the video and to which I have also notated his actions and the corresponding graphical representations that appear on the screen (these annotations appear in square brackets and are italicised):

> [*Forsythe stands in an empty black-box space facing the camera.*]
>
> 'In room writing you're going to imagine a room, its architecture and its contents, and you're going to analyze the architecture and the contents for its geometric content. In other words a doorknob is a circle. For example…I might describe that with two points…'
>
> [*Draws a perfect circle with his two elbows. This is illustrated with a corresponding graphic that traces the line of his elbows as they move.*]
>
> '...Like this.'
>
> [The *graphic trace disappears.*]
>
> 'Now I have this imaginary doorknob in front of me.'
>
> [*Re-draws the doorknob with his elbows. Graphics create the corresponding trace. This time the graphic trace remains on screen.*]
>
> 'And in room writing what we're going to do, in one case of room writing, is, we're going to take that doorknob and knock it off the door.'
>
> [*Reaches across his body with the right arm and grasps the imaginary doorknob, overhand, from which position he swipes back across his body with great force. The graphic trace of the doorknob is dislodged from the centre of the screen in tandem with the swipe of his arm and flies off screen.*]
>
> 'OK? Now the purpose of doing that is simply to take me off place. So, I'm going to describe the doorknob'

[*Re-draws the doorknob with the points of his elbows. Corresponding graphic trace appears and remains on screen.*]

'This time lower. And then, knock it out of place.'

[*Repeats the right hand swipe, and this time allows his body to continue with the momentum so that he loses balance. The graphic trace flies off screen once again.*]

'So then, maybe I have a door, yeah, so I think the door is flat, I'll do it very simply, boom-boom, boom-boom.'

[*Uses the full length of his arms with hands pointing down to the floor to demarcate the imaginary outline of the door. A graphic trace appears and marks the door frame which then disappears.*]

'The door is here. And then I say, maybe the door is there'

[*A graphic representation of the door appears in front of him.*]

'And then I'm gonna go…'

[*He kneels on the floor in front of the imaginary doorframe and leans with force into it with the flats of his forearms, as if to slam the frame into the floor. The graphic frame tips with the force and lies flat on the floor.*]

'…and knock the door onto the floor. And then from that point I might take the sides of the door…'

[*Reaches across to one side of the door (now lying flat on the floor in front of him) and grasps the imaginary frame with both hands*.]

'…and try to slide that door across the room.'

[*Swipes both arms back across his body and across the floor, swinging with momentum and rolling backwards. The graphic representation of the doorframe flies off the floor and out of the screen*.]

On the one hand, Forsythe's Room Writing video is an exceptional *visualisation* of the theory that I have presented in this chapter. We see Forsythe bring forth a meaningful world by projecting embodied kinesthetic image schemas into an empty space. The graphic traces that record Forsythe's movements visualise the kinesthetic image schema associated with, for example, the doorknob. The precision with which he attends to the dimensions of this imaginary doorknob indicates an acute coupling to the object or, to put it another way, the projection of a doorknob-schema that has been highly refined by real-world experience. In short, the visualisation shows the manner in which the individual interacts with their own states (as described in my description of the nervous

system) and brings forth a world (as in our description of enactive cognition). This is not to contradict the argument thus far by stating that the individual *has* an innate map (as the representationist might argue). Rather, in bringing forth a meaningful world the individual *develops schemas through experience*.

On the other hand, the Room Writing video *demonstrates* the powerful way in which cross-domain mapping allows the individual to create opportunities for meaningful interaction in the world. We see the projection of a doorknob-schema, an analogy of a real-world object that gives structure to the environment in terms that are meaningful for the individual. Forsythe interacts with the projected object in a manner that is not consistent with real-world interaction (swiping the doorknob out of the room) so that he may *experience* an unusual distribution of momentum through the body and configuration of the limbs "Now the purpose of doing that is simply to take me off place." The Room Writing exercise demonstrates the projection of known spatial relations to instigate meaningful experience in the sense that it reveals new possibilities for movement that can be accommodated into existing body schema through repetition.

Another way to articulate this process would be to say that, *by projecting kinesthetic image schemas into the world Forsythe has instigated a domain of perceptual and actional fields sufficient for meaningful interaction.* This process is dependent upon Forsythe having kinesthetic image schemas to project that are suitably formed through real world sensorimotor activity. By sharing this technique with his dancers Forsythe is showing them how to project meaningful perceptual and actional fields so that they discover new dynamics of the body. We can see then that manipulation of the external environment (in this case, through the projection of kinesthetic image schemas) may empower these individuals to create new ways of using their bodies. Indeed, it is hard to imagine any other conceivable way in which these particular movements could be discovered. The projection of known spatial relations leads to the discovery of new movement that can be inculcated into the existing body schema.

Additionally, it seems reasonable to state that the knowledge that is at stake in the room writing exercise is tacit and, furthermore, provisional to the act of moving-in-relation-to-an-imaginary-doorknob. Such provisional knowledge is ubiquitous in everyday life, consider again the way in which we learn to ride a bicycle: the insurmountable

complexity required to communicate the information necessary to successfully ride a bicycle is overcome by exposing the student to the tacit experience of bike riding.

Of course, there is much knowledge that is relatively easy to communicate using language. However, in the performing arts (and indeed many other fields of expertise such as, for example, sport) it seems that a significant component, if not the majority, of any disciplinary vocabulary consists in tacit knowledge. Forsythe's room writing exercise is just one strategy for empowering individuals to gain such tacit knowledge. Since it has been my aim to investigate the ways in which performance technologies (particularly those consistent with electronic music) may be deployed to empower individuals as extradisciplinary performers it is necessary to pay further consideration to the way in which individuals may be empowered.

2.6 Empowerment Networks

Let us return briefly to the notion of habitus that was introduced in the preceding chapter. To recap, habitus is the set of dispositions inculcated in each of us from the conditioning that follows from our social environment. This definition seems now to be too narrow in respect of the theory of autopoiesis that has now been introduced. A more encompassing definition might read:

Habitus is the domain of interactions to which each of us can attend that follows from our history of structural coupling to our environment.

I shall qualify this definition by reviewing the primary fundamental principle that governs autopoietic systems: *agency is life.* Without agency there can be no living system. In his writing, Varela identifies a number of interconnected regional selves:

1. biological (cellular identity)
2. bodily (immunological identity)
3. cognitive (behavioural identity)
4. sociolinguistic (personal identity)
5. collective (social identity)

I have already discussed the manner in which agency emerges at the biological level (singularity) and cognitive level (embodiment). Now let's briefly consider our social

identity. As an operationally closed system the human being is not subject to instrumental interaction from the environment, rather, the former becomes structurally coupled to those elements that are meaningful to it according to its autopoietic project. This is relatively easy to comprehend at the biological level as we see, for example, a structural congruence between the respiratory system (internal) and the atmosphere (external) that enables the organism to breathe. However, it is perhaps more difficult to grasp at higher levels of cognition. Previously we saw that the cognitive-self emerges from recurrent interaction with the states of the nervous system. A further claim of autopoiesis is, therefore, that the cognitive self can *only* interact with its internal states that are perturbed by the external environment. If that is the case, then what of our interactions with other individuals? Is it also the case that there are no instrumental social interactions? Regarding the interaction between organisms, Maturana and Varela state:

> An organism can modify the behavior of another organism in two basic ways:
>
> 1) By interaction with it in a manner that *directs* both organisms toward each other in such a way that the ensuing behavior of each of them depends strictly on the following behavior of the other, e.g.: courtship and fight. A chain of interlocked behavior can thus be generated by the two organisms.
>
> 2) By *orienting* the behavior of the other organism to some part of its domain of interactions different from the present interaction, but comparable to the orientation of that of the orienting organism. This can take place only if the domains of interactions of the two organisms are widely coincident; in this case no interlocked chain of behavior is elicited because the subsequent conduct of the two organisms depends on the outcome of independent, although parallel, interactions.[103]

In short, interaction relies upon consensuality rather than explicit consensus among those involved. *Behaviour is denotative of some internal neuronal state* and, as such, organisms that share a sufficient consensual domain can either direct (as in interaction) or orient (as in communication) the behaviour of other organisms. The organisms do not select in one another some behaviour; rather, each selects behaviour that is congruent *to*

[103] Maturana and Varela, *Autopoiesis*, 27-28. [Italics added].

the other.[104] Maturana and Varela provide a concise summary of these principles as follows:

> Linguistic behaviour is orienting behavior; it orients the orientee within his cognitive domain to interactions that are independent of the nature of the orienting interactions themselves. To the extent that the part of its cognitive domain toward which the orientee is thus oriented is not genetically determined and becomes specified through interactions, one organism can in principle orient another to any part of its cognitive domain by means of arbitrary modes of conduct also specified through interactions. However, only if the domains of interactions of the two organisms are to some extent comparable, are such consensual orienting interactions possible and are the two organisms able to develop some conventional, but specific, system of communicative *descriptions* to orient each other to cooperative classes of interactions that are relevant for both.[105]

Now consider the following example: if a man in the street approaches me and says "there are blue cats" he orients my thought to all that I know about cats, all that I know about the colour blue, and all that I know about the relation between cats and the colour blue. But I will also refer to what I know about strangers and truth. It is fair to state that I would not be too hesitant to disregard this statement as untrue. However, if my father should state that "there are blue cats" then I am more inclined to consider the validity of this statement given what I recall of my father and truth. My disposition to respond to the statement is conditioned by my history of structural coupling to the orienter (the stranger or my father). At no time can the statement simply be deposited in me as a truth. Agency is life and is the only way of *being* at all levels of cognition. To interact or communicate with another individual is to orient them to some perceptual or actional field within a consensual domain to which they will respond in a manner consistent with their history of structural coupling. If agency is life then interaction with other living organisms can be considered only in terms of empowerment and disempowerment.

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[104] This is an extremely brief introduction to the notion of consensual domains of interaction. For a more rigorous account please see Maturana and Varela, *Autopoiesis,* 22-35; Mingers, *Self-Producing*, 77-80; and Randall Whitaker, 'Tutorial 2: Concepts and constructs', Enolagaia.com, 2001, http://www.enolagaia.com/Tutorial2.html#Languaging (31st March, 2012).
[105] Maturana and Varela, *Autopoiesis,* 30.

Bourdieu's formulation of habitus and Elder-Vass' ontology of dispositions are appealing because they accommodate the individual's fundamental agency. To revisit one of Elder-Vass' statements:

> Normative compliance is not physically forced compliance but voluntary compliance; and hence it is *directly* caused, not by the *existence* in the present of normative pressures from the community, but by the individual's *internalization* of past pressures in the form of beliefs or dispositions.[106]

We see that the individual *opts* into norm-circles and that, whilst there may be pressure to comply, compliance is ultimately a decision taken by the agent. However, we have since also seen the inextricable role that our embodiment plays in the way we understand and see the world, including the way in which our interactions with the material environment condition our behaviour. Therefore, the purpose of my new formulation of habitus is not to deny the original formulation but rather to enfold it in a more encompassing definition that takes into account agency at all levels of cognition and the interdependence between them. Given that much of our perception depends upon interaction with physical objects in the environment it is essential that we develop a better understanding of the role of the material in action.

The role of the material environment in formation of our dispositions to act has traditionally been overlooked in action analysis. Henrik Bruun and Richard Langlais sought to address this problem in their article *On The Embodied Nature Of Action.* In this article they state that traditional action analysis has been concerned with conscious phenomena. This would not be problematic were it not for the fact that such analysis assumes too narrow a definition of consciousness, Bruun and Langlais state:

> A narrow understanding of consciousness is based on the idea that a state is conscious only if there is non-mediated consciousness about its being conscious. According to this view, I am conscious, for instance, that a particular person is sitting next to me only if I attend to his or her presence by thinking about it in some way. Thus, consciousness requires

[106] Elder-Vass, *Causal,* 125.

> self-consciousness in the sense that we are conscious about our own conscious states.[107]

They indicate that such a definition excludes, for example, the behaviour of babies and many animals from conscious action. The narrow definition also excludes action that is frequently performed without attending to what one is doing such as, for example, walking, driving a car, or bowing a violin. These actions would therefore be considered *unconscious.* If such actions are not personal level phenomena are they simply sub-personal physiological processes or is there perhaps a third state in-between these levels of activity? A more preferable definition of consciousness is proposed by Susan Hurley[108] who argues that perceptions are conscious if we can act on them in an immediate (unforced) way, that is, if we have *intentional* access to them. Bruun and Langlais summarise this broader definition of consciousness as follows:

> [A]ctions are conscious, although not necessarily reflexively accessed, phenomena. Humans, however, are normally able to gain reflexive access to their action whenever needed. This is the point of the oft-repeated claim that, despite carrying out many actions non-reflexively, humans are able to report what they are doing if asked… It should also be noted that the comprehensive notion of consciousness leads to the inclusion of some processes that traditionally have been seen as in apposition to the idea of action as a form of intentional behaviour, in the category of action. The act of breathing can be mentioned as an example. We clearly have intentional access to breathing because, reflexively or non-reflexively, we stop breathing when, for instance, diving into water.[109]

The claim that Bruun and Langlais make is that 'action is *embodied* in the sense that certain physiological processes are internal in relation to it, they play a constitutive role for its performance'.[110] We have seen evidence of this throughout the discussion of autopoiesis (consider Held and Heins 'kittens' experiment, for example); indeed, it is a notion that is concomitant with Varela's study of enactive cognition. If the way in which we make sense of the world is through embodied action, and much of this action involves interaction with the physical world then, as Bruun and Langlais agree, any

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[107] Bruun and Langlais, *Action,* 40.
[108] Susan Hurley, *Consciousness in Action* (Massachusetts: Harvard University Press, 1998).
[109] Bruun and Langlais, *Action*, 40.
[110] Ibid., 45.

analysis of action may benefit from considering the role of the material in behaviour. To further understand the way in which the material functions in action we can refer to the interrelated notions of *external scaffolding* and *epistemic action.*

External scaffolding is a term coined by Andy Clark[111] to express the manner in which humans employ external objects to simplify complex cognitive tasks. Clark posits a connectionist picture of the brain as a network of distributed parallel processing. He states that, whilst such networks are good at real-time motor control and pattern recognition tasks, their weakness is that 'they are not intrinsically well-suited to highly sequential, stepwise problem-solving of the kind involved in logic and planning'[112] or, to put it another way, 'good at Frisbee, bad at logic'.[113] These features of the brain, Clark suggests, force human agents to employ external devices to accomplish cognitive tasks. For example, for most people to calculate 3245 X 8676 they would employ paper and pen, or a calculator. Such external scaffolding is so crucial to the completion of the task that they can be considered constitutive to it. This is an example of instrumental utilisation of the environment to achieve particular goals. The use of external scaffolding, Clark claims, is both common and essential for altering the information-processing tasks that our brains confront.

Epistemic action is a notion first posited by David Kirsh and Paul Maglio[114] and is broadly defined as follows:

> Epistemic actions – physical actions that make mental computation easier, faster, or more reliable – are *external* actions that an agent performs to change his or her own computational state.[115]

Epistemic action is another form of external scaffolding that involves the *restructuring* of the environment to simplify complex mental tasks. For example, consider how when assembling a jigsaw puzzle, one groups together similar pieces. It is possible that such

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[111] Andy Clark, *Being There: Putting Brain, Body, and World Together Again*. (Massachusetts: MIT Press, 1998)
[112] Ibid., 60.
[113] Ibid., 60.
[114]David Kirsh, and Paul Maglio, 'On distinguishing epistemic from pragmatic action', Cognitive Science, 18 (1994), 513-549.
[115] Ibid., 513-514.

grouping may be constitutive of assembling the puzzle, at least within a narrow timeframe.

