

# Playing and Hearing Sonic Environments

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## Abstract

As an artist, I have created a number of interactive sonic environments that seek to provide a truly unique outcome for each person.

The audible domain provides an intuitive, experiential, visceral, instinctive, spontaneous and intimate perceptual habitat where the human body is central, where the visceral engagement with sonic architectures dismisses the western mind-body split as hopelessly inadequate. Do we really only listen with the mind and not the body?

The interactive sound environment presents a unique articulation of space and place, one in which the fluidity of the human body can be empowered to find new ways of engaging with environment. This unique and many faceted approach appoints space itself as a performative medium, instructing the user in new ways of listening, whilst simultaneously casting the listener as performative agent.

The interactive sound environment establishes a causal loop in which the individual comes to consider the way in which the environment conditions their behavior, and conversely their behavior conditions the environment. Questions of preferential behavior and preferential environments come into play in a manner that is simply not available within an installation environment that uses pre-recorded and/or triggered content.

This essay discusses a number of works developed by the author, using them to illustrate strategies that provide direct visceral and almost tactile engagement with what is otherwise a very abstract sonic and architectural space.

## Space, Place and Presence

*As I walk into the gallery, I hear a soft trickling, ambient sound, as if the room from which it comes is singing, resonating to an unseen excitation, calling out its place in the world, proud, assured, yet wholesome, not extravert, not trumpeting the technological wizardry it contains – inviting, like a siren on a rock, but here disguised, enclosed, almost intimate.*

*I walk towards the source and stand at the threshold of the room, absorbing the rich and multifarious tones, aware as I come closer, of their complexity, and an almost life like sense of movement, of interaction (Paine, 2002b) and articulation inherent in the resonating layers.*

*As I step over the threshold, through the open door into the room, the resonant singing dissipates as if the attention of the room has been interrupted. As it turns its attention to me, I am greeted by a multitude of small, intimate trickling bubble like sounds, moving from the far corner around the room to greet me, to investigate my appearance and in that instance to make me aware of my presence, my immediate and total presence within the system. No longer an observer, but an integral part of the whole, I move another step, and sense a whoosh of small watery sounds moving away from me*

*as if in flight, dancing to-and-fro, at once intimate and curious, wrapping around me and then dashing away as if to get a bigger-picture view – acting as an observer as the dynamic of my movement increases rather than immersing me. I am aware of the space as alive, dynamically filling itself with sonic invitations to engage with it in a dance, enquiring as to my intentions, which I seek to make clearer through my gestures and behavioral responses, exploring the terrain, I find myself embraced in a kind of sonic womb.*

*I am aware that my gestures cause the space to react, changing the timbre of its expression in relation to the weight and size of my movement. I sense a kind of visceral, almost tactile engagement, an intimate wrapping of my every interaction in a fluid and all encompassing veil. The evolving dialogue feels free, unrestricted – allowing me to create flowing and varied temporal structures, densities and weights of sound that mould their presence into a landscape that feels uniquely mine, an articulation of place and environment that matches the energy I impart, as if the very energy of the interchange is creating the future.*

*As this relationship deepens, I realize there are many simultaneous layers of communication that wax and wane with the weight of my motion. Fascinated I start to explore, evolving a cognitive map of my engagement with the environment. The gentle, intimate trickling bubble like sounds grow into a much deeper rich texture, a low frequency bass drone, whose surface is fluid and viscous, adapting to my movements, my position in the environment, my recent actions, our dialogue. As I exert myself more, I hear a higher frequency texture, song like, as if the environment is celebrating our dance, and then above that comes a rich tumbling, bubbling voice, spinning away from me, towards me and over my head, playfully taunting me. Then comes a breath, a female breath, light, floating above me, a vocalization, marking the place as human, as of me, as an integration of our dialogue. When I run and jump, rejoicing in this interaction, a baby like giggle bursts forth, like the combination of the bubbly sounds with the vocalization, it marks a celebration, a freedom of expression, a human articulation of space, time and relationship, an expression of a unique place.*

*This experience reflects my interactive environment installation Gestation, which also contains a separate animated gallery space, where animated fetuses grow. The foetus', are created by the activities in the interactive sound environment. Their rate of growth, life length and position in the environment are determined by the activity that creates them, they are a reminder of our engagement with the sonic space, a vision of evolving life made possible through ultrasound.*

The above passage is a description of the experience one might have in one of my interactive, response immersive environments. We come to know space through body and movement, an examination in time - it takes time to move through space, to understand the relationships of and within space that inform us about place. Sound is also fundamentally a temporal medium – requiring enquiry and patience to unravel the complex data contained therein. Psychoacoustics allows us to disentangle reverberation, discovering information about the size of the sonic environment. When reverberation is considered along with timbre and attack, the human mind can envision the source of the excitation and determine qualities pertaining to the surfaces and furnishings of the space (marble floors and heavy drapes...), the distance from the source, the force of the excitation gesture and often, aspects of intent, the accuracy and consistency of the bell strike for instance, the energy of purpose or hesitancy.

This is all well and good, but a space is an abstract conception, and the information we divine about the source is about the “other”, the external, detached object of the mind's eye. Within the context of this book, our direct relationship with that space is what is important – how do we engage, experience and digest those qualities our psychoacoustic skills yield? How does this corporeal perceptual awareness condition

the manner in which we inhabit the space and engage with others therein? How does it determine the activities we engage in in that space (recording in a recording studio where the reverberation is kept to a minimum, singing in a cathedral where the reverberation time is long and the resulting vocal sound is thick, dense and surreal, hanging like the very spirit it proclaims in the air above our heads)? We all understand that there is a relationship between the built environment and the activities it fosters, whether it is because we have experienced a pleasing symbiosis in this relationship, or been distressed by an acoustic environment that seems to repel us from communal activity, be it as a result of noise pollution, long reverberation smearing speech intelligibility, or absorbent surfaces that encourage quiet, meditative states. The acoustic must support the activity, and combine to foster the corporeal perceptual awareness that signifies an appropriate environment, and from this combination of environment and activity we develop a sense of place.

Western society can be characterized as constructing spaces that condition our behaviour, however, we can equally argue that the behavior conditioned the environment, or that the environment is a result of design considerations regarding the accommodated activity.

This dilemma regarding the relationship between behavior and environment is the foundation of my art practice. The hustle and bustle of the modern city does not encourage such considerations. As skyscrapers, like goliath sundials, cast shadows in the streets, the wind is directing into amplified tunnels signifying the behemoths breath. Within all of this, the human space, the street, is noisy and dusty, leaving many feeling disempowered by the pressures of economy, financial and population density, decisions of the architect, the city planner, and the self-esteem of the corporation, bigger, shinier, exclusive, alienating. As relief we consign areas of heavily manicured gardens to parks, conduits for memories of the source of life, the democracy of nature. Little wonder then that we have so little real affinity with nature, that we so rarely consider the relationship between behavior and environment at the human scale, our place in the system, our personal responsibility, our individual power for change.

### **The Sonic Gestalt**

Sound is a unique media, for it is not an external artifact, literally penetrating the body. Further more, it is almost impossible to concretely tie it to a representation of anything beyond a communication of emotional states, of experience. This is a great benefit to the sound artist/composer who by virtue of this fact is not tied to real-world representation in order to be judged successful.

The composer writes music from the point of 'knowing' the phenomenological point of experience - the pre-analytical point of relationship where the experience, as yet undefined, un-categorised, un-labeled, un-rationalised is profound. At this point the experience has no bounds, it envelops time and space, the nub of relationship.

All explorations examine a relationship, or a series of relationships, and in turn their inter-relationships. My Motus Operandi is to illuminate the interaction that is inherent in the relationship established through human observation - the human as observer, prior to the process of cognition is conduit for experience - this corporeal perceptual awareness is the material of all my art.

When music is composed from this perspective, the composers' point of reference is the emotional body, which in its original state is unbounded. The composer therefore has at his disposal an infinite space - a space in which sound implies, revives experience.

This ability to work in an unbounded space is unique to those working with sound. An animator for instance is restricted to screen real estate, and the development of a pre-conceived image - the screen is used both as a presentation platform, and during the production phase as a source of feedback as to how successfully the animator has fashioned their creation to their original intention. They will tweak and refine until the end product is sufficiently close to the original concept, always working with a concrete image, intention and expectation.

The composer cannot approach their work from that perspective. Only the final, recorded work is concrete. The composer must begin from the point of phenomenology, experience, and work to express that encounter. They work towards a communication of something fundamentally abstract. In so doing, they use an abstract language, and create abstract forms. The composition is fundamentally abstract, whether it is pre-structured and recorded, or as in the interactive environment, created in realtime.

### **The Immersive Environment**

Dualist theories subscribe to the well-established Cartesian mind/body split. Such conceptual positions desire to leave the body behind. Hans Moravec argued that the age of the protein-based life form is coming to an end, superceded by silicon-based life forms (Moravec, 1988). N. Katherine Hayles comments; *At the end of the twentieth century, it is evidently still necessary to insist on the obvious: we are embodied creatures (Hayles, 1996)*. She also comments that *Traditionally the dream of transcending the body to achieve immortality has been expressed through certain kinds of spiritualities. Dust to dust, but the soul ascends to heaven. Moravec's vision represents a remapping of that dream onto cyberspace...*

By contrast to the Dualist theories, Identist theories discover the physical system we are is conscious. In line with cybernetic theory (Wiener, 1948) the Identists' see the whole as greater than the parts. Diana Gromala argues that consciousness and memory are distributed through the entire viscera. She is interested in *the conditions that enable the visceral register to remain in a liminal state, between autonomic processes and conscious awareness, imminent reflection coupled with persistent, quivering flesh.* (Gromala, 2003)

*She asks; is it possible for the visceral perception to be sustained as a persistent recurrence, an infectious field, an open wound, a compulsive disposition that exists before, beyond or beside habit?*

*This examination of visceral perception and habit may lead, I argue, to a deeper understanding of the transmutating fields of a corporeal perception we need for our evolving cultural condition. (Ibid)*

Gromala's comments bring forth an extension of Humanistic Psychology, expressing the state of mind, memory and experience as distributed through the entire viscera, not housed in the head, and certainly not separable from the body. This is an admirable extension of humanism.