The interrelated concepts of external scaffolding and epistemic action lead Bruun and Langlais to conclude:

> The idea of external scaffolding can help us understand the way in which a whole set of environmental features become parts of human agency and action. At the simplest level of action, external scaffolding can involve modification of spatial arrangements… In cases of more complex action, such as doing complex arithmetic operations, or performing complex reasoning, human agents use written numbers and public language (in thought and in writing) as instruments. These 'external' instruments can become so crucial for the action to be performed that they acquire a constitutive status.[116]

The notion that external scaffolding can be *constitutive* to action is of some importance. It suggests that, in certain instances, having an intention to act is dependent on knowing that one is going to have access to sufficient resources to realise the action. For example, my intention to write this thesis within the allocated timeframe presupposes access to personal computer and desktop publishing software. Knowledge of the flexibility afforded by the personal computer and desktop publishing software is constitutive to my intention to write the thesis on time.

Given that external scaffolding may have a constitutive role to certain actions it seems logical to consider these elements in any analysis of such actions. Bruun and Langlais usefully lay the foundations for such analysis by specifying the manner in which external scaffolding may empower or disempower humans with regard to agency. They begin with a definition of agency: '*Agency* designates the capacity of agents to realize intended states of the world'.[117] They continue:

> Since agents have varying access to resources (practice, knowledge, instruments, money, contacts, status, position, etc.), they differ in their degree of agency in relation to various kinds of intentions. Some resources are contingent in relation to the action in question. This means

[116] Bruun and Langlais, *Action*, 44.
[117] Ibid., 45.

> that they can help the agent to improve performance, but are not necessary for the action as such. Other resources have a constitutive function; the action cannot be performed without them.[118]

The implication here is that we can be empowered in two ways. On the one hand, by gaining access to contingent resources, we can be empowered in the performance of an action. On the other hand, by providing access to constitutive resources, we can be empowered as *agents,* 'in the sense of being able to perform a broader range of actions.'[119] Likewise, by diminishing access to contingent resources, we can be disempowered in the performance of an action. Finally, by diminishing access to constitutive resources we can be disempowered as agents; the range of actions that are available to us is reduced.

Finally, Bruun and Langlais conclude that Actor Network Theory (ANT) provides a suitable mode of analyses for action. ANT was developed by Bruno Latour, Michel Callon and John Law and is a framework that analyses action in terms of networks of agency – *empowerment networks*. ANT is a suitable model for analyses as it accommodates the role of material in action in the terms I have now discussed. Indeed, the following passage found in Latour's *Reassembling The Social* summarises the sentiments I have expressed above:

> In addition to 'determining' and serving as a 'backdrop for human action', things might authorize, allow, afford, encourage, permit, suggest, influence, block, render possible, forbid, and so on. ANT is not the empty claim that objects do things 'instead' of human actors: it simply says that no science of the social can even begin if the question of who and what participates in the action is not first of all thoroughly explored, even though it might mean letting elements in which, for lack of a better term, we would call *non-humans.*[120]

I shall conclude this chapter with a number of examples that I will consider in terms of empowerment networks. Before I do so, there is one final theoretical discourse that I should like to introduce. The perceptual psychologist James J. Gibson's notion of

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[118] Ibid., 45-46.
[119] Ibid., 46.
[120] Bruno Latour, *Reassembling the Social: An Introduction to Actor-Network-Theory* (Oxford: Oxford University Press, 2005), 72.

affordances will serve two purposes: on the one hand it will nuance our understanding of the perceptual and actional fields that empower agents and, on the other hand, it will provide a lexicon with which to deploy in our analysis of empowerment networks.

2.7 Affordances

Like Maturana and Varela, James J. Gibson[121] theorised a radical alternative to representationist theories of cognition.[122] He proposed that behavioural responses to the environment are not dependent upon pre-formed mental structures but are rather a function of the individual's ability to *directly* prehend meaningful attributes for action in the environment relative to their own capabilities and needs.

Gibson's ecological approach specifies the individual's ability to distinguish objects from a background through the perception of relatively stable constants within shifting planes of ambient energy in the optical array. Gibson names these relatively stable sources of sensory input *invariant variants*, a term that expresses their relative stability amongst the continuously shifting ambience of the sensory arrays. Invariant variants attain meaning as a function of the individual's duadic perceptual capacity; the individual at once *just knows* the present state of their body (I have already introduced this concept above as *proprioception*), and the body's state relative to the environment (*exteroception*). Exteroception and proprioception are not mutually exclusive but rather co-dependent: it is not possible for one to occur without the other, Gibson states:

> [An] environment implies something that is surrounded, and therefore awareness of the environment implies an awareness of the body existing

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[121] See James J. Gibson, 'The theory of affordances in perceiving, acting, and knowing' in Shaw, Robert and Bransford, John (eds.), *Perceiving, Acting, and Knowing* (New Jersey: Lawrence Erlbaum Associates, Inc., 1977), 67-82 and James J. Gibson, *The Ecological Approach to Visual Perception* (New Jersey: Lawrence Erlbaum Associates, Inc., 1986).

[122] I shall show in the conclusion to this outline of Gibson's approach the manner in which it differs from Maturana and Varela's. However, since these differences are not insurmountable with respect to purpose of my discussion I will proceed, for now, with Gibson's theory.

> in the environment. Equally, an awareness of the body entails some feeling of its relation to the surroundings.[123]

Gibson's theory emphasises the complementarity between the individual and the environment; the individual at once gains immediate knowledge of their present condition relative to their present environment, and vice versa. This brings forth a world of perceptual and actional fields to which the individual can attend. Gibson deploys the term *affordances* to articulate the apparent expressiveness of the environment that results from the emergence of such perceptual and actional fields, he states:

> The affordances of the environment are what it *offers* the animal, what it *provides* or *furnishes,* either for good or ill. The verb *to afford* is found in the dictionary, but the noun *affordance* is not. I have made it up. I mean by it something that refers both to the environment and the animal in a way that no existing term does.

The following example illustrates Gibson's characteristic linguistic method for expressing an affordance: an individual identifies an object in the environment that has a smooth horizontal surface. If the surface is broader than the individual's body, and lower than their waist, it is "sit-on-able". Likewise, a ball no bigger than the hand is "grasp-able"; a freshly picked apple is "eat-able"; and a cliff is "fall-off-able". These examples also illustrate the way in which affordances are meaningful; the affordance "eat-able" will provide valuable nutrition, whereas the affordance "fall-off-able" will cause great harm to the individual (the value of an affordance may also be ambiguous or mis-perceived; this is a topic that will become central to our discussion further on).

Gibson acknowledges that culture, experience and memory affect which affordances the individual is likely to perceive in the environment. For this reason it is apparent to me that his theory aligns with Bourdieu's notion of habitus. The individual's normalised dispositions to act determine which affordances they will perceive and subsequently attend to. For example, a dancer will attend to those affordances in the environment that

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[123] James J. Gibson, [Unpublished] 'On the Difference Between Perception and Proprioception', Trinity College, 1968, http://www.trincoll.edu/depts/ecopsyc/perils/folder4/difference.html (18th March, 2012).

facilitate kinetic action whereas a musician will attend to those that afford sonic action. However, it is important to recognise that whilst inculcated dispositions determine the individual's behaviour they do not specify the affordances that are *available* in the environment to be perceived. For example, whilst the dancer may only prehend those affordances that enable kinetic action, many (if not all) of the affordances that enable sonic action are still available to be perceived (although they are likely to be overlooked). The group of affordances to which the individual attends constitutes their *niche* in the environment, Gibson states:

> Environmental scientists, ecologists, make use of the concept of a *niche*. A given species of animal is said to utilize a certain niche in the environment. It is not the same as the *habitat* of the species, that is, where it lives, but rather how it lives.[124]

Whilst there are strong resonances between affordances and Maturana and Varela's theory of cognition, there are also notable differences. On the one hand, Gibson postulates an objective world that contains suitable information to specify the environment. The individual picks-up on the information that is consistent with their capabilities and needs – perception, for Gibson, is direct detection. This is not consistent with Maturana and Varela's approach that shows meaning in the environment is enacted according to the capabilities and needs of the organism. On the other hand, both approaches deny the representationist view of perception in favour of the idea that perception is perceptually guided action. Therefore, whilst the origins of perceived meaning in the environment is a contentious issue, the notion of emergent perceptual and actional fields relative to the condition of the individual is consistent. The resonances between the two approaches seem to me sufficient to encompass Gibson's theory into the theoretical discourse that I am presently constructing. Whilst I subscribe to the enactive approach I also believe Gibson's method for articulating the perceptual and actional fields available to the individual to be consistent with this approach and a useful mechanism with which to express the opportunities for action afforded by the environment.

The Gibsonian concept of affordances has gained prominence in fields of research concerned with designing interaction, most notably in human user interface design.

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[124] Gibson, *Affordances*, 69.

Both Donald Norman and William Gaver advocate the application of Gibson's theory in the design of everyday objects.[125] Whilst Norman is widely credited as being the first to introduce the concept of affordances to the design community, Gaver has usefully embellished Gibson's theory to further unpack the way in which new behavioural possibilities arise through exploration:

> The notion of affordances may be extended to explicitly include exploration. For instance, [a] pivoting door handle… may appear to afford grasping, but passive observation will probably not indicate the affordance of turning it or using it to open the door. However, once grasped, a random or exploratory press downwards will convey tactile information revealing the affordance of turning the handle. When the handle is fully turned, the new configuration is one from which pulling is natural. The results of a pull will indicate whether the door affords opening or not.[126]

This example illustrates Gaver's notion of *sequential affordances*. Gaver introduces a second useful concept, that of the *nested* affordance:

> … a handle alone only appears to afford pulling. A door alone may suggest an affordance for manipulation due to its partial separation from the wall, but not what sort of manipulation will be effective. Only by seeing the affordance of pulling the handle as nested within the affordance of pulling the door can opening the door be a perceptible affordance.[127]

These related concepts illustrate the way in which opportunities for behaviour emerge in the environment both in time (sequential affordances) and in space (nested affordances). The individual who attends to an affordance in the environment inevitably uncovers additional behavioural possibilities – *behaviour affords behaviour*. The individual, therefore, is engaged in a constant negotiation of the affordances in the environment and

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[125] See Norman, Donald A., *The Psychology of Everyday Things* (New York: Basic Books, 1988); Norman, Donald A., 'Affordance, conventions and design', *Interactions*, 6/3 (1999), 38-43; William W. Gaver, 'Technology affordances' in Robertson, Scott P., Olson, Gary M. & Olson, Judith S., (eds.). *Proceedings of the ACM CHI 91 Human Factors in Computing Systems Conference*, New Orleans, 28 April – 5 June, 1991, 79-84; William W. Gaver, 'Affordances for interaction: The social is material for design', *Ecological Psychology*, 8/2 (1996), 111-129.
[126] Gaver, *Technology*, 4.
[127] Ibid., 4.

discriminates between them, attending to those that are most valuable according to their present needs and capabilities.

Andrea Scarantino, in her article '*Affordances Explained',* presents yet another particularly useful nuance on affordances, she states:

> The trademark feature of affordances is that their *manifestation* is always constituted by an *event* in which the affordance-bearer X and the organism O are *both* involved. If we look at Gibson's examples of affordances, we notice manifestations such as climbing, catching, getting under, eating, mailing a letter, but also such as bumping into, getting burned by, falling off, being eaten by. Whereas events in the first list constitute things organisms *do,* events in the second list constitute things that *happen* to them.
>
> The distinction is in my view important enough to distinguish between two classes of affordances, namely *goal-affordances* (their manifestation is a *doing*) and *happening-affordances* (their manifestation is a *happening*).[128]

Scarantino furthers the complementary notions of goal and happening affordances by introducing an additional lower-level description according to their degree of reliability:

> I distinguish between *surefire-affordances,* i.e. affordances such that the manifestation follows the triggering circumstances with certainty, and *probabilistic-affordances,* i.e. affordances such that the manifestation follows the triggering circumstances with some positive probability p less than 1. *Sit-ability* is *now* for me a candidate surefire goal-affordance, and *catch-ability* and *ride-ability* are *now* for me probabilistic goal affordances of different degrees of reliability. Notice that the surefire/probabilistic distinction applies to both goal-affordances and happening-affordances. Many of the latter seem in fact to be of a probabilistic variety (e.g. the brink of a cliff possess the *probabilistic affordance* of fall-off-ability).[129]

It seems to me that the concept of affordances, nuanced by Gaver and Scarantino, generates a substantial lexicon with which to express the perceptual and actional fields that constitute an empowerment network. It is a lexicon that captures the inextricable

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[128] Scarantino, Andrea, 'Affordances explained', PhilSci Archive, 2003 [Unpublished], http://philsci-archive.pitt.edu/1104/ (15th February, 2012), 15.
[129] Ibid., 18.

relationship between the capabilities and needs of the agent relative to the environment. As such, affordances are a useful and powerful augmentation to the theoretical discourse that I have presented thus far. I shall now provide a series of examples in which I will attempt to consider a variety of scenarios in terms of the theoretical discourse that I have constructed. As it is one of the aims of my research to understand the way in which performance technologies can be deployed to empower individuals as extradisciplinary performers, my examples primarily consider scenarios in which the physical environment is manipulated in some way. The final example will consider site-sufficient extradisciplinary performance as an empowerment network.

2.8 Three Examples of Empowerment Networks

2.8.1 *Playgrounds and Climbing Frames*

A playground is a site in which the normative rules and regulations that govern everyday life are relaxed. Children are free to run, jump, and shout with reckless abandon. As such, the playground overtly demonstrates the antistructural phenomena we associate with liminoid sites (note, liminoid sites are not astructural spaces *without* rules; a parent would still likely discipline their child if the latter should swear at or hit another, for example). This liminoid site allows the child to explore the possibilities of imagination, language, movement, etc.– indeed, to experience all the benefits implicit in play. The climbing frame sits within this liminoid play-space. It is an object with no pregiven rules for interaction. It is an object that affords climbing, swinging, hanging, revolving, tapping, etc. This is a site rich with affordances, both in the socio-cultural and physical domain. The child is free to project concepts and ideas into the space and onto the climbing frame. In role-play the child can imagine a prison, a wigwam, a castle, a lion filled cage, a rocket, etc., projecting their own rules into the site and their own spatial relations onto the climbing frame.

This is, of course, a site that empowers the child in many different ways. The re-imagining of social rules affords new encounters that reveal the complexity of, for example, a trip to the moon, keeping lions, defending castles, etc. The thresholds of social dynamics are re-enacted and tested, the child discovers what it means to lead and to follow, to make friends, to have a family. Likewise, the ambiguity of the climbing frame with its myriad affordances reveals new bodily configurations, new thresholds of movement, strength, flexibility, and momentum otherwise unavailable in the ‘real’, non-

liminoid, world. The playground is a site that affords the interrogation and vast expansion of schemas through the provision of a multitude of ambiguous, sequential, nested and happening affordances.

Adults, too, have their playgrounds…

2.8.2 *Parkour and Free Running*

Parkour is a physical discipline that focuses on efficient movement around obstacles in the urban environment. The parkour practitioner, or *traceur* (feminine, *traceuse*) (a term derived from the French meaning trace, or trail, as in "he escaped without a trace") must find the swiftest route from A to B by vaulting, climbing, rolling, sliding, and swinging over and around obstacles encountered en route such as benches, bollards, stairs, and gaps between the roofs of buildings.

The traceur/traceuse enacts a degree of perceptual flexibility by setting aside basic-level categorisations in favour of super-ordinate geometric and spatial categorisations. For example, the basic-level categorisation *bench* is set aside in favour of the super-ordinate categorisation of the same object that specifies it as a flat, solid surface at knee-height. Such conceptual shifts reconfigure the affordances that the object presents relative to the individual. As a bench the object affords sitting, however, when the same object is re-conceptualised as a flat solid surface it affords rolling-over, leaping-on, sliding-across, etc. Setting aside the socially prescribed rules that govern the normalised modes of interaction with everyday objects enacts this conceptual shift. To participate in parkour is to set-aside or reconfigure the rules that prescribe the normative use of objects in the environment. To put it another way, to participate in parkour is to forge a liminoid fault line through the urban environment.

Such perceptual flexibility potentialises multiple happening and goal-affordances in the environment that are encountered for the first time through exploration and experimentation. The traceur/traceuse is empowered with respect to their ability to negotiate any obstacle in the environment and to respond spontaneously to the happening-affordances that they may encounter (for example, a rooftop may appear solid yet may crumble underfoot). The traceur/traceuse encounters new configurations of the body, its momentum and shifts of balance, and develops sufficient body schema (through practice and repetition) to respond with great fluidity to such occurrences.

Parkour is now commonly employed to train military personnel all over the world, evidence of its capacity to empower individuals to negotiate any terrain with ease.

A related activity is *free running*. Free running encompasses the practice of parkour but does away with the rule to "get from A to B". The emphasis, therefore, is on creativity rather than efficiency. As such, free running shares much of the qualities that are present in William Forsythe's *Improvisation Technologies*. In *Improvisation Technologies* the dancer is required to imagine a physical environment, in free running the traceur/traceuse re-imagines an existing environment. Both are mechanisms that function to expose the individual to new configurations of the body.

2.8.3 *Site-Sufficient Improvisation: The Cinder Path*

In the introduction to this thesis I provided a first-person account of *theybreakinpieces'* performance on the Cinder Path. I would now like to consider this performance in terms of affordances and empowerment networks.

I see many similarities between parkour, free running, and the improvisation on the Cinder Path. As in Parkour, a score was deployed so that the participants would journey from A-to-B. However, the score deployed on the Cinder Path did not specify to do so "as swiftly and efficiently as possible" and so it afforded the performers moments in which to dwell, to gather themselves, or to revisit some incidental sonic/kinetic behaviour or event that they may have stumbled upon (in this respect, the performance reflects the creative impetus of free running). In a manner akin to that of the traceur/traceuse, the participants re-imagined the rules that govern normative day-to-day use of the path: whilst they still used it to get from A-to-B this was no longer the priority, rather, this normal use of the path was subjugated to creative exploration. Consequently, this simple modification of normative rules enabled the performers to interact with the site in a manner most unusual, enacting a milieu of otherwise concealed kinetic and soniferous affordances. For example, the surfaces of the walls and gravel floor now afforded launching, leaning, kicking, scraping, rubbing, tapping, rolling, pressing, sliding, rustling, skidding, and jumping, to name but a few. These goal-affordances constitute a provisional vocabulary with which the performers improvised with one another, creating momentary kinetic and sonic exchanges, structuring the environment in response to one another. The site was also rich with happening-affordances, the surfaces, shifting under hand and foot, made the body slip,

tumble, and fall, movement was abruptly curtailed, and skin was scratched, poked, rubbed, and covered in dirt and grime. This was experienced as resistance, provoking behaviour, flinches in pain that would carry the body into new movement and resonate throughout the group who acted together.

It is fair to state that the resistance experienced on-site disrupted movement and in doing so revealed new articulations of the body that would otherwise have remained unknown. This extended beyond our own performance vocabularies by revealing new, more aggressive and disruptive ways of interacting with one another. This new quality of movement and interaction would, indeed, be carried forwards into future performances, our interactions together, and our individual practices.

Additionally, the performers – exploring together – engaged in a number of cross-modal interactions. Kinetic behaviour created sonic events and vice versa, each behaviour resonating through the group – some performers responding to motion and some to the sonic events. Such cross-modal interactions potentialise associations between gestures and sound so that one might move to generate an audible response to something that was heard. Further, the performers would orientate each other to possibilities for producing movement and sound so that techniques emerged, new provisional knowledge that could be revisited and explored. In short, the site-sufficient strategy re-animated the Cinder Path, revealing new affordances and a wealth of emergent provisional knowledge that was enacted and exchanged through collaborative interaction. As such, the site-sufficient strategy empowers individuals to interrogate their disciplinary vocabulary, discover new actions, and exchange knowledge with other individuals through the act of performing-together.

2.9 Closing Remarks

In this chapter I have introduced the notion that living systems are defined in terms of agency. We have seen that the individual is fundamentally embodied and this specifies the manner in which they project forth into the world. This embodiment fundamentally affects the way in which we perceive, understand and act - by enacting a meaningful world through interactions with the environment. Further, we have seen that this embodiment is overlooked in traditional action-analysis. To truly understand habitus - our inculcated dispositions to act in particular ways - we must take into account both the socio-cultural and material environment.

I subsequently introduced the interrelated notions of external scaffolding, epistemic action and empowerment networks, and augmented these ideas with the Gibsonian concept of affordances. These concepts provide a greater understanding of the way in which human beings interact with the material environment and, further, establish a vocabulary with which to describe the perceptual and actional fields that are present to us in the world.

By looking at some examples we have revealed various ways in which the environment can be manipulated to afford opportunities for behaviour. The theoretical lens that I have now established helps to answer the question "why site-sufficiency?" by revealing and articulating the mechanisms that make extradisciplinary interactions possible.

In the following chapter I will introduce the practical research from which this theory has emerged. I shall, wherever possible, apply the theoretical lens that has now been established in my reflections upon these practical projects.

Chapter 3. Reel Experiments, Terrain and SynSite

In this chapter I shall provide an overview of the practical research from out of which the preceding theoretical discourse emerged. We shall see a progression from solo electronic music making to the construction of technologically mediated sensing-systems that are designed to empower the individual as an extradisciplinary performer. These systems function as metaphors of operationally closed autopoietic organisms but also, and more importantly, demonstrate the same liminoid antistructural phenomena that make site-sufficiency suitable for interrogating habitus. As such, we shall see the way in which performance technologies present *unique* possibilities for creating dynamic and complex empowerment networks.

3.1 Reel Experiments

The early stages of practical research marked a return to the electronic music making practice that had become marginalised through my interdisciplinary work with theybreakinpieces. During this early period I produced software instruments (applications authored in the Max/MSP programming environment) and used these in conjunction with re-appropriated analogue audio technologies to explore various performance ecologies[130]. The software instruments developed at this time include: a granular synthesis application that allowed for the generation of synthesised grain-clouds with multiple filter, pitch, waveform, duration and amplitude parameters and envelopes; and a modular application for live sampling that incorporated an audio-routing matrix so that sampled audio could be routed to various effects modules (including reverb, delay, limiter, band pass filter, and a module that reproduced short slices of the sampled audio at programmable rates). I also experimented with a variety of external hardware controllers, using them to interface with these applications. These controllers included a Behringer FCB101 MDI foot controller, Evolution UC33 MIDI controller, and a Saitek Dual Analogue Stick games controller. Additionally, the re-

[130] I borrow the term performance ecology from John Bowers, who states: 'our 'object of design' is not a single piece of technology – neither an instrument, nor a particular piece of software. Rather, to exhibit multiple forms of interactivity, we must deal with an assembly of devices in a performance ecology.' In: John Bowers, 'Improvising machines: Ethnographically informed design for improvised electro-acoustic music', Ariada.uea.ac.uk, 2002, http://www.ariada.uea.ac.uk/ariadatexts/ariada4/bowers-improvising_machines.pdf (31st March 2012), 59.

appropriated audio technologies employed included AM/FM radios, miscellaneous cassette recorders, dictation machines, a Casio keyboard, a vintage drum synthesiser, and reel-to-reel tape decks. I deployed these instruments in multiple combinations and configurations. These ecologies were pressed into the service of various modes of solo and collaborative performance including ‘jam sessions’, workshops, and public concerts. This period of activity revealed the technical knowledge, instrumentation, and modes of interaction through which my electronic music performance practice is defined. I proceeded to survey this disciplinary vocabulary and identify those elements that could potentially contribute to the syncretism between electronic music and extradisciplinary modes of performance.

Figure 3.1 Reel-to-reel tabletop performance ecology.

One of these experimental performance ecologies revealed interactions that indicated potential for further investigation. This ecology consisted in a pair of Akai 4000D reel-to-reel tape decks and the granular synthesis software application running on a laptop computer (Figure 3.1). Each reel-to-reel tape deck was configured to play audio from a short loop of audiotape that extended outward, around a microphone stand and back to the machine. Audio routed to each tape deck could thus be recorded to its respective tape loop (approximately fifteen seconds of audio could be recorded to each of the two tape loops). The audio from the granular synthesis application could be routed to each tape deck individually or to both simultaneously via a mixing desk. Additionally, the

audio output from each tape deck could either be routed back to its own input to create feedback effects or passed to the input of the neighboring tape deck where it could be recorded onto the respective tape loop. A demonstration of this performance ecology can be seen in the film *Reel Experiments Sonic Improvisation* [RE1], included in the accompanying DVD documentation.

This tabletop performance ecology generates affordances for action consistent with the *supervisory* interactions described by John Bowers in his Masters thesis *Improvising Machines*:

> Writers on complex systems like power plants or those in industrial process control often speak of supervisory interaction. Through operations at a control room, one might supervise a complex process but it may have its own complex physics or chemistry (in the case of power generation) which one cannot hope to manipulate in detail. In musical cases, a notion of supervisory interaction might capture cases where a complex algorithmic system is overseen in the production of real-time musical material with, perhaps, the algorithm's parameters being set but its internal operation being autonomous.[131]

Once audio has been recorded to a tape loop one can engage in supervisory interactions such as, for example, starting and stopping playback using the tape deck's transport controls; moving the body of the tape deck to alter the tension of the tape loop, thus affecting the playback speed of the audio [RE1, 05m22s – 05m56s]; or simply adjusting the levels of the audio mix as the tape loops on each deck phase with one another.

Additionally, this tabletop ecology generates affordances consistent with *instrumental* interactions.[132] By grasping the audiotape one can manipulate the sound output directly and expressively [RE1, 02m30s – 03m03s]. Possibilities for manipulation include, for example, variable pitch and amplitude effects such as vibrato and tremolo; stuttering effects, caused by rapidly pinching and releasing the audiotape; and temporal effects caused by drawing the audiotape back and forth across the playhead of the tape deck (an effect equivalent to that of the 'scratching' technique commonly used by turntablists). In this way the audiotape functions as a direct interface between the performer and the sonic material. The performer's actions upon the tape are immediately transposed as

[131] John Bowers, *Improvising Machines*, 59.
[132] Ibid., 59.

sonic events, instantiating a coherent causal one-to-one relationship between gesture and sound.

Figure 3.2 Solo movement experiments with the reel-to-reel tape recorder.

The physicality necessarily exerted upon the audiotape to create these sonic effects was of particular interest during the initial experiments. It struck me that the reel-to-reel tape recorder might generate suitable affordances to accommodate a more comprehensive movement vocabulary. I subsequently conducted further experiments using a single reel-to-reel tape deck upon which was loaded an audiotape containing pre-recorded material, as can be seen in the film Reel Experiments Solo and Collaborative Investigation [RE2]. I discovered that I could pull great lengths of tape out, away from the deck without disrupting its motion across the playhead. This allowed me to move *within* the audiotape, manipulating its motion across the playhead and, thus, manipulating the audio output (Figure 3.2). In this way I was able to use my whole body to control the sound output bringing the entirety of my movement vocabulary into play. This system, which I shall henceforth refer to as the *Reel Experiments* system, invoked a complex dynamic between the performer, sound, and movement. Each of these elements was held together, connected, by the motion and physicality of the tape.

The *Reel Experiments* system generates adequate surefire and probabilistic goal affordances to be useful in performance. The audiotape is grasp-able and, as such,

affords manipulation over the temporal characteristics of the sound affecting the pitch, amplitude and duration of sonic events (including the ability to silence the output by holding the tape still). Additionally, once a significant length of audiotape has been pulled outward from the tape deck one can attend to affordances that facilitate movement utilising the whole body whilst still manipulating the sonic output [RE2, 00m12s – 00m46s]. However, as we shall now see, this movement is not unencumbered.

The audiotape rotates anti-clockwise, outward from the tape deck into the performance space and back across the playhead. Whilst subtle, the rotation of the audiotape creates a resistance that is sufficiently substantial to act upon the body. One can move against this force, creating a tension that pulls the body, or submit to its provocation to turn in sympathy with the motion of the audiotape. The resistant force placed upon the body as it touches the audiotape exposes the performer to a multitude of contingent events, happening-affordances that turn, pivot, pull, and push the body, dislodging it from its place of standing and creating dis-equilibrium that provokes compensatory movement.

The physical resistance also reveals the fragility of the system. Once the audiotape is set in motion its rotation must be sustained. If one should grasp the tape, preventing its motion for any length of time (in excess of a few seconds), the motor on the tape deck itself is liable to 'burn out' rendering the whole system defunct. Additionally, if one allows the audiotape to drop below the base of the tape deck it will no longer run smoothly over the playhead but instead becomes entangled in the transport mechanism of the machine[133]. Therefore whilst the system affords a milieu of kinetic and sonic actions, including a resistance that provokes interaction, it is also fail-able. This probabilistic happening-affordance consequently implicates the performer in an *obligatory* mode of supervisory interaction, that is to say that, whilst one attends to kinetic and sonic affordances, one always has to attend to the maintenance of the system.

Therefore, whilst the performer *inhabits* the audiotape environment they are implicated in a constitutive role within it. The performer is connected to the audiotape that is

[133] This may be overcome by using heavy-based stands around which the tape can run (as can be seen in the film *Reel Experiments Solo and Collaborative Investigation* [RE2]); the use of such objects will be discussed later.

driven by the tape deck. So long as this is sustained there will be audio output. However, should the performer fail to attend to the obligatory supervisory affordances then the transport mechanism fails, the rotation of the audiotape ceases, the audio output falls silent and there is no longer any resistance acting upon the performer who is left cohabiting a space with passive, non-functional objects.

Of course, any movement against the audiotape affects the sonic output. The shifting sonorities of the sonic environment also provoke movement. The performer is, therefore, connected physically to a resistant material and inhabits the sonic environment. This places the performer in an environment rich with happening and goal-affordances. Whilst the performer may consciously attend to many affordances in the act of improvisation, often these intentions will result in unforeseen outcomes. Behaviour resonates through the environment and manifests multi-modal consequences; movement triggers sonic events and physical re-combinations of the space. Intentions are not met with the correlating intended outcome, creating a cognitive dissonance that demands an intuitive response.

Amidst this milieu of shifting perceptual and actional fields the performer may be said to enact meaning in the environment through the intuitive cross-modal associations that they make. Acting intuitively through their embodied movement vocabulary, the performer becomes aware of the general multi-modal dynamic shifts that their behaviour instigates. Movement is no longer a simple shift of the body but instigates a resonance through the entirety of the environment to which they are connected. Embodied movement is thus interrogated, sometimes resulting in a known outcome yet often subject to unforeseen consequences. These shifts, across a spectrum of clarity and cognitive dissonance, expose the performer to contingent events that may reveal possibilities for action, new ways to contribute to the milieu.

In some sense the *Reel Experiments* system is analogous to the operationally closed autopoietic system discussed in the preceding chapter. All elements are connected – sound, audiotape, and performer are entwined and working together to maintain the organisation - and yet the boundary of the system changes dimensions and contorts according to the way in which the performer behaves. These contortions are acceptable whilst the system's organisational integrity remains intact otherwise the audiotape becomes entangled and the whole unity ceases to be.