When designing interactive, responsive environments, one must consider gestural interaction, that is, the manner in which the body engages with the work, the relationships different classes of gesture have to the realtime sonification and animation of the space. In so doing, wanting to maximise corporeal perceptual awareness, it is useful to turn to a dancer for guidance, an artist whose *raison d'être* is the embodiment of experience. Thecla Schiphorst, (One of the original developers of the *Life forms* choreographic software in collaboration with Merce Cunningham) has written widely about the body as interface in immersive environments. In describing the human body's role as interactive agent, Schiphorst says:

*I am interested in thinking what is body in relation to the construction of systems. I can describe the body as being fluid, re-configurable, having multiple intelligences, as being networked, distributed and emerging. ... From my personal history and my own live performance experience I developed the notion of body knowledge and what I call 'first person methodology' and use this as a basis for interface design (Schiphorst, 2001)*

Schiphorst paints a picture of the human body being deeply engaged with the act of interaction on many levels, being intuitive, visceral, corporeal and intelligent while exhibiting parallel processing features.

Indeed, I posit that when walking into an interactive, responsive environment, the first moment of interaction is a profoundly intuitive, corporeal one (Paine, 2004). The moment that you note that the environment changed on your entrance, there is a relationship, an invitation to explore, and an acknowledgement that you are immediately a part of an intimate causal loop. The patterns of relationship in an interactive, responsive environment are made explicit and coherent through many iterations of the closed causal loop. Each one rendering with greater detail the nature of the relationship. The user/inhabitant of the interactive, responsive environment installation develops a cognitive map of the responses of the installation, testing their map through repeated exploration, confirming prior experience, and actively engaging in the evolution of the ecosystem of which they have become part.

In 1998, the virtual reality and interactive installation artists Christa Sommerer and Laurent Mignonneau expressed similar thoughts when discussing the development of the interactive digital arts:

*... the art work ... is no longer a static object or a pre-defined multiple choice interaction but has become a process-like living system. (Sommerer & Mignonneau, 1998)*

Sommerer and Mignonneau (1998) also comment that:

*From the insight that interaction itself and the interrelation between entities are the driving forces behind the structures of life, ... artists investigate interaction and the creative process itself. Creation is no longer understood as expression of the artists' inner creativity or "ingenium" (according to Hegel) but becomes itself an intrinsically dynamic process that represents the interaction between the human observer, his/her consciousness and the evolutionary dynamic and complex image process of the work ("Art as a Living System"). (Ibid)*

Sommerer and Mignonneau assume, similar to Gregory Bateson (Bateson, 1973), that the patterns of mind (consciousness) and the patterns of matter are reflections of one another and part of an unbroken dynamic whole, suggesting that the body, the space, and the resulting sense of place are inseparable.

One of the pioneers of interactive arts, the American video, and responsive environment artist Myron Krueger expresses a similar sentiment when discussing his early interactive video works:

*In the environment, the participant is confronted with a completely new kind of experience. He is stripped of his informed expectations and forced to deal with the moment in its own terms. He is actively involved, discovering that his limbs have been given new meaning and that he can express himself in new ways. He does not simply admire the work of the artist; he shares in its creation. (Krueger, 1976)*

Here, Krueger, as an artist, draws the same parallels expressed by Sommerer and Mignonneau, and myself; He indicates that the experience of engaging in a responsive environment involves an active commitment to each moment, and that each moment of engagement contributes to the creation of the art work. The participant does not have the option of assuming the role of detached spectator; they are inherently part of the process, part of the artwork, the instrument itself.

### **Gesture as Relationship**

My interactive responsive environments use human gesture, movement and deduced behaviour patterns to form the relationship with the interactive agent, the interactor. The decision to use gesture as the primary means of engagement was to ensure a dynamic and active engagement. It was a kind of express statement about work ethic – the more you put in the more you receive in return. I desired the relationships between the sonification, visualisation and the interactor to be many and complex; to define multifaceted simultaneous layers of engagement. Furthermore, although most do not like to ‘dance’ in public, we inherently understand the relationship of gesture to communication, and have embodied a profound subconscious awareness of inferred relationships and weight of gesture, intimacy, inclusiveness, delicacy being understood in small gestures, dynamism, commitment, and possible anger and exclusion being understood from large, energetic gestures. I also suggest that each person has a unique vocabulary of gesture, a ‘body language’ that if read with sufficient detail brings into being an individual sonic signature.

Professor Robert Hatten suggests that:

*Musical gesture is biologically and culturally grounded in communicative human movement. Gesture draws upon the close interaction (and intermodality) of a range of human perceptual and motor systems to synthesize the energetic shaping of motion through time into significant events with unique expressive force. (Hatten, 2005)*

Hatten begins and ends by suggesting that musical gesture is biological, and as such that the human gesture, central to musical production, is mellifluous, viscous, and fluid, that it is not made up of individual events, but rather a contiguous movement that has form, shape, structure and duration, that;

*Musical gestures are emergent gestalts that convey affective motion, emotion, and agency by fusing otherwise separate elements into continuities of shape and force. (Ibid)*

The characteristics of affective emotion and agency are central considerations when designing the sonification and visualisation strategies, for as an artist I want to express through the interactive process the intent of the gestural engagement. As discussed above, sound is an excellent medium for this communication, so the trick is analyzing the gesture in such a way as to determine qualities of intent, which we can

also describe as affective emotion and agency, for without this initial analysis, it is impossible to reflect the interactor's expression back to them, to faithfully acknowledge their presence and innate capacity within the microcosm that is the interactive responsive environment.