There are strong resonances between the *Reel Experiments* system and *theybreakinpieces'* site-sufficient strategy for performance. These strategies instantiate a liminoid site in which the relationship between the performer and the environment is intensified. Site-sufficiency instantiates antistructural, liminoid phenomena once the performers commit to specific form elements (for example, rules, scores, objectives) so that their behaviour is conditioned by the resistance – the happening-affordances – that emerge from the environment that they inhabit, the actions of the other individuals, and their disposition to discover new modes of behaviour. Likewise, the *Reel Experiments* system demonstrates antistructural, liminoid phenomena; however, it differs from site-sufficiency because it is instantiated by implicating the performer in obligatory interactions so that they themselves become a constituent element of the environment (i.e. if they cease to behave, the system ceases to exist). In doing so the performer is exposed to a constant array of happening-affordances to which they must respond. Site-sufficiency and the *Reel Experiments* system both instantiate sites that the individual may *inhabit*. These sites are rich with *affordances*, some of which act *upon* the individual by resisting or provoking behaviour. Consequently I argue that these sites manifest the antistructural phenomena that potentialise the reconfiguration of habitual behaviour. It is this theoretical premise upon which I invited the dancer and aerial specialist Mona McCarthy to further investigate the potential of the *Reel Experiments* system.

Figure 3.3 Collaborative experiments with the reel-to-reel tape recorder.

The subsequent period of collaborative experimentation illuminated many new possibilities, both in terms of the additional affordances for kinetic and sonic interaction that were discovered, and the numerous ideas regarding the possible applications of the *Reel Experiments* system in performance (for example, kinetic sculptures, installations, and durational performances determined by the degradation of the audiotape or the sonic material over time) [RE2, 02m54s – 04m27s]. The film *Reel Experiments: Solo and Collaborative Investigation* [RE2, 01m00s - 05m19s] provides a succinct overview of this period of experimentation and so it is not necessary to dwell upon it here. However, I would like to foreground two significant and inter-related insights that emerged from these experiments.

First, the *Reel Experiments* system provokes modes of *collaborative* interaction that are common within site-sufficient performance. The notion that *behaviour affords behaviour* is brought to the foreground as the audiotape connects the individuals physically to one-another in such a way as their actions may be felt through contact with the material [RE2, 02m16s – 02m55s]. An additional connection is also made through the audio output as actions are immediately transposed into sonic gestures. This is akin to the sound of the gravel on the *Cinder Path* that unified the performers through an audible rhythm that permeated the group's acting-together [RE2, 04m27s – 04m54s].

Further, the boundaries and dimensions of the physical performance space can be dynamically altered, re-aligned and re-animated by using the audiotape to 'draw' lines in space. The effect of such spatial reconfigurations is very much akin to the form elements (i.e. score) deployed in site-sufficient work that instantiate a shifting environment, re-animating the space so that its properties shift dynamically. Adapting to these spatial reconfigurations is something of an impossible task and is consequently the catalyst for many collisions, both between individuals and the material boundaries of the audiotape [RE2, 01m01s - 01m44s]. These collisions create resistant forces upon the body and abrupt distortions and morphologies in the sonic output, all of which disrupt interactions and create moments of tension to be negotiated. It is these co-operative and co-determined negotiations of the system's spatial and sonic configuration together with its dynamic re-animation that so closely align the *Reel Experiments* system with site-sufficiency.

Second, when multiple individuals collaboratively interact with the *Reel Experiments* system the obligation to maintain the transport of the audiotape is shared. Whilst one individual attends to the fail-ability of the system the other may move freely within the performance space [RE2, 04m58s – 05m19s]. This touches upon the notion of *expressive latitude,* a term introduced in the field of Human Computer Interaction by John Bowers and Sten-Olof Hellström[134] that refers to gestures not directly sensed by an interface. In the book *Performing Mixed Reality*, Steve Benford and Gabriella Giannachi outline expressive latitude as follows:

> Having a region for making gestures that do not make input… enables performers to temporarily disengage from the interface in order to rest or reposition themselves before subsequent reengagement. It may also support the handing over of an interface from one person to another without causing unwanted input while not properly connected to either.[135]

[134] John Bowers and Sten-Olof Hellstrsöm, 'Simple interfaces to complex sound in improvised music'. *Proceedings of CHI 2000, Extended Abstracts* (The Hague: ACM Press, 2000), 125-126.
[135] Steve Benford and Gabriella Giannachi, *Performing Mixed Reality* (London: The MIT Press, 2011), 157.

By introducing *loop points* (stands around which the audiotape can placed to sustain enough tension to maintain its transport) to the performance space one is able to reduce the fragility of the system (i.e. decreasing the probability of the fail-ability of the system) [RE2, 01m45s – 02m16s]. Subsequently, this increases the expressive latitude that the Reel Experiments system affords. Of course, the introduction of such loop points also introduces new affordances to the system, particularly, we found, with regard to those that afford control over sonic events because the loop points increase the number of areas of tension, making these areas particularly sensitive to movement [RE2, 04m28s – 04m51s]. The loop points also enable the tape to be momentarily maintained at different heights, an occurrence that allows for (and provokes) movement at different levels (e.g. floor work and vertical stretches).

The management of expressive latitude became one of the central concerns of our experiments as we continued to explore the range of possibilities for performance that the system afforded. Whilst multiple loop-points afforded an increase in the range of expressive latitude there was still a significant amount of the movement vocabulary that was suspended because it could not be realised without disrupting the transport of the audiotape and subsequently causing a catastrophic failure of the system. Most notably, the system did not allow for adequate movement at the extremities of the vertical range - floor-work and reaches upward. Whilst the system exposed the performer to contingent events too much specialist knowledge was suspended in its present state. Therefore, whilst the *Reel Experiments* system was rich with affordances it was clearly an inadequate empowerment network with respect to extradisciplinary performance. One solution that we explored in order to improve the system was to create a frame upon which performers could attach pulleys and over which the audiotape could be placed so that its transport would continue unhindered. This frame was referred to as The Cube and allowed for a much greater range of movement to be performed(Figure 3.4) [RE2, 05m19s – 07m02s].

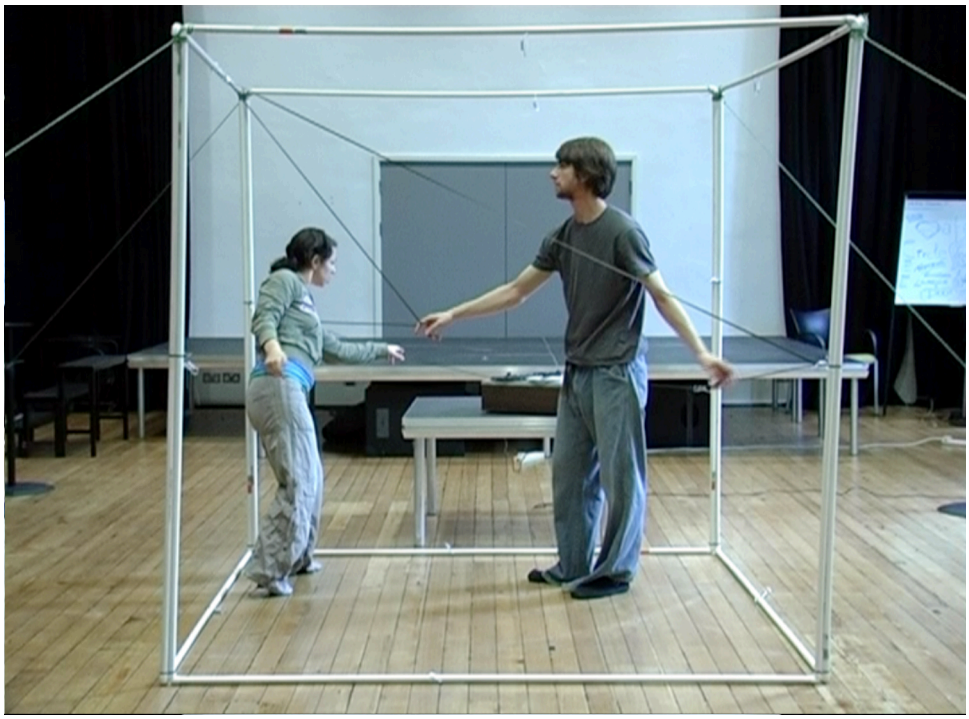

Figure 3.4 Experiments with *The Cube.*

The Cube presents an opportunity to re-balance the roles, resistances, and relational-dynamics that had been present in the original *Reel Experiments* system – in short, to refine the empowerment network. The frame enables the performers to free themselves, to some extent, of the obligation to maintain the system by hooking the audiotape to a pulley so that it is self-sustaining. In this way each performer can move free of the tape or with a section of the tape yet know that it is adequately supported to maintain the integrity of the system. As such, The Cube facilitates a much greater degree of expressive latitude. The Cube also affords the full kinespheric range of movement to be exploited (one can execute movement at the extremes of the vertical and horizontal axis without the tape becoming entangled). The Cube, however, is still not an ideal system, the flimsy design (admittedly the original prototype was made of plumbing materials), in particular the temperamental hooks and pulleys, mean that the structure is liable to contort and destabilise. When this occurs the audiotape inevitably becomes entangled ending improvisations all too abruptly.

Ultimately Mona and I did not feel that the time and cost involved in refining The Cube would be justified, however it had provided valuable insights regarding the elements that needed to be taken into consideration when designing a performance system for cross-disciplinary work. In these early practical experiments we saw for the first time

the way in which performance technologies, specifically those associated with my electronic music making practice, could be reconciled with site-sufficient performance.

In summary, the *Reel Experiments* system and site-sufficiency both instantiate similar affordances, yet, where the latter is instantiated through the deployment of, and commitment to, form elements that re-animate a site, the former is mechanically determined. What is of most notable significance here is that the *Reel Experiments* system presents an opportunity to create many *sites* for exploration within a single space, indeed, within a single performance, whereas, as has been discussed previously, *theybreakinpieces'* site-sufficient strategy is dependent upon finding new locations in which to perform. The technologically mediated site facilitates site-responsive practice in a portable and accessible format. Most significantly, the *Reel Experiments* system illustrates how performance technologies may be deployed to create a bespoke site in which affordances – both sonic and kinetic - may be authored according to the pre-determined requirements of the artist. Ultimately one may state that the *Reel Experiments system is an effective analogue of site-sufficient performance.*

These insights subsequently propelled my practical research in two interrelated directions. I shall now introduce the first of these trajectories, *Terrain*, a cross-disciplinary performance outcome (of which there are multiple instances) in which the *Reel Experiments* system is deployed and developed in such a way as to instantiate suitable affordances and expressive latitude for an ensemble cast.

3.2 Terrain

Figure 3.5 *Terrain* at The Cluny. Chemaine Cook (left), Nicholas Williams (Centre) and Wendy Erikson (Right).

An opportunity had arisen to present an experimental performance at The Cluny, Newcastle. This was an opportunity to investigate the *Reel Experiments* system with a small ensemble cast of performers consisting in Chemaine Cook (a dance and theatre practitioner who also improvised dialogue), Wendy Erikson (a dancer), Mona and myself. A short extract of this performance can be seen in the film *Terrain Performance Extracts* [T1, 0m16s – 03m37s].

The original concept for the performance was to divide the venue's large performance space into three sub-terrains (Figure 3.5). Each performer was assigned to one of these sub-terrains. The three neighbouring sub-terrains, viewed in their totality, defined the overall performance space. A score specified that the performers should first attempt to define their terrain through exploration of its boundaries (real or imagined) and then explore the ways in which they could cross those boundaries. The boundary crossings could be physical incursions into neighboring terrains or realised through interactions with other performers, for example, by mimicking the actions of a neighbor so that gestures or sonic events resonated throughout the performance space.

In the first performance at The Cluny the three sub-terrains were assigned as follows: Chemaine inhabited the first, and shared this territory with a single microphone on a stand. As such, she could move freely and improvise text into the microphone. The

signal from the microphone was routed to a mixing desk located in the second territory [T1, 00m28s – 00m57s].

I occupied the second territory, crouched on the floor in the centre of the performance space. From this position I controlled all of the audio technologies including two reel-to-reel tape decks and a mixing desk. The first tape deck was loaded with a reel of audiotape containing found-material (in this instance, a recording or popular music from the 1970's and 1980's). The audio from this tape deck was routed to the mixing desk. The second tape deck received audio from the mixing desk and was therefore used to sample the signal coming from either Chemaine's microphone or the first reel-to-reel tape deck (or both simultaneously). This configuration afforded many ways for manipulating the audio output: I could mix the audio output from the mixing desk (mixing between the output of the first tape deck and Chemaine's microphone), or, I could *play* the second tape, improvising with the sampled audio in a manner similar to a turntablist (just I had done in my initial period of practical research) [T1, 01m35s – 02m36s].

Mona and Wendy occupied the third territory. This territory neighbored the second, on the opposite side of the performance space to the first. The third territory was the largest of the three, allowing its inhabitants to move freely. It was decided that Mona and Wendy should pull the audiotape outward from the first reel-to-reel tape deck (situated in the second, central territory) in the manner of the Reel Experiments system. Therefore, Wendy and Mona were subject to all the relational dynamics, resistances, and affordances that the Reel Experiments system initiated. As such, they were required to collaborate so that the integrity of the system was maintained whilst simultaneously manipulating the audio on the tape and redefining the space by drawing new boundaries (just as Mona and I had done in our early experiments) [T1, 02m42s – 03m37s].

As intended, the first performance of *Terrain* saw the performers making connections across space in numerous ways. Wendy and Mona, following an initial period of play within their territory, began redefining the space using the audiotape as a physical barrier with which to *herd* the audience whilst creating lines that extended to the other territories. For example, they managed to draw the audiotape upwards from their own territory to Chemaine, situated on a raised platform, all the while affecting the pre-recorded audio as they moved. Chemaine, located by the microphone throughout the

entire performance, called across the space, vocalizing text rich with provocations to re-act in between gestures and repetitive movement cycles. Located in the centre of the milieu and crouched amongst the audio equipment, I fervently gathered and manipulated the incoming sonic material, occasionally silencing both channels coming from the outside territories, choosing to improvise with that which I had managed to capture on the second reel-to-reel tape deck and sometimes allowing the audio from outside to flow through untouched. In this way I was able to induce silence, or offer provocations across the territories with moments of improvised sound.

Throughout the performance Mona and Wendy used the audiotape to redefine the boundary of the third territory in a manner such that the individual territories could no longer be distinguished. Chemaine remained in the first territory yet communicated across its boundary with her voice, feeding the audio output and calling to Mona and Wendy. I remained crouched in the centre of the space and busied myself with the sound output, sometimes allowing audio-signals to pass un-hindered to the speakers and, at other times, improvising with the second reel-to-reel tape deck. I would improvise either in response to a particular performer (e.g. accompanying Chemaine's movement and vocalisations) or simply to embellish the existing audio output.

Whilst the subsequent performance was relatively successful, it was agreed that there was potential for improvement in a number of respects: first, it was felt by Mona and Wendy that the fragility of the reel experiments system was such that it demanded too much of the obligatory supervisory interaction. This was prohibitive of their collaboration together in terms of their ability to duet as movement practitioners. Second, the found sounds on the audiotape of the first reel-to-reel tape deck seemed at odds with the rest of the performance content. These sounds were alien to the performance environment that otherwise comprised original content. Third, Chemaine had felt that she had only been able to contribute to the performance in a superficial manner; once she had spoken she had little control over the manipulation of the sound of her voice before it was output through the PA, this created a sense of disconnection that needed to be addressed.

Therefore, the task that we faced at this time was to reconsider the opportunities for action that *Terrain* afforded. The environment had been too prohibitive for the performers to improvise in a manner that was productive. That is to say that, rather than

being empowered as performers to find opportunities and explore new creative actions, the individuals found the environment to be overwhelmingly restrictive and, ultimately, disempowering. *Terrain*, as a strategy for performance, had to be refined as an empowerment network in terms of the affordances that it made available to the individual performers.

If we were all to feel connected in a manner that our actions resonated through the rest of the group then it seemed logical to consider the performance space as one single territory (as opposed to three distinctly separate territories). The performers could then act together to sustain, redefine and manipulate this single territory. In this way we would improvise together with the intention of co-originating a dynamic and evolving environment. Mona and I had identified this potential during our early experiments with the Reel Experiments system. We had discovered that the audio output and the activity of both performers were inextricably connected and created a single, dynamic environment in which the performers had to negotiate their role. Therefore, we proceeded to experiment as a group of four, exploring the Reel Experiments system as a single environment once again. We held a number of workshops, the focus of which was to identify the affordances available to each performer and, more importantly, the affordances that were missing that might allow us to exercise a sufficient portion of our performance vocabularies so that we were each able to challenge one another whilst being challenged ourselves to reveal new possibilities for action. Consequently, we began to modify the system and introduce affordances that were otherwise unavailable.

Some of these modifications were less dramatic than others. For example, Wendy and Mona's concern that the obligation to supervise the maintenance of the system was too restrictive was relatively easy to resolve. We introduced a stable loop-point (a speaker stand with a heavy base) to the performance space so that the performers could choose to loop the tape around it, thus adding extra stability to the system and allowing the performers to move more freely (although this did not remove the responsibility to maintain the integrity of the system altogether).

Further, we all spent time improvising with the Reel Experiments system so that we became more attuned to the way in which we could shift our responsibilities between *performing with* and *maintaining* the system. In this way we developed a group-sensitivity to each other's actions with respect to the stability of the system. I suggest

that our ability as a group to exchange roles can be attributed to our sensitisation to the behaviours and desires of one another, thus, any cue to either take up the role of *maintainer* or move into the role of *performer* was tacitly *felt* and never spoken or instructed. Likewise, our ability to orientate one another to each role was refined, becoming implicit in our gestures and behaviour. For example, one might sense that a dancer's solo was 'winding down' and this present an opportunity to provoke an exchange of roles. Such sensitivity demands experience of what a performer 'winding down' looks like and this will, of course, be different for each performer. In contrast, such sensitivity also allowed for moments in which one performer could choose to disrupt a performer or force them to assume a role.

A more dramatic modification to the system was the way in which the audio technologies were reconfigured. At this time I had presented the outcomes of my early experiments with the Reel Experiments system at a workshop in Newcastle University. Kirk Woolford had seen this presentation and, during a conversation afterwards in which I discussed the improvements to be made to *Terrain*, he had suggested I explore the possibility of using the audio output of the reel-to-reel tape deck as a control mechanism for audio software. I experimented with this idea and eventually authored an application in Max/MSP for use in *Terrain*.

The application was a simple auto-sampler. The auto-sampler monitored an incoming audio signal (from Chemaine's microphone). Subsequently the audio buffer would contain snippets of Chemaine's voice in such a manner that there were no silences between fragments of her words. When the buffer was full it contained a stream of vocal fragments and rapidly spoken words. Playback of this content was controlled by a signal coming from an audiotape loaded onto the first reel-to-reel tape deck. This audiotape had a 2000Hz sine wave recorded onto it. When Mona and Wendy interacted with the audiotape it caused fluctuations in the pitch of the sine wave. The auto-sampler monitored these fluctuations and used them to specify the playback speed of the audio buffer's content.

The performers interacting with the audiotape could now control the playback of Chemaine's text, bringing it to silence by preventing the motion of the audiotape across the playhead of the tape deck, or changing its pitch by slowing or speeding up the motion of the audiotape. This system also allowed Chemaine to constantly update or

overwrite content in the audio-buffer simply by speaking into the microphone at appropriate amplitude.

This simple auto-sampler was significant in moving toward a single collaboratively authored terrain. There was no longer any need for found or prerecorded sounds as Chemaine had the facility to generate all of the source material for the performance herself. Further, the system overcame her feeling of disconnect as her vocal performance was now a integral part of the system. Likewise, by performing with the audiotape one felt as though one was performing with Chemaine rather than some arbitrary sonic material.

This configuration of *Terrain* was presented twice, at Platform 00000008 (Star and Shadow Cinema, Newcastle, (12th December 2008)) [T1, 03m38s – 06m04s] and Public Announcement 2009 at Dance City, Newcastle (30th January 2009) [T1, 06m05s – 08m41s]. Once again these performances revealed numerous ways in which we could improve the system. Most notably these performances allowed us to refine the function of the auto-sampling software. For example, at the start of the performance at Dance City, the audio buffer was empty and Chemaine was required to speak at relatively a high volume in order to fill it up. This was contrary to how she *actually* began the performances; whispering and only occasionally reaching the correct amplitude to trigger the auto-sampler's record function. Therefore, when she stopped improvising text a few minutes into the performance, she had expected to hear her voice being manipulated by Mona and Wendy, however, the buffer was empty and so there was only silence. Then followed an act of overcompensation as she yelled and droned into the microphone, filling the audio-buffer in one or two breaths with mono-dynamic content that was then reproduced numerous times as Mona and Wendy improvised with the audiotape.

Again, these observations subsequently led to small but not insignificant modifications to the system. I worked closely with Chemaine to calibrate the auto-sampler in such a way that she could be assured that it was recording her at all times. This was achieved by creating a mechanism in the software that would dynamically measure the amplitude of her voice and adjust the recording threshold to just-below-her-present-volume. In this way the auto-sampler auto-calibrated according to the dynamics of Chemaine's voice. This minor mechanism meant that the auto-sampler would record fragments of her

voice regardless of how loudly or quietly she spoke. I also created a large presentation window in the auto-sampler that displayed the content of the audio buffer in real-time. This afforded visual feedback for Chemaine so that she could see the waveform of her voice as it was recorded (Figure 3.6). This simple feedback mechanism gave her a much greater understanding of the way in which the software worked and her relationship to it. The overall improvements to the auto-sampler meant that Chemaine fully grasped the system and could interact with it with great control.

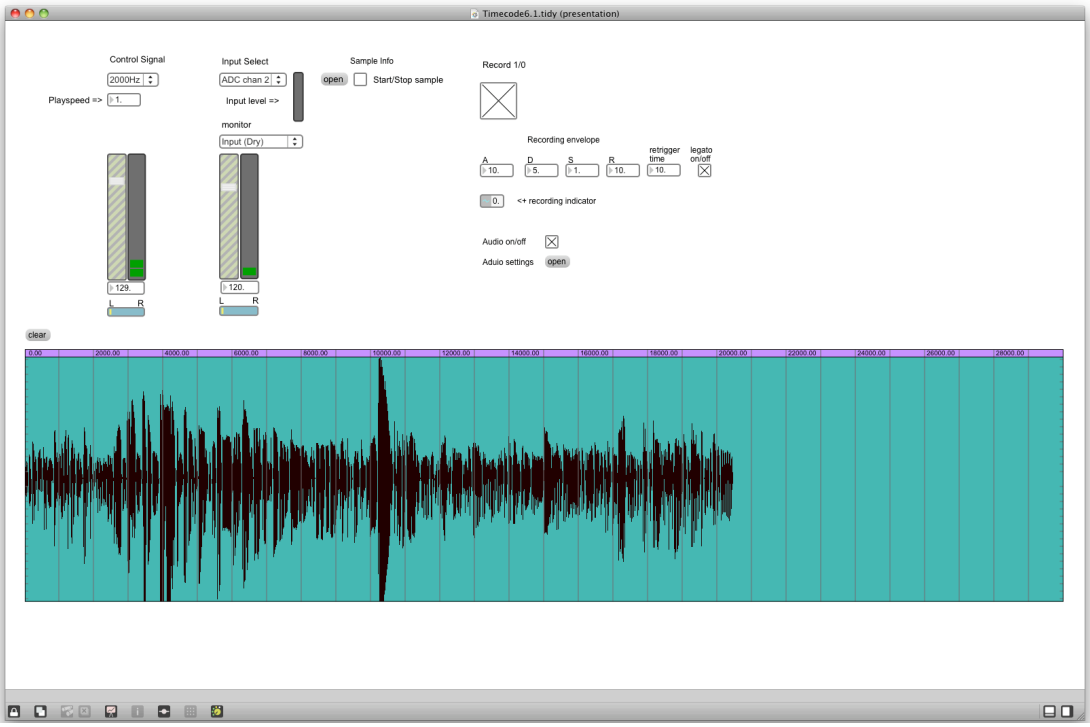

Fig. 3.6 Large presentation window in the auto-sampler application.

One might argue that this is a good example of the way in which minor modifications to the environment can have a very empowering effect. The visual feedback provided by the audio buffer display is an example in which external scaffolding functions to improve Chemaine's capacity to interact with the software. In doing so this minor change also empowers her as an agent by reducing the amount of attention that she must give to the state of the system. This frees Chemaine to attend to her actions with respect to the group rather than worrying about the auto-sampler.

In addition to the modifications to the auto-sampler I replaced the second reel-to-reel tape deck with the music improvisation software that I had developed during the initial

period of practical research. This allowed me to utilise more of my performance vocabulary as a musician to embellish the soundscape.

The final modification to *Terrain* was to amend the score. The lighting arrangement at Dance City had foregrounded a physical separation between the performers that was counter to our intention of co-authoring a single terrain. As such, we decided that each member of the cast should be free to interact with the Reel Experiments system, improvise text at the microphone and use the performance software at will. Each member of the ensemble had experience in improvised movement, music and text so it was a decision that enabled each performer to utilise a much broader range of their performance vocabulary.

This final configuration of *Terrain* was never presented in public. However, it was a successful experiment that achieved the co-authored terrain that we had been striving for. The piece was rich with affordances for each performer and the Reel Experiments system bound all of our interactions in such a way that the ensemble was implicated in a constant negotiation with one another. The sonic environment, now more complex, offered many more provocations for reaction. As the definitive version of the piece, this configuration of *Terrain* is presented as a primary output in the film *Terrain Final Configuration* [T2].

To summarise my practical research so far, the Reel Experiments system was a fruitful first step toward reconciling extradisciplinary performance with my electronic music practice. The reel-to-reel tape deck provided a rich milieu of affordances both for the dancer and the musician. Additionally, the audiotape could be deployed in such a way as to instantiate a self-contained, synthetic environment. The audiotape was both fragile and resistant. The fragility obliged the performers to work collaboratively and negotiate their roles within the system. Subsequently, the performers acted as one unit, performing together yet always ensuring the integrity of the system was maintained. The resistance generated by the audiotape as it rotated around the space created a physical force against the body, a happening-affordance that provoked and interrupted movement. Additionally, the performers would pull lengths of audiotape against one another, constraining movement and restricting limbs. The space would contort, its dimensions expanding and contracting with lines of audiotape marking these new boundaries. The effect resonated with my experiences of site-sufficient performance in

which a score could re-animate the surfaces of a site. Such dynamic reconfigurations of form pose a challenge to the individual, affordances rapidly appear and disappear, one must either speedily adjust to these new opportunities or commit to an action and prepare for collision. These disruptions create moments of crisis in which the habitual behaviour of the dancer enters a moment charged with potential, a moment in which the next fall of a foot or shift in weight may reveal a new encounter.

All the time the performer's actions are affecting sound. And, all the time the performers are responding to sound. Manipulations of pitch, silence, and timbre grow in association with movement. A cross-modal mapping occurs, a tacit knowledge of the way in which to control sound through *my* movement. No explanation is required, only movement with the tape, and a vocabulary emerges with which to manipulate the audible environment, bringing it to the body so that it is felt to move with the limbs.

The environment that we created using the Reel Experiments system is rich with potential. It reveals a multi-modal array of affordances sufficient for numerous individuals to explore the environment on their own terms. A provisional knowledge emerges amongst the group - knowledge of the system, its state, and the affect that one can have at any given moment. However, we had reached the limits of the Reel Experiments system. We had begun to master it, it was becoming predictable, affordances were becoming familiar and we were discovering *our* way of working within it. The challenge was dissipating as the antistructural succumbed to structuration once again. Just as *theybreakinpieces* moved from site to site in order to exploit unfamiliar happening-affordances so too were we ready for a new environment. However, this mechanical environment had offered valuable insights into the way in which technology might create a synthetic environment that empowered individuals as extradisciplinary performers. I began to consider the way in which these relationships might be instantiated in a system that *continually* reconfigured to present a shifting environment, one that could be revisited time and time again yet always presents a new array of affordances.

3.3 SynSite

Having realised Reel Experiments and *Terrain,* Mona and I were keen to pursue the notion of a synthesised environment in which all elements were connected and co-

dependent. *Reel Experiments*, *The Cube* and *Terrain* had shown that there was potential to create such an environment yet each system was limited in its affordances. The Cube had foregrounded the possibility to create an environment that facilitated full range of kinespheric movement and had the capacity to be reconfigured in real-time. The Cube, however, would take a significant investment of time and money to produce a useable model. It seemed to be the logical next step to investigate the possibility of creating a synthesised environment in the digital domain that may afford reconfiguration *ad infinitum*. If such a synthesis was possible then performance technology could be said to provide an entirely unique opportunity with regard to site-sufficient performance.

Given that I would clearly need to acquire new skills to complete this task, Mona and I decided to produce the project on a smaller scale. We would work together, I would assume the role of engineer and she would perform. We would work closely on the development of the piece, exchanging observations and critically reflecting on our progress. It was clear that, in the first instance, we would have to use motion capture technology to realise any kind of digitally synthesised environment. I shall present the development of SynSite in three phases.

3.3.1 *Phase 1: Motion Tracking and the Trigger-Regions Experiment*

Mona and I had first to decide which technology we would use to track her motion. We had two resources at our disposal, the Vicon Motion Tracking System installed in Newcastle University's Culture Lab, and Isadora, an object oriented programming environment designed specifically for the manipulation of A/V media and motion capture in performance.

The Vicon system is traditionally used to record capture data that will then be played back, manipulated, or analyzed. However, I was fortunate to have participated in the Creator motion capture workshop at Cambridge University during which time a small group of computer scientists had created a library for Max/MSP that allowed the Vicon capture data to be accessed in real-time. This created the possibility that the system could be used in live performance.

The Vicon system captures motion data at an extremely high resolution. The space within which the system will 'see' markers is specified according to the position of eight individual infrared cameras that designate the capture environment. Each stream of data

gives the coordinates of individual reflective markers in three-dimensional space. The reflective markers are attached to the subject that is to be monitored. The Vicon system has the capacity to simultaneously monitor a large number of the reflective markers and so an individual's joints, hands, and even individual fingers can be monitored with great accuracy creating a high-resolution 3D representation of the body in motion.