### **Dynamic Morphology**

Dynamic Morphology (Wishart, 1996) is a conceptual model developed by Wishart<sup>1</sup>, for acousmatic composition, but which I propose can be applied to both sound generation and gestural interfaces, suggesting a continuously evolving stream of sound events (audible or silent). This is important because the human gestural input is dynamic, and if it is to be fully acknowledged as discussed above, the sonification must be equally plastic. Many interactive sound installations use pre-recorded sonic material that is triggered by movement, however the recorded material contains its own morphology, constructed at the time of recording, and as such is not responsive to interactive input, being the same for all interactors, regardless of the sensed qualities of intent. The pre-recorded material may be collaged, pitch-shifter etc, but the morphology is immutable. This approach does not provide for individual relationships to be developed with the installation. It takes for granted the commitment each person invests in exploring the interactive installation, preferring the artists aesthetic, the sublime self-image, reflected in the quarantined, fixed and sanctioned response.

The morphology of a sound is expressed in “a three-dimensional pitch-duration-timbre space” (Wishart, 1996) indicating a simultaneous and continuous multi-dimensional deviation through the characteristics of pitch, timbre and time. It is important to note here that Wishart is referencing timbre as one of the inherent musical characteristics of a sound. With few exceptions, existing musical composition practice investigates timbre as a function of orchestration rather than a product of a single source over time. A naturally occurring sound has just such a morphology, fashioned by the many facets of its initial sounding source and the architectural and acoustic space(s) it inhabits. Rodet, Potard and Barrière (Rodet *et al.*, 1984) point out that our recognition of certain consonant sounds in speech is heavily dependant on the nature of this morphology, so it is vital to our understanding of the world, and our everyday experience of it.

Human gesture is characterised by a smooth, continuously changing relationship of the limb(s) to the body, each movement being made up of many infinitesimally small variations and adjustments. The overall movement defines a gesture, and the nature of the way in which that gesture is enacted is described as the weight of the gesture. It is not possible to extricate from a gesture the individual moments of movement and adjustment that make up the overall gesture. In this sense, human movement reflects Wishart's statement that gesture is “*the articulation of the continuum by the agent which instigates the event*” and that “*sound objects with a dynamic morphology can only be comprehended in their totality*” (ibid)

Computer sound synthesis is also characterised by continuance of variation and adjustment. Similarly a single sound is perceived as a whole, not as a collection of the myriad samples that create it in a digital playback system, but as a stream of

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<sup>1</sup> based on Pierre Schaeffer's *sound object morphology*, outlines in *Morphologie and typologie des objets sonores*. (Schaeffer & Moles, 1952)

multifarious sonic information. Whilst it is possible with a computer to extract a single sound sample it is meaningless to the human ear; the qualities of the process of change (dynamic morphology) will predominate in our perception over the nature of individual properties. (Wishart, 1996)

When considering interactive, responsive installations that use sound as their principle medium, dynamic morphology can be applied to both the sound production process and the analysis and management of the relationship(s) between the person(s) interacting, and the system response(s), the audio artefacts. For the immersive environment installation to respond dynamically, there must be dynamic variation in timbre, pitch, amplitude and associated envelopes. The spectro-morphology model (Smalley, 1986) is also a useful tool for the analysis of the input gestures. As an analytical tool, applied to human gesture rather than a sonic object, it allows the differing weights of gesture to be categorized as distinct, while the listening modes attached to spectro-morphology can be applied as a model that illustrates the embodiment of the individuals relationship of gesture to sonification.

A realtime interactive system is dependant on the resolution of qualitative characterization of the input data, and in the same way that a complex audio signal can be broken down into primary frequency partials, it is important to examine the individual movements that make up a gesture as a whole. Complex data analysis of this kind can provide a large number of control variables which make for subtle and unique synthesis responses.

If dynamic morphology is applied to the design of responsive and interactive instruments and installations, it becomes clear that the system design itself must be dynamic, and that during an interaction, an instrument must be able to change in fundamental ways to produce timbres that were impossible at its inception. In other words, it must be possible for it (in accordance with the nature of interaction) to evolve into a new instrument altogether, otherwise the sonification specified by the artist remains immutable. The entire expressive domain of the installation is bounded by its creator, even though historical relationships may express a conditioning for response patterns beyond the originally defined timbral domain.

### **Dynamic Orchestration**

In addition to the sound design approach discussed above, where the weight of gesture is reflected in the sonification, I have also developed techniques that bring about an adaptive, evolving sonic landscape. I have termed this technique Dynamic Orchestration.

For the gesture of a performer to be fully inscribed within a realtime sound output, the sound must evolve and change in such a manner as to correlate with the qualitative development of the gesture, an evolution of momentary events, which is unknown to the system at any point prior to their execution. The morphology of a particular gesture is unknown even at the beginning of the movement; the performer may change the direction or speed of the movement at any time, and may alter the position of the limb in both the vertical and horizontal planes at a rate of change that does not match any previous event. Small variations will occur even if the player is attempting to perform the gesture in an identical way to a previous movement event. It is only the highly trained dancer, with a spatial awareness developed over years of exacting training that can reproduce spatial positioning, rate of change and horizontal and



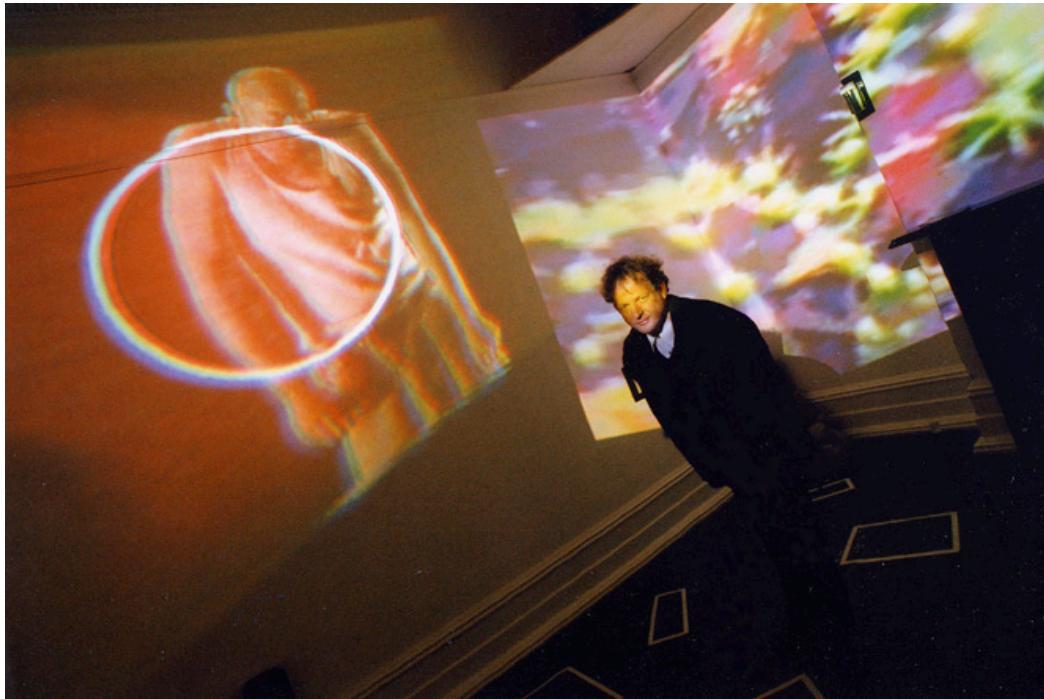
vertical gesture within sufficient bounds for us to perceive them as repeatable. To the video analysis system, even these highly trained executions alter in subtle ways.

The evolution of the timbre space as a correlate to the qualitative development of the performative gesture is what I have termed Dynamic Orchestration. Dynamic Orchestration applies the ideas of dynamic morphology beyond the scope of varying a fixed audio stream through the use of equalization or other filtering, or an otherwise variable synthesised output from a collection of algorithms, (which no matter how the algorithm is designed will have a finite range of aesthetic and timbral variation), to a dynamically forming orchestration. In such a dynamic orchestration, a new sound object (synthesis algorithm) is created when the morphological scope (by which I mean the aesthetic range of expression) of the current algorithm is reaching its limits. The new algorithm may exist only as long as it is required, and may be augmented by other dynamically created instruments, before being disposed of. Interactive input may generate something similar at a later date, but it will exhibit variation in accordance with the varied collection of the conditions of creation. Any synthesis approach that does not allow for the realtime addition of new algorithms is inherently limited.

The majority of sound synthesis programming languages assume the predominant paradigm of music composition, whereby the composer/programmer creates the resources they expect to need for the entire composition at the beginning of the work. These resources contain a set group of instruments (the orchestra), with an inherently limited aesthetic and morphological scope, a limitation, that in my view, has no place in interactive electronic music performance, because as discussed above:

1. It does not address the human context, by this I mean it has evolved to cater for existing musical practice and neither addresses the potential flexibility of computer music systems or the developing range of approaches to interfacing with interactive music system;
2. It is not driven by artistic values, it is predicated by programming limitations;
3. It is aesthetically limited;
4. It does not allow for the evolution of a musical work over an extended time frame, where the context for the work may also change, and
5. It caters to a paradigm based on a pre-determined musical work being performed by an expert performer, and as such, does not cater to the indeterminate form or resource requirements of an interactive musical installation being 'performed' by inexpert agents (the general public).

These five points form the basis of Dynamic Orchestration, informing the technical software programming specification, and providing the foundation for the sound design, and the experiential nature of my interactive, responsive environment installations.



*Figure 1 Dr Garth Paine in MQM*

## **The Works**

This exploration of corporeal perceptual awareness has evolved over a series of interactive, responsive immersive environment installations<sup>2</sup>.

1. Moments of a Quiet Mind (Linden Gallery, 1996)
2. Ghost in the Machine (Linden Gallery, 1997)
3. Map1 (Span Galleries, 1998, Next Wave Festival)
4. Map2 (Musical Instrument Museum, Berlin, 2000)
5. Gestation (RMIT Gallery, 2002)

The early works, Moments of a Quiet Mind (MQM) and Ghost in the Machine used pre-made sound files (189 different sound files, composed in rising intensity, with sound file length being reduced with intensity), floor pad triggers and light beams.