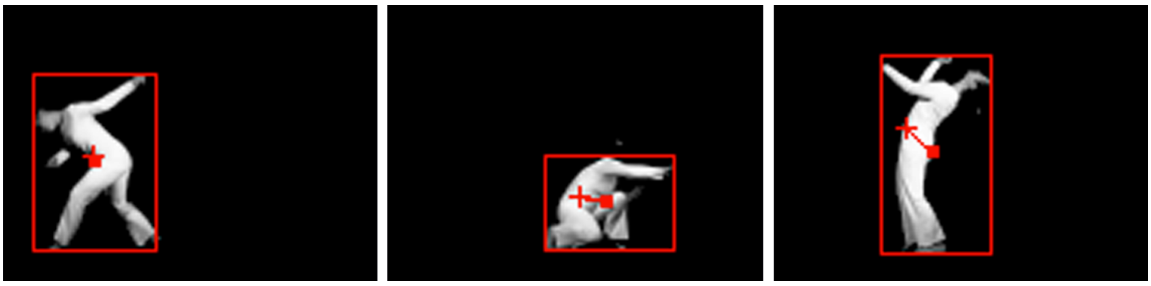

Figure 3.7 Blob tracking in Isadora.

Isadora, on the other hand, requires a digital video camera to send a live feed to the application. Once the footage is being received one can adjust its properties, for example, by adjusting contrast, brightness and saturation, flipping, and inverting the image so that the subject to be tracked stands out against the background. Once the image has been optimised for tracking the signal is routed to the *Eyes++* object. Eyes++ identifies a prescribed number of objects in the image. Upon identifying the object Eyes++ creates a rectangular wire frame or *blob* around it (this method of tracking is commonly called *blob tracking* (Figure 3.6)). The blob demarcates the extreme edges of the detected object and dynamically adjusts as the object moves, keeping the object bounded. Once the blob is instantiated Eyes++ generates numerous streams of capture data representing the relative position of its sides, centre, and the weighting of the object within the blob (i.e. where there is more of the object according to the distribution of white and black areas within the bounds of the blob). Because Isadora uses a digital video camera it has the capacity to create only two-dimensional motion data.

Both of these systems have their advantages and disadvantages. The high resolution of the Vicon system was attractive, producing exceptionally accurate data of small portions of the body. Isadora, on the other hand, created motion data for a blob, an approximation of the subject, making detailed tracking of finger movements and such subtleties (initially) difficult. However, whilst the incredible accuracy of the Vicon system was appealing there were numerous significant reasons not to use it: first, the

technology was conspicuous, the motion tracking cameras and the computer work station were necessarily prominent and the performer, whose motion is being tracked, has to wear numerous reflective markers all over their body. These markers are restrictive because they demand an adjustmentent of the fundamental movements of the body. The markers also look rather ridiculous (admittedly the Vicon system is designed for *recording* motion tracking information and so it is not normally deployed in live performance, therefore the markers normally do not need to be hidden from view). Second, the motion tracking system is not at all portable. Any performance we created with the Vicon system at Culture Lab would have to be presented *at* Culture Lab or an institution with the same technology in a similar, if not identical configuration. This was highly restrictive as it was our intention to create a piece for public and academic presentation. Third, the system was unstable and frequently needed recalibration including the cameras that needed to be regularly re-aligned (the Vicon system was in use regularly in various configurations by other people). Finally, the Vicon system is extremely expensive and so there would be little chance of being able to continue our work with it beyond the duration of my PhD.

The Isadora tracking system had a lower resolution and could not track depth (it was two dimensional). However, the system was portable (as the only technology required was a laptop and a digital camera) and reliable (compared with the rampant idiosyncrasies of the Vicon system). Whilst Isadora didn't produce nearly as much usable data as the Vicon system it still created a significant amount of which we had only explored a small fraction. Finally, the Isadora system was reasonably affordable (a few hundred pounds compared with the multiple-thousand pound Vicon system).

Ultimately, the portability and affordability of the Isadora system was chosen for the project as this provided the best opportunity to continue our work over a longer-term period and to reach a broader audience. Later on we shall see how the lower resolution was, to a large extent, overcome by discoveries we made regarding the mapping of movement into data.

Trigger-Regions

In the first instance we set up a camera facing stage front. The camera relayed a live feed showing the entire breadth of the stage. The image was routed to Isadora,

optimised for capture, and a blob was created. The motion tracking data generated by the blob was converted to MIDI note on/off messages. These messages were sent via MIDI to an Elektron Machinedrum, a powerful hardware drum synthesiser. The breadth of the image from the camera was divided into sixteen regions and each corresponded with a single sound on the Machinedrum. Whenever the blob's centre point (i.e. Mona's centre point) crossed into a new region the corresponding sound was triggered. This early experiment can be seen in the film *SynSite Trigger-Regions Experiment* [SS1].

We had created a very simple, two-dimensional interactive environment. The sounds were essentially fixed in space and Mona could interact with them in only one way, by moving to or through their location so that they would be triggered. The environment within which the performer moved was fixed, as if it were a static, objective external world. The objects that inhabited the environment (the sixteen individual sound events) could not be moved or manipulated by Mona, they could only be 'discovered' and re-visited. We hadn't created an environment so much as a passive instrument that the performer could play.

As such, this early *trigger-region* system afforded instrumental interactions only. The system also afforded a high degree of expressive latitude because, once Mona had entered a region and triggered a sound, she could move freely without having any affect on the system until she entered a neighboring region. This was the expected outcome from our initial experiment, the primary purpose of which was simply to get a feel for the reliability and limitations of Isadora as a motion tracking system. This early experiment did, however, provide a useful point of departure for further developments.

The first point of note was that the expressive latitude afforded by the system was far too great. The performer was in complete control of the system that offered little in the way of happening-affordances and thus lacked any kind of contingency. As such, the system was easy to master and offered no interrogation of the performer’s habitual patterns of behaviour.

Second, it was clear that we wanted the performer's movement to be monitored in greater detail. That is to say that, too much of the performer’s movement had no effect on the system. The system was not capable of monitoring depth and so the performer’s spatial dynamics (the paths along which she traversed the stage; back and forth, side to

side, and vertically) were only partially recognised. If we were to create any meaningful sense that the performer inhabited an environment then she had to feel much more intricately coupled to it.

Third, the sounds from the Machinedrum were predictable and static, lacking any notable spectral, timbral, spatial, or rhythmic morphogenesis. As such, the sonic environment offered minimal provocations to interact with or respond to and was of little interest either to the observer or the performer. Clearly this would have limited use in performance.

In order to develop a new system that addressed these points of interest we devised a working strategy that would become the staple method for the rest of our research and development process. In the final moments of our session with this early system we recorded a number of short films, each of Mona improvising with a different movement vocabulary and specified in terms of dynamics rather than specific gestures, such as, for example, 'subtle bobbing', 'fast sharp transitions', 'slow gliding'. The emphasis here was not on recording a specific gestural vocabulary or choreographed sequence; rather it was our intention to accommodate those general movement dynamics that Mona often realised in improvisation. This enabled me to work with Mona's movement vocabulary in her absence whilst building new software systems and experimenting with relationships between the motion data and the sonic environment.

3.3.2 *Phase 2: Procedural Audio, Spatialisation and the Locator*

It was clear that in order for the performer to *inhabit* the environment we would have to rethink both the way in which sonic events were instantiated and their subsequent behaviour. We needed to find an alternative to the trigger-regions method that we had already explored. Trigger-regions created a static environment but we were interested in creating a space that demonstrated the same malleability that the audiotape had afforded in both the Reel Experiments system and The Cube, a space the dimensions of which could be manipulated by the performer. This catalyzed a fundamental change to the way in which I conceptualised the relationship between the performer and the sonic events. I began considering the way in which sonic events could be bound not to locations in space but instead to the performer’s body.

To achieve this new relationship would require a powerful and flexible method of sonification. A sample-based system would be too rigid. The only way samples could be sufficiently malleable would be to create an enormous array containing multiple variants of each sound and then create a gestural recognition system that would provide sufficient analysis of movement so that samples could be selected according to particular gestures. This would not be possible given the low-resolution blob tracking method of Isadora that had already shown itself to be limited with regard to monitoring the intricacies of a single gesture. Given the limited data that Isadora generated it seemed a more suitable solution could be found by using *procedural audio*.

Procedural audio is a technique deployed commonly in the development of computer games. By deploying a simple and efficient synthesis engine, games developers are able to create sound effects and musical scores that reflect the player's progress and actions in the game. For example, when a player shoots a gun in a tunnel the parameters of the synthesis engine apply the correct filter settings so that the gunshot reverberates as if in a tunnel. If the player should then leave the tunnel and fire the gun in an open field the filter parameters adjust accordingly to provide the correct reverberation once again. This method allows for the intricacies of a player's posture and location relative to objects to be reflected in the sound (for example, a gunshot close to a wall will sound different to a gunshot a few steps back). This is an extremely elegant and computationally efficient method for sonification as all of the sounds required in a game can be created using only a small array of synthesisers as long as their parameters are sufficiently versatile. This is by far preferable to a sample-based method in which hundreds of individual samples of gunshots, footsteps, breath, etc., are stored in memory and recalled according to in-game events. It seemed that procedural audio was a proven method for creating powerful and versatile audio engines that could be deployed in interactive environments and so I explored this possibility.

It was also clear at this time that in order to give the dancer a sense that she was interacting with the sonic environment the sonic events should move in relation to her. Such a relationship would require use of spatialisation techniques. Therefore, my experiments at this time focused on two areas (1) creating a procedurally controlled synthesis engine to produce sounds that could reflect inferences drawn from the dancer's movement and (2) the effects of spatialisation relative to the dancer's location.

I used Supercollider to conduct my first experiments. Supercollider is a powerful application that is capable of instantiating hundreds of user-defined synthesisers to create complex tapestries of sound. Never having used the programme before, I found it to be very accessible and relatively easy to grasp. Whilst researching psychoacoustics and theories of spatialisation (during which time I had to re-acquaint myself with trigonometry by doing exercises on the BBC's GCSE mathematics website!) I created a number of patches in Supercollider that would pan sound with varying degrees of Doppler and filtering effects. Whilst these experiments were fruitful (indeed, trigonometric functions and Doppler would feature in future versions of the systems) I found granular synthesis in Pure Data to be more productive.

In short, granular synthesis is a method in which small fragments of a pre-loaded audio sample are played back in rapid succession to create streams or clouds of sound that can vary drastically in density and texture. In addition to the different source samples one may use other powerful variables including grain duration (usually ranging from 10 to 100ms), density, playback speed (each individual grain can be reproduced at different speeds), panning (each grain can have its own trajectory in the stereo field), and grain source (each grain may originate from any point in the source sample). By combining multiple streams or clouds a single sample can produce an almost infinite timbral and textural palette.

Following a period of experimentation, I authored a grain-cloud generator in Pure Data. This application created two grain-clouds from a variety of source samples and could therefore produce an enormous range of sonic events. The application had numerous variable parameters that were randomly specified once an event had been triggered. The grain-cloud generator was created in such a way that the two clouds would originate with great density from the same location in the stereo field and then move in opposite directions as their respective densities decreased with the individual duration of grains increasing to give the effect of a dense granular ball that splits and softens into a slippery texture before finally fading away. Happy that this application afforded great potential I turned my attention to the way in which the dancer might interact with it.

How best to draw upon the dancer’s behaviour? The trigger-regions had only limited use and so it was necessary to find a new way of initiating sonic events. Isadora provided speed data for the subject being tracked and with minimal manipulation this

could be used to indicate whether the dancer was still or moving. I created a mechanism in the granular synthesis application that monitored both the dancer's location in space (on a horizontal axis) and speed. This allowed the dancer's location to be identified and her level of activity registered as either *on* (moving, a speed greater than 0) or *off* (stillness, a speed of 0). This mechanism determined that when the dancer moved, a granular event would be initiated at the equivalent position in the stereo field. The way in which the randomisation of parameters was programmed meant that this grain-cloud would split into two streams and move away from the dancer before disappearing. Whenever the dancer moved, a new granular event was created. Each granular event was distinct due to the randomisation of parameters that occurred at its initiation. This experiment can be seen in the film *SynSite Grain-Clouds Experiment* [SS2].

In practice this granular system was relatively successful. It was clear to the observer that sounds emerged from the dancer's action and, further, that the relation between the dancer's location on the stage and the granular clouds could be clearly understood. Additionally, the trajectory of the grain-clouds afforded the dancer opportunities for more complex interactions; she could choose to follow the path of one of the clouds, to move in opposition to it, or to remain still. Further, the duration of the grain-clouds exceeded that of each movement and so the dancer could instantiate a temporary audio environment that she could either allow to develop and reach its silent conclusion or reinvigorate by moving once again to create additional clouds.

Thus we had achieved something of a paradigm shift. We had replaced a static external environment with a dynamic and somewhat unpredictable milieu that originated from the dancer's movement. Once instantiated this environment offered further opportunities for interaction. We had thus edged a little closer to our goal of an interactive environment that was co-determined by and bound to the activity of the dancer.

During our initial experiments with the granular system it was clear that as the sonic environment became increasingly dense it also became more difficult to decipher the relationship between the sound and the dancer. We decided to create an additional sound that would remain tightly bound to the dancer's location at all times. This *locator sound* would move with the dancer and allow both her and the observer to correlate the movement with at least one element in the soundscape.

In the first instance the locator was created using an additional FM synthesis engine within the grain-cloud patch. This synthesis engine monitored both Mona's position (along the horizontal axis) and her activity (using the speed data, as above). When Mona stood still on the stage the locator sound would 'find' her location and create a regular pulse on the spot where she stood. When she moved (instantiating a granular event) the locator would become agitated and shift around her position, pulsing with irregularity until she was still when, again, it would find her and settle on the spot. In this way the locator came to the fore during moments of stillness and receded to the background when sound events were triggered, making way for the grain-clouds. This locator experiment can be seen in the film *SynSite Grain-Clouds Experiment* [SS2].

This simple device produced great clarity for both the observer and the performer. The locator created a sonic anchor that specified the relationship between performer and sensing-system from which the relationship of the other, more chaotic, granular elements could be deciphered. For the first time we began to consider the different functions that elements of the performance would need to have so that it presented a suitable challenge for the performer and yet was cohesive to the observer.

Challenging The Performer

The granular system had revealed the potential to create a complex soundscape that originates from the movement of the dancer. Additionally, the introduction of the locator provided the dancer with feedback as to the state of the system at any given time and also functioned to clarify the relationship between the performer and the system for the observer. However, the relationship between the system and the performer was singular – the dancer triggered a sonic event each time she moved - and this did not yet generate the resistance that had proven productive in site-work and the Reel Experiments system. Site-sufficiency exposed the performer to contingent events - happening-affordances - by re-animating the environment so that the body was situated in unfamiliar territory. The fragility of the Reel Experiments system obliged the performer to attend to the audiotape that, in turn, provoked movement through its physical resistance against the body. Likewise, The Cube generated physical resistance but allowed for a greater degree of expressive latitude by affording the performers the opportunity to suspend their attention to the fragility of the system momentarily. We

would draw upon these experiences and consider the ways in which we might author resistance into a system using the audio technologies. Therefore there were two possible areas in which we could introduce resistance (1) in the mapping between movement and sound events and (2) in the morphologies and content of the sound events themselves.

1) Mapping resistance: Physical Modelling

The first step was to consider the way in which more complex data might be generated from movement. It seemed that an additional layer of mapping might occur between the initial tracking data that represented the properties of the blob (speed, size, etc.) and its control over the synthesis engine. This re-mapping would be used to produce a more complex array of data that could subsequently be mapped onto a more complex synthesis engine. This additional layer would subsequently imbue the system with a behaviour that would exceed the dancer's control. Following experiments with behavioural algorithms that mimicked the flocking and swarming of birds (using the Boids object library for Max/MSP)[136] I found the most elegant solution in physical modeling systems.