James Rowland reviewed MQM in MESH (Rowland, 1996)<sup>3</sup>;

*MQM was a bouncy-castle for the mind.*

*The virtual environment installed in Linden Gallery was composed of trigger pads concealed in the floor; light beams intersecting the room to sense movement; video projection on three walls; and speakers, which, like the projected images, responded to movement. By shifting oneself around the room it was possible to generate a variety of responses from the sound and video sources stored in a small room next door. And after setting off the triggers and breaking the light beams, the viewer could integrate the external environment directly with the pattern of choices in his/her head... an installation which gave new meaning to the term 'cerebral architecture'. Without the use of*

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<sup>2</sup> Video, sound, images and reviews of these works is available at <http://www.activatedspace.com> June 30, 2005

<sup>3</sup> Also available online at <http://www.experimenta.org/mesh/mesh10/10rol.html> June 30, 2005

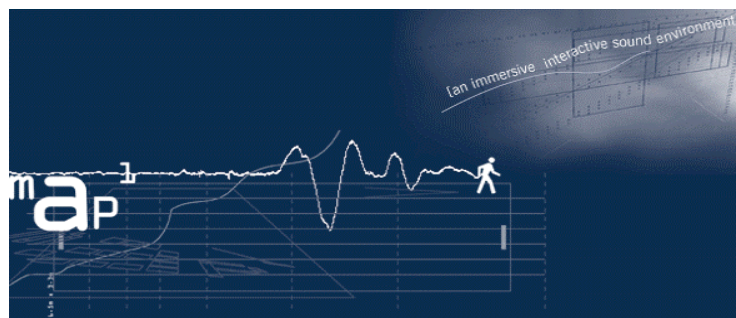
*cumbersome interface equipment, MQM gave the mind the power to build an environment using the body's movement to generate aural and visual outcomes.*

The basis of corporeal perceptual awareness is evident in this review, however the variations were essentially constructed by collaging the available sound and video files. Furthermore, it became obvious that the system knew nothing of movement and behaviour patterns when those within the installation were between floor-pad sensors, or not engaged with the light sensors. That meant that people were able to trick the installation, and so the relationship between behavior and environment was not consistent.

For MAP1, MAP2 and Gestation, I used video tracking, a single camera in the centre of the roof, with the exception of MAP2, for which I used two cameras mounted so as to create a three dimensional tracking matrix. The video tracking solution allowed the environment to have a persistent relationship with those within it, to map presence as well as gesture, amplifying an awareness that you are immediately a part of an intimate causal loop, an immersive ecosystem, no longer the 'player', addressing the space as 'other', but part of the whole – no area out of view, no movement or gesture opaque.

An important aspect of this change was that, due to the persistent relationship that was establish using video tracking, realtime synthesis could now occur, mapping every small nuance of the gestural articulation of space into sound and image. This heralded the end of pre-recorded content and its associated fixed morphology in favor of a much more dynamic system that acknowledged the uniqueness of each persons engagement.

## MAP1



*Figure 2 The flyer for MAP1 (Designed by Kat Mew)*

MAP1 still used a control paradigm external to the inherent nature of the gesture – a control surface with four enormous faders, which you could walk up and down, but two other parameters were controlled by the amount of movement in the entire space (seeking to express the dynamic of the energy in the space), and the position in the space that had the greatest velocity of movement. In this work I began mapping direction of movement and velocity and acceleration of gesture, determining first order<sup>4</sup> qualitative characteristics to apply to the sound synthesis. Furthermore, the sound synthesis was based on granular synthesis, which took as its source, sounds people made over a certain amplitude threshold within the space. Those within the environment were therefore empowered to re-mold their own sounds, to enter sounds

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<sup>4</sup> first order values are derived from the immediate representation of a characteristic (velocity for instance).  
Second

into the system with morphologies of their choosing, or to work with sounds others had entered before them.

In the program notes for MAP1, I comment:

*Map 1 explores ways in which humans develop and re-evaluate cognitive mappings of personal relationships with their environment. Human expectations, frustrations, desires and experiences are usually expressed to the outside world as a physical or aural response.*

*This installation focuses on sound using the immersive, fluid and emotive qualities of the medium to generate a rich, enveloping and ever evolving environment. The sounds are made more fluid by the use of a system capable of moving the apparent source of the sound through the physical environment. This creates a dynamic relationship between the presence and position of a body and the position and movement trajectory of the sounds. The ability to move sound through space affords the sound a physicality and, in so doing, the sense that the sound becomes another physical character or presence within the installation.*

*Those within the installation sense a physical interaction with the sound. A wide range of different aural qualities are mapped in qualitative groupings to different regions within the installation space, generating a plethora of aural textures and densities, chosen on the basis of the quality of movement of the body within that region of the exhibition (Paine, 1998)*

MAP1 exhibited no pre-defined musical/sound/compositional form. The sound environment could evolve through an extremely broad range of aesthetic qualities. The move away from pre-made content was a direct outcome of my own intention to remove myself, as much as possible, from imposing an aesthetic; a collection of outcomes, a form, or a prescriptive experience. I wished for inhabitants of the installation to mould their own individual experience, and I saw any kind of prescriptive system as a hindrance to that outcome.