Physical modeling seemed to offer a variety of elegant solutions for adding additional layers of behaviour through the remapping of data. Using the Mass Spring Damper (MSD) object library for Max/MSP[137] we experimented with numerous different physical models that the dancer could interact with. For example, we created a virtual mesh that covered the entire capture area like a net. The net consisted in several parallel rows each containing numerous springs that connected one mass to the next. The weight of each mass, elasticity of the springs and dampening effect could all be adjusted to give an extremely variable virtual mesh with which to interact. The motion data was mapped to the virtual mesh so that the dancer could move through it, causing each mass to move depending on how fast the dancer was travelling. In this way disturbances would ripple through the mesh. It seemed that we could create nests of sound so that when a mass was agitated sound would spring forth from its respective location in the stereo field. This experiment can be seen in the film SynSite Mesh Demonstration [SS3].

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[136] The Boids object library was created by Eric Singer, Jach, André Sier and Wesley Smith. The library can be downloaded from http://www.s373.net/code/

[137] The MSD object library by Nicoas Montegermont can be downloaded from http://grrrr.org/ext/beta/macos/max/

The mesh instantiated momentum in a manner that gave a sense that the dancer's movements would create a rippling effect through the whole environment. This was much more akin to the effect we had been seeking, but was still a relatively stable environment that could be mastered easily by the dancer. However, we found that by reducing the virtual mesh down to just two individual masses with a single spring between them we created a swing-ball type effect. By locking one mass to the dancer's position in space (the equivalent of the centre of the blob in Isadora) we found that the second mass would swing and orbit this position depending on how taut the virtual spring was and the strength of its dampening effect. This allowed the dancer to work closely with a single sound source that always moved in relation to her, although this would not always behave in predictable ways (for example, sometimes the mass would be too heavy to move and sometimes it would move well in excess of the dancer's trajectory). This experiment can be seen in the film *SynSite Swing-Ball Demonstration* [SS4].

2) Sonic Morphologies

Granular synthesis had been a fruitful method for sonification but further experiments with Frequency Modulation (FM) synthesis proved to be more computationally efficient and allowed for powerful sonic manipulation with only few parameters. Having worked with granular synthesis many times in the past I was keen to explore the sonic possibilities of this alternative method.

I built a relatively simple FM synthesis engine (based upon a model in the book *Designing Sound* by Andy Farnell[138]). I had crafted a number of presets for this engine that produced textures and rhythms that I thought might be either evocative or provocative of movement. However, it was an incidental moment when I was playfully scrolling between presets to test the stability of the engine that I discovered the unusual and wonderfully rich sonic events that occurred *between* presets as the automated parameters shifted from one setting to another. These contortions gave a sense of transformation that was consistent with an organic environment, one that had its own life and behaviour, in a sense, its own singularity.

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[138] Andy Farnell, *Designing Sound* (London: Applied Scientific Press, 2008), 276.

A second development at this time concerned the locator sound. Previously the locator was generated by an FM synthesiser and had created a regular rhythm (beeping) when the dancer was still. This dissipated when the dancer moved and turned into a texture that receded into the background when the dancer moved again. However, the primary function of the locator was to anchor in the space and reinforce the relationship between the performer and the environment (e.g. some kind of indication that this was not arbitrary movement in an arbitrary sonic environment). Therefore, I re-created the locator engine using white noise as a source material. This white noise was filtered according to the dancer's movement so that it created a wind effect. At a very low amplitude this new locator augmented the movement and showed a close relation between the dancer and the audio environment. This version of the locator engine can be seen in the film *SynSite Locator Sound Demonstration* [SS5].

Movement Affordances: Eyes++ From Above

Figure 3.8 Motion tracking the dancer from above.

The next significant development that we made was with regard to the affordances for movement that the system generated. All our experiments up to this time had used a camera facing stage front. This meant that the dancer's movements toward stage front or back were not tracked. Instead the camera tracked movements along the horizontal (stage left/right) and vertical (jumping, crouching, etc.) axis. It occurred to us at this time that if we suspended the camera above centre stage facing downward then we

could achieve a number of things. First of all, it would allow us to create an installation style environment where the audience could view the piece from anywhere around the perimeter of the performance space. This resonated with our conceptualisation of the system as a self-contained environment that the audience would observe from the outside. It also concealed the tracking equipment in the rafters so that the audience would have to decipher the relations based upon what they saw and not what equipment they could see. Second, the tracking system could now monitor the dancer's trajectories across the whole of the performance space (Figure 3.7). This increased the sensitivity of the system by reducing the amount of movement that could not be detected. Third, this configuration would allow us to use a quadrophonic speaker setup so that the audience and performance space could be fully engulfed by the sound. Also the quadrophonic speaker arrangement would lend itself particularly well to the three dimensional movement of the MSD physical modeling system so that sound could now pan and traverse the space with the same freedom as the dancer.

Gesture vs Dynamics: Motion Tracking the Dancer's Experience

By placing the digital video camera above the stage we had gained tracking data for the dancer's trajectories across the space yet, in doing so, we had sacrificed the tracking of height so that jumps, stretches, crouches, and moments when Mona executed floor-work were no longer reflected in the tracking data. However, following further experiments with the tracking data we discovered that by monitoring fluctuations in the blob's total area the system could identify with much greater accuracy small gestures and micro-movements. Whilst the system was incapable of creating detailed models of exact limb positions it could now indicate activity no matter how small the movement, in this way the movement of individual fingers, hands and feet, turns of the head, even breath would indicate activity and be tracked by the system.

This development revealed a new approach for tracking motion. Rather than attempting to capture the detail of individual gestures we would monitor the overall *dynamics* of movement with great precision. This approach not only overcame the limitations of the Isadora blob tracking system but allowed us to address another of our observations: Mona's *experience* of moving was consistently different to the system's *observations* of her movement. For example, Mona's experience of being still was different to the absolute stillness detected by the system; following a period of intense movement, Mona would pause, the system would indicate that she had reached stillness yet Mona

would report that she *felt* still only after a few seconds. Therefore, the absolute stillness reported by the system did not correlate to the relative experience of stillness reported by Mona's. This unforeseen sense of movement as an internal force or momentum may be attributed to what Erin Manning has called, preacceleration:

> Preacceleration refers to the virtual force of movement's taking form. It is the feeling of movement's in-gathering, a welling that propels the directionality of how movement moves. In dance, this is felt as the virtual momentum of a movement's taking form before we actually move. Important: the pulsion toward directionality activates the force of movement in its incipiency. It does not necessarily foretell where a movement will go.[139]

Mona's sense of stillness would vary depending on conditions such as how tired she was or what time of day she was improvising. I therefore created a calibration mechanism that generated a buzzing sound whenever it detected stillness. This mechanism had a variable threshold so that its tolerance of small movements could be increased or decreased. The calibration process would therefore be a trial and error process in which Mona would improvise and a buzzer would sound each time the system sensed that she was still. Often Mona would feel that she was still after the buzzer sounded so I would increase the threshold of the system's stillness indicator. In this way we could home in on Mona's relative sense of stillness, eventually arriving at an appropriate threshold suitable for the subsequent performance.

At this stage of development the system still only reported a binary level of activity (stillness/motion) and the position of Mona in space. The next task was to manipulate the data in such a way that it reported the dynamics of movement. That is to say that we wanted the data to reflect the general dynamic curve of the improvised performance. Just as the sensation of stillness is highly subjective so too are the overall dynamics of improvised movement. For example, if the dancer engages in a period of rapid movement then even a slight decrease in tempo *feels* like a dramatic slowing even though she may still be moving rapidly in absolute terms. I needed to build a mechanism that sensed the overall dynamic of each improvisation and reported the details of activity relative to this global dynamic. The solution to this problem was to

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[139] Erin Manning, *Relationscapes* (London: The MIT Press, 2009), 6.

give the system a pulse, a mechanism that allowed the dancer to energise or de-energise its overall dynamics. In short, I created a heart for the system and this marked the third and final phase of development.

3.3.3 *Phase 3: The Heart*

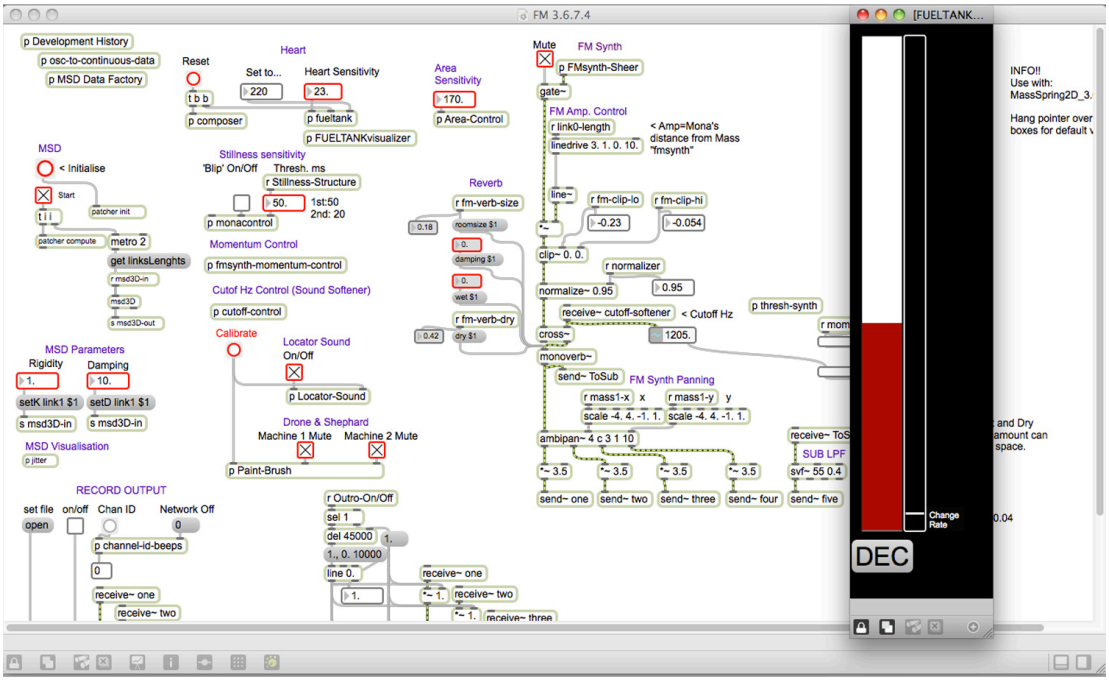

Figure 3.9 Screenshot of the Max/MSP patch created for *SynSite*. The bar on the right hand side shows the state of the system's 'heart'.

The heart had global control over numerous system parameters including the physical modelling system (e.g. the elasticity of the springs, the weight of the mass, and the dampening effect on the springs), the FM synthesis engine (rate of preset scroll, rate of rhythmic mechanisms internal to specific presets and the duration of sonic events), and control over the parameters of a high pass filter and reverberation unit that the signal from the FM synthesis engine was passed through.

By employing the mathematic formula for standard deviation I was able not only to record the average speed of the fluctuations in Mona's movement but also to indicate the degree of variation between fast and slow transitions. This stream of data accumulated in real time so that the heart acted like a fuel tank, filling with activity and emptying with relative inactivity (Figure 3.8). The overall pulse of the system was determined by how full the heart was at any given moment. This created an accurate

correlation between Mona's experience of movement, particularly in terms of periods of intensity, and the system's heart rate.

A particularly powerful property of the heart was its resistance: Mona had to sustain or increase her dynamics in order to sustain or increase the heart rate. Therefore, whilst she could control the heart rate she had to work hard to maintain this control. This resistant function of the heart can be seen in the film *SynSite Heart Demonstration* [SS6].For example, at the start of the performance the heart rate was 0, the system was not yet energised. Therefore the physical model responded stiffly to movement data, mirroring Mona's movement step for step. In this state the FM synthesiser produced abrupt textures that existed for the duration of a movement phrase only and was not affected by the high pass filter. However, as the dancer increased and sustained her dynamics the heart rate began to increase. As it did so the physical model would behave more erratically, the FM synthesiser produced increasingly dense textural bursts that would exceed the duration of the movement phrases and this was filtered as it faded away so that a slippery texture shifted around the space and the dancer.

The effect was such that once the heart became energised the system developed an obstinate behaviour. This behaviour manifested erratic sonic and spatial events that were only partially under the control of the performer. Here was a form of resistance different to that created by the physical motion of the audiotape in the Reel Experiments system yet equally as provocative. The dancer had to continually re-negotiate her role within the system, exploring the changing relationships between her movement, the sound, and spatialisation as the performance evolved. The precariousness of this changing relationship generated conflict between the dancer's intention and the outcome of her behaviour. Much like Forsythe's *Improvisation Technologies*, this created a virtual space in which the dancer was continually thrown off balance, habitual behaviour once again entered an antistructural margin in which to be reconfigured and interrogated. The dancer could momentarily regulate the heart rate by sustaining her present movement dynamic (within an allowable range) so that she could carve out a space in which to explore newly discovered movement or relationships between her and the system. This allowed her to manipulate the degree of expressive latitude in real-time although this was always susceptible to subversion if she failed to attend to the heart rate for too long.

The heart mechanism also presented the possibility to have the environment change state so that once the heart rate increased beyond specific thresholds the whole system would reconfigure its parameters to begin a different movement. This created the possibility for *procedural composition*, a way of progressing through a compositional structure not in terms of duration but instead by acting in the space. This development enabled us to author two separate movements in the performance (although any number of movements could be controlled in this way). Each movement was defined in terms of a set of parameters controlling the various elements of the system (the physical modeling system, the FM synthesis engine, and the locator sound). In the final version of *SynSite* the system transitioned from the first to the second movement once Mona had increased the heart rate to 51% of its capacity.

This development marked the final configuration of *SynSite*. The camera placed over the stage tracked Mona's movement as she traversed the performance space. The system accurately tracked her activity and distinguished between motion and stillness. The locator augmented Mona's motion with quick sharp movements generating prominent *swooshes*, whilst short gentle movements created just a hint of a breeze. The FM synthesiser sonified the environment and this was tethered to Mona's body by way of a virtual spring that spatialised the sound around the quadrophonic speaker setup. All of the parameters that controlled these mechanisms were determined according to the heart rate. This heart rate created an environment with an obstinate behaviour, resisting the performer so that she may once again interrogate entrenched embodied behaviour. This version of SynSite can be seen in the film *SynSite Final Configuration* [SS7].

3.4 Closing Remarks

3.4.1 *Practice As Metaphor, Theory In Practice*

It is possible to consider each of the projects that I have presented here as a metaphor of autopoiesis. For example, in each of the projects – Reel Experiments, *Terrain* and *SynSite* – we see the simulation of an operationally closed system. In both Reel Experiments and *Terrain* the system boundaries are defined with a physical line of audiotape, a membrane that demonstrates structural plasticity yet encloses the performers who worked together to sustain its essential organisation. In *SynSite* there is no such material membrane, instead a theatrically lit space within a larger black box

environment defines the system boundary. The audience surrounding the space quickly learns that this is a *sensing* area within which the dancer negotiates her role whilst sustaining the equilibrium of the system's constitutive parts. In each case the audience looks in as an outsider, observing the complexity of a self-sustaining operationally closed dynamic system. The individual components of these systems appear to operate together, finding meaningful ways to sustain the organisation, collaborating to create a shifting unity and, in doing so, animating the system so that it evolves in form, dynamics, and soundscape.

A metaphorical reading such as this is somewhat superficial. However, it is useful for indicating the manner in which the theoretical discourse emerged from the practical investigation. This investigation began with a period of experimentation that focused on the creation of unique performance ecologies - configurations of instruments - and yet quickly progressed to the creation of closed systems that performers could inhabit. In practice I can attribute this paradigm shift to the resonances between the closed systems and my experiences of site-sufficiency, but it also demanded that I consider the dynamics of such systems. In doing so, this shift in my practice revealed a theoretical discourse that comprehensively articulated the mechanisms that I was observing and experiencing first hand as my practical research developed: limen and antistructure, embodiment, individual agency, enactive cognition, orienting behaviour, proprioception and cross-modality. Further, the evidence supporting this theoretical discourse is comprehensive and compelling. And here, I propose, is the essential point: these mechanisms *are* at play in these performances.

The performers – autopoietic living systems - enacted meaning in their environment according to their individual capabilities and needs. Even a brief look at the video documentation will reveal performers finding a place in ever changing environments, discovering meaningful ways to interact and re-act. No instructions to act are spoken, no gestures are made to indicate where one should go or what one should do, rather, these individuals find their own way and orientate one another using the weight and momentum of their bodies, the material boundaries of the environment and the sonic events that they produce. Provisional vocabularies emerge in which cross-modal associations are made and behaviours are discovered through interaction and collision. We can see performers empowered and disempowered, tied up in tape by others or by their own misjudged manoeuvres. In *SynSite* we see Mona become lost amidst a

swirling squall of noise. Hierarchies come and go, roles shift from person to person; the environment is momentarily mastered only to overwhelm the individual once again. These performances are rich with happening-affordances and contingent events. The projects presented here are not metaphors or high-concept works of art; they *are* empowerment networks within which embodied agents act together.

On its own the evidence that underpins the theoretical discourse is not sufficient to allow me to make such claims. Indeed, ultimately it is the integrity and sincerity with which the performers commit to the act that enables collaborative extradisciplinary exchange. To clarify this I find it useful to align the practice of extradisciplinarity – a goal-oriented activity - with the formulation of game playing posited by Bernard Suits in *The Grasshopper*:

> To play a game is to attempt to achieve a specific state of affairs… using only means permitted by rules… where the rules prohibit use of more efficient in favour of less efficient means… and where the rules are accepted just because they make possible such activity… I also offer the following simpler and, so to speak, more portable version of the above: playing a game is the voluntary attempt to overcome unnecessary obstacles.[140]

Suits summarises the essential attitude necessary to realise such goal-oriented games and, in doing so, also reveals the attitudes that may invalidate such activities:

> [I]t may be said that triflers recognize rules but not goals, cheats recognize goals but not rules, players recognize both rules and goals, and spoilsports recognize neither rules nor goals[.][141]

In extradisciplinary performance it is essential that each participant recognise both the rules and goals of the game. In doing so, they recognise their responsibility not only to seek out meaningful interactions in the environment but to also share this provisional knowledge with others. It is their responsibility to be players, adopting a *lusory attitude,* 'The acceptance of constitutive rules just so the activity made possible by such

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[140] Suits, Bernard, *The Grasshopper: Games, Life and Utopia* (Toronto: University Of Toronto Press, 1978), 41.
[141] Ibid., 47.

acceptance can occur'.[142] It should be evident that I have every faith in my collaborators as players of the game.

Perhaps the greatest challenge that I now face as a practitioner moving forward is to convey the authenticity of the performance to my audience in a manner that supersedes metaphorical readings and notions of motion capture performance, sensing-systems, re-appropriated technologies, site-sufficiency and extradisciplinarity so that my work can offer the viewer a moment to consider our very way of *being*, as living embodied agents enacting meaning in the world.

There is one final notable relationship between the theoretical discourse and practical research: the interrelated notions of empowerment networks, external scaffolding, empirical action and affordances generate a lexicon with which to discuss the construction of collaborative environments, a vocabulary that has since proved to be exceptionally functional in practice. This vocabulary helps to clarify ideas exchanged between artists from disparate disciplines, whether by discussing individual affordances or reflecting upon feedback from collaborators in terms of empowerment networks. Throughout my description of the practical research above we see a constant negotiation of affordances in the manipulation of objects, software, and rules that proceed from discussions between collaborators. This is a theoretical discourse with a functional role to play in practice. The precision and efficiency afforded by this theoretical discourse improves the exchange of knowledge between collaborators in the process of creation.

3.4.2 *Electronic Music and Extradisciplinary Performance*

At this stage it is appropriate that I should address the question from which this research project departed; What knowledge can I draw from the vernacular of contemporary electronic music, and how can I apply this knowledge within the context of cross-disciplinary performance practice? What new creative possibilities arise out of this activity?

It should be evident from the research that I have presented here that this project was never intended as a musicological study of electronic music. Such projects are numerous and the history and evolution of electronic music is well documented and

[142] Ibid., 40.

comprehensive. Therefore, in the earliest stages of this research project I chose instead to engage in an intensive period of practice, exploring all the avenues in which *I* perform electronic music. This period included facilitating interdisciplinary improvisation workshops (at Northumbria University), improvised electronic music performances in various duets and trios with my colleagues at the university, interactive installations and network performances with theybreakinpieces, a devised interdisciplinary performance for the theatre with The FATHoM Project, performances of electronic dance music at club nights, and participation in numerous workshops. One could easily be overwhelmed by the milieu of techniques, technologies, venues, scores, musicians, and contexts that constitute such a practice. However, the invariant amongst all of these variables is the ingenuity and resourcefulness of the practitioners. The vernacular of electronic music of which I am a participant is one driven forth by the invention and re-appropriation of technologies old and new. This is a technologically mediated vernacular in which the tools of the trade evolve rapidly from one performance to the next (indeed, in a collaboration with Will Schrimshaw our preferred method of working was to create instruments on-the-fly during rehearsals, developing them throughout day-long sessions in which it was never quite clear whether we were performing together or modifying our instruments; this proved to be an *extremely* productive and creative mode of collaborative practice). Subsequently it was clear from the outset that I could have pursued numerous trajectories in order to address my research question. Therefore I simplified the task by choosing a single object for investigation – a reel-to-reel tape deck – an instrument ubiquitous throughout my performance practice. If this path had not proven to be fruitful I would have abandoned it but, of course, that was not the case.

As a theoretical discourse emerged and illuminated the mechanisms at play in site-sufficiency, the practical research gained momentum through the possibilities afforded by the technologies to be pressed into the service of empowerment networks suitable for extradisciplinary performance. The most notable possibility afforded by the technology was to instantiate resistant environments, sites in which the artist must negotiate a balance between performing and maintaining the system whilst being subjected to forces that disrupt and intervene in their actions. This alone is not particularly unique; indeed we see such resistant phenomena in prepared instruments, site-sufficiency, and all manner of performance strategies (scores, one-off collaborations, Boal's *Theatre Of*

The Oppressed, Parkour, to name but a few). However, once these principles are applied in the digital domain they reveal a myriad of creative possibilities.

SynSite deployed resistance, not through physical means, but instead through the obstinate behaviour of the interactive environment. The morphology and spatialisation of sonic events, remapping of behaviour onto dynamic physical models, and procedural composition all manifest a complex milieu of real and imagined resistance. I have only begun to scratch the surface of the infinite different ways in which these techniques may be executed. *SynSite*, for example, used procedural composition to transition between two movements (two different system states) however, this technique could be used to create a *network* of movements that dynamically evolves throughout, generating a performance that may pursue infinite possible trajectories in response to the artist's action. Likewise, the input and output of the system may accommodate numerous disciplines, for example, musicians could provide input to affect video, lighting, film, web-based applications, and even physical machines. I feel that the principles and techniques that I have developed and deployed in this practical research project not only instantiate an infinitely variable site-sufficient environment but also constitutes a portable tool-kit that has an extensive range of applications elsewhere. It is my intention to investigate these possibilities over the coming years.

Conclusion

The point of departure for this research project was the need to reconcile a disparity between electronic music and site-sufficient extradisciplinary performance practice. The project proceeded from this point of departure in two parallel trajectories. On the one hand I engaged in a period of playful experimentation during which time I refined technical skills, developed instruments and explored numerous performance ecologies. These were deployed in a variety of performance contexts including gigs, collaborations, workshops and installations and yet, whilst I had felt that this was suitable preparation for what was to come, the true purpose of this experimentation with respect to my research project remained elusive. On the other hand I began to unpack the mechanisms at play in site-sufficient extradisciplinary performance. This consisted in tentative excursions into pedagogical theory, psychoanalysis, sociology, anthropology, cognitive science and historic accounts of improvisation, postmodern performance, electronic music, and digital media in the arts. As this trajectory developed a theoretical discourse emerged that began to resonate strongly with my past experience of site-sufficient extradisciplinary performance and observations I was making in the practical research.

In Bourdieu's notion of habitus I had found, for the first time, an articulation of that which is the subject of extradisciplinary performance, those entrenched dispositions inculcated in the individual that constrain action to habitual behaviour. Elder-Vass augmented Bourdieu's theory by revealing the socio-cultural mechanisms – norm circles – that produce such normative behavioural practices. Subsequently Turner's anthropological study of liminality revealed the mechanisms that arise in everyday life that have the capacity to interrogate these normative practices. These liminoid sites demonstrate antistructural phenomena, spaces in which behaviour has no direct affect on the real world and yet may generate knowledge to be carried forth into quotidian life. Whilst performance strategies such as site-sufficiency, prepared instruments, and improvisation clearly demonstrate liminoid aesthetics, this association alone was not adequate to account for the manner in which embodied behaviour such as playing an instrument or dancing is interrogated through such strategies. To gain a more comprehensive understanding required a closer examination of individual agency, an investigation that would reveal the fundamental embodied nature of our being in the world.

Maturana and Varela's theory of autopoiesis revealed biological agency as the essential characteristic of living systems and, further, showed the manner in which consciousness arises from this fundamental level of cognition. Further, Varela and his colleagues showed that, as an operationally closed yet interactionally open system, the individual enacts meaning in the environment. Cole and Gallagher's study of proprioception revealed the manner in which the body recedes into the background yet Lakoff and Johnson show that this absent body permeates experience by projecting the known onto the unknown through cross-modal and metaphorical mapping. Subsequently, this discourse brought to the foreground the essential role of the body in cognition. This was further understood by introducing the interrelated concepts of external scaffolding and epistemic action, showing the way in which we manipulate the environment to simplify complex cognitive tasks. This also revealed the ways in which the environment, both socio-cultural and physical, can be manipulated to empower and disempower the individual as an agent. Finally, the notion of empowerment networks and Gibson's theory of affordances provided a vocabulary with which to articulate the opportunities for action available to the individual according to their capabilities and needs relative to the environment.

The assembly of this theoretical discourse was inextricably bound to the development of my practical research. This practice progressed from experiments with performance ecologies to the creation of closed self-organising systems, synthesised environments, and finally empowerment networks. Each of these perceptual shifts propelled the theoretical discourse forth which, in turn, informed the subsequent stage of practical development.

The practice, consisting in the vocabularies of music and motion technology, sound and movement, frequently provided a means of understanding, interrogating and reconfiguring the theoretical discourse. The performance systems presented living analogies of the discourse, animating the theory and enabling the first-hand observation and experience of ideas. As my understanding of embodiment, enaction and affordances deepened I became increasingly interested in technologically mediated environments and their affect on the behavior of individuals and less concerned with the production and preparation of artworks for public performance. As such, the function of public performance during this project changed as the research progressed.

During *Reel Experiments* I felt no need to share my work in public and was instead concerned with exploring the creative possibilities of multiple performance ecologies. The discovery of an ecology that shared many qualities with site-specific performance led to *Terrain*, the first public output of my research. By presenting *Terrain* to the public we (Chemaine, Wendy, Mona and I) sought to overcome our mastery of the *Reel Experiments* system by setting it amidst an audience and, in doing so, revealed new affordances and creative possibilities (a strategy shared with *theybreakinpieces* who had moved from one location to the next so that encounters with contingent events could be optimised). The presence of an audience potentialised unforeseen events such as, for example, the audiotape snapping during contact with a heavy handed individual, or the incidental sampling of sounds that originate from the audience and then become amplified and reproduced throughout a performance. These public presentations took place during scratch nights (events in which works-in-progress and experimental works are shown to an audience), platforms (sharing the bill with numerous other works that are often representative of a broad spectrum of disciplinary vocabularies), and sharings. Such events imply that the work on show is in development – in a state of flux - and so feedback, critical response and suggestions are encouraged and to be directed to the author (who is usually present). Performances at these nights are often followed by a discussion during which the audience can offer their thoughts. Very little context was offered to audiences prior to performances of *Terrain*. I did not inform the audience that it was a research output or part of a research project. Written credits for the piece stated each performer's name alongside a vague description of their role within the piece. This allowed us to discover what the audience observed when considering *Terrain* and the *Reel Experiments* system as an independent artwork. As such, feedback from these performances provided an opportunity to hear what others had seen in our work when the technicalities and theory was not known. Feedback from these events contributed to understanding, for example, the degree to which the relations and interactions between performers and the technology were observed and understood.

During the later stages of practical research – *SynSite* – insights of this nature were secondary to my investigation of empowerment networks and the affects on participant's actions and behaviour. To gain feedback and further insight from audiences with regard to these primary concerns Mona and I offered workshops to provide a much greater understanding of the work, its development and theoretical

foundations. During a workshop we would, for example, demonstrate the principles of affordances through discussion and then allow participants to interact with the *Reel Experiments* system. In these workshops we were able to observe the way in which individuals with a limited knowledge of the system may learn and interact with the technologies. Audience members, having now interacted with the system, could discuss their experiences and suggest further reading (whether of texts or performances) that may contribute to the project's trajectory. Feedback from these sessions also revealed the way in which the systems affected participants' actions and behavior. In addition, these workshops were an opportunity for participants to collide my research with their own practice and discover the ways in which the theories, technologies and systems may inform their own work.

It is possible that one may view the performances of *Terrain* and *Synsite* as metaphors of the theoretical discourse, however, whilst being a perfectly valid reading, it is important to recognise that this would be reductive. These performances are liminoid sites in which antistructural phenomena may be attributed to the resistant capacity of the performance systems. These are sites in which the performer utilises external scaffolding – the audiotape in motion, the bodies of other performers, sonic events and their spatialisation – not to simplify complex cognitive tasks but, instead, to encounter and negotiate contingent events. As such, these sites empower the individual as an extradisciplinary performer so that they might interrogate entrenched, embodied behaviours and exchange this knowledge with collaborators in the act of performance.

This body of work is a comprehensive record of an extradisciplinary exercise that has had significant implications for my practice. I have drawn from numerous disciplines to assemble a theoretical discourse that both enriches and validates the notion of extradisciplinarity. This theoretical discourse is now interwoven in my practice and provides a vocabulary with which to articulate, discuss and reflect upon the systems and performances that I create. Furthermore, this practical research project has allowed me to develop extensive technical skills and techniques with respect to motion capture, interactivity, procedural audio and procedural composition so that I may now develop ever more complex, efficient, and effective performance systems to empower individuals as extradisciplinary performers.

Whilst it is clear that this project has had significant impact on my own practice, it is my hope that the theoretical discourse and, indeed, my approach to interactive environments will be of use to artists working in similar fields. Just as the theory of affordances has been widely adopted in the design community, I believe that its presentation here alongside the interrelated ideas of external scaffolding, epistemic action and empowerment networks will prove to be insightful and useful in practice to anyone concerned with the creation of collaborative interdisciplinary environments. I have presented a comprehensive account of the theories of embodied cognition that underpin these ideas as evidence of their validity.

This project has revealed one possible way in which I might reconcile electronic music and site-sufficient extradisciplinary performance. However, in doing so it has revealed much broader and more significant questions regarding, for example, the nature of free will, resistance, and pedagogy. Whilst I am satisfied with the outcome of this project I am both overwhelmed and invigorated by these questions that will undoubtedly further my practical research over the coming years.

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