In working towards this approach, I was inspired by a number of Fluxus artists and composers who addressed these same issues in their musical compositions. Among them, composers such as John Cage, Morton Feldman, Christian Wolff, George Brecht and Earle Brown. They explored approaches to musical composition and performance that introduced freedom of form and content. Earle Brown wished to keep his music 'plastic'. Whilst he acknowledged the composer's responsibility to establish a structure, a point of focus, a form of guidance, he wished the work to be defined at the point of creation. He wished for each performance of that work to be different, to be influenced and defined by those involved in its performance. Alexander Calder's kinetic art, especially his mobiles, caused Brown to consider spontaneity and open form. Brown's particular fascination with the Calder works, and also the spontaneous techniques being developed by Pollock, is born out by the following reflection:

*[The]... creative function of 'non control' and the 'finding' aspects of the work within the process of 'making' the work, the integral but unpredictable 'floating' variations of a Calder mobile and the contextual rightness of Pollock's spontaneity and directness in relation to the material and his particular image of the work. Both show an awareness of the 'found object' tradition as well as established unique and personal conditions of control of the totality. The momentary resolution of this dichotomy seems to me to be the 'subject' (as distinct from object) of today's art, common to all the arts. (E. Brown in Nyman:1999:56)*

Brown comments "what interests me, is to find the degree of conditioning (of conception, of

*notation, of realisation) which will balance the work between the points of control and non-control ... there is no final solution to this paradox ... which is why art is.” (E. Brown in Nyman:1999:56)*

Brown’s interest is clearly in the flexibility of systems, the composition of a work in such a manner that its ‘performed’ form would draw from the practices of ‘found object’ art and spontaneity. He sees

*“...form as a function of people acting directly in response to a described environment ... it seems reasonable to consider the potential of the human mind as a collaborative creative parameter.” (Ibid:57)*

Brown is very clear, though, that the composer brings something to the work. The work is not simply a collection of spontaneous events; the composer establishes the groundwork for content and the conceptual framework.

*... there must be a fixed (even if flexible) sound content, to establish the character of the work, in order to be called ‘open’ or ‘available’ form. We recognize people regardless of what they are doing or saying or how they are dressed if their basic identity has been established as a constant but flexible function of being alive. (Ibid:70)*

The considerations of Earle Brown are in reference to the composition of acoustic performance works. Composers working with electronics were exploring similar ground.

Nyman (Nyman, 1999) states how Gordon Mumma elucidates a

*... case for the use of electronic systems in live performance; ... they present or exploit in some way the qualities of variability, instability or unpredictability - things which may arise of their own accord or are in some way beyond the immediate control of the composer or the operator. (Nyman:1999:91)*

These are some of the many inspirations within contemporary music composition from which I drew my approach to fluid, evolving, and realtime interactive, responsive sound synthesis frameworks. MAP1 was the first major step in this direction, successfully presenting a very fluid and visceral articulation of the sonic landscape.

## MAP2



*Figure 3 Images of MAP2 in the Musical Instrument Museum, Berlin*

MAP2 was commissioned by the Staatliches Institut für Musikforschung (State Institute for Music Research) (SIM), Berlin as part of the Festival of Culture

(KUNSTFEST) for the millennium. It was developed in collaboration with Dr Ioannis Zannos<sup>5</sup> at SIM and exhibited at the Musical Instrument Museum in Berlin 1999-2000.

In an effort to move fully into realtime synthesis and to elevate gestural morphology to top priority, MAP2 used two cameras to provide a full three-dimensional mapping of gesture and behavioral patterns. The vertical and horizontal planes assumed different roles with the horizontal being divided into four zones, independently and synchronously tracking the x-y position of people in each zone. Independent polyphonic articulation of the sonic environment became available – collaborative sonifications could occur. In line with the three-dimensional tracking, the vertical plane was segmented to place some sonification options above head height, encouraging a wider range of exploratory gestures.

The layering approach was also applied to the sound design, with the introduction of Dynamic Orchestration. Four instruments were made available within each quadrant of the horizontal space; additionally, different filters were applied to the output, allowing a flexible and mellifluous timbral variation based on the dynamic and position of gestures within each zone.

The ‘orchestra’ consisted of 4 sonic layers:

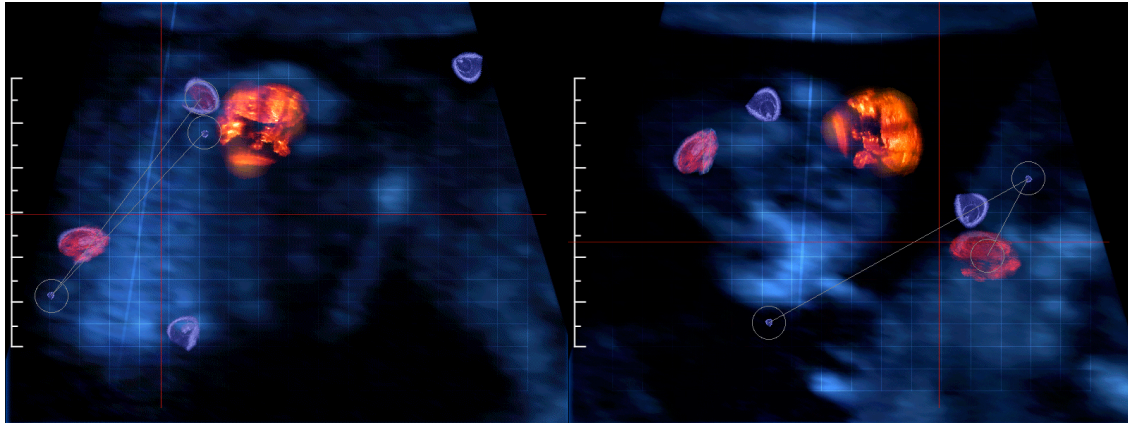
1. Layer01 consisted of a drone like sound that was constantly being modulated by the resonant filter discussed above. This was the only sound audible when the installation was uninhabited and, in that state, the resonant frequencies slowly changed. This layer responded more dynamically when engaged interactively, because the interactive process then drove the filters.
2. Layer02 was a more dynamic and more defined sound. It moved through greater pitch ranges and its filter outputs changed more dramatically in relation to interactive input within its threshold range.
3. Layer03 was a bubbly, bouncy sound that used a varying echo to accentuate the dynamic of activity that was needed to add this layer to the orchestration.
4. The vertical active space (camera02) was set at just above head height and defined a row through the middle of the installation space that was mapped to play a physically modeled guitar sound.

The key to this sound design was an increase in the internal complexity of the sounds as associated with increased gestural intensity, and a constant variation in the filtered timbre with all gestural activity. The Dynamic Orchestration and dynamic filtering produced a very fluid, mellifluous sound environment, one in which the space itself became a flowing graceful medium that could be sculpted into amorphous forms, swept clean and reconfigured at will. The immediacy of this approach, combined with an eight channel spatialisation so that sounds followed your gestures creating an immersive experience that heightened corporeal perceptual awareness and provided a visceral, almost tactile articulation of place.

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<sup>5</sup> Dr Garth Paine was responsible for all the concept development, sound design and video sensing approach. Dr Paine also wrote the instrument algorithms and the Max code for controlling the video sensing and communicating with SuperCollider. Dr Zannos assisted with the writing of the SuperCollider structure for dynamic allocation of synthesis algorithms depending on sensed activity levels and the dynamic audio filters used to constantly vary the timbre of the instruments.

## Gestation



*Figure 4 Images of the animation gallery in Gestation (RMIT Gallery)*

With Gestation, we come full circle, back to the experiential text at the beginning of this essay, an audio-visual environment that sought to immerse the visitor, and provide an even broader range of possibilities for personalized articulation of space than MAP1 and MAP2. A sense of Place is important here, for Place indicates ownership, an understanding of the relationships inherent in your presence, greater than the sum of the parts, a belonging, and a special identification of the closed causal loop that exists between creation and created, a true dialogue.

*Gestation consists of two integrated spaces. Gallery One contains a surround sound field, generated in real time using video sensing of gestural movement and behaviour patterns, mapping them onto real-time audio algorithms providing a tight gestural relationship between gesture and sonic landscape. No prerecorded material is used in the generation of the sounds, they are all generated algorithmically in realtime, creating evolving streams of spatial articulation.*

*Gallery Two contains, a large projected image represents the development of new human life. The image background represents a sea of life forming cells. Additional layers are formed by the development of new fetuses, created in response to particularly dynamic activity in Gallery One.*

*The aesthetic of the sound environment is a carefully tended intimately textured sound. It is intended to create a viscous, fluid environment for the 'making of life'. The qualities of this sound change in relation to the direction and speed of movement and number of people within the space. In addition to the underscore sound, more contained points of interest are tied to the creation of each new foetus, and are associated with the position within the gallery space at which that activity is sensed. The growth sounds express the qualities of life forming: the binding of cells, the development of human form, and the growth of the foetus.*

*Ultra-sound videos of friends' first-born children form the basis of the moving images. The cells begin growing at a point in the two-dimensional grid associated with the sensed movement in the sound gallery, and grow at a rate associated with the dynamic of that activity. Varying rates of growth are associated with thresholds of activity.*

*Participants in the sound gallery cannot see the visual element without leaving the gallery space. They can make life, but not observe it at the same time.*

*The two galleries are detached to illustrate the hidden outcomes of our activities, and to encourage a deeper engagement with the details of the sound environment, a heightened corporeal perceptual awareness resulting from conscious engagement with the fluidity and variability of the sounds. (Paine, 2002a)*

## Conclusion

In this essay I have articulated the basis of my interactive, responsive environment installation practice; sought to explain why the Cartesian mind-body split is inoperable when the inhabitant is engaged at a deeply visceral, corporeal level, and attempted to express the potential, experiential environments have for the development of individual interactive expression.

The relationship between gestural articulation of space, the interactive response and the evolution of a sense of Place is explicit in the work I have presented. The cybernetic closed-causal loop defines this relationship in a true “whole is greater than the sum of the parts” manner.

Life is an emergent condition (Bermudez, 1999; Gromala, 2003) – my artwork attempts to take this as its foundation and address the body as interface (Scott, 1999).

Julio Bermudez eloquently describes the nature of living interfaces:

*A close scrutiny of life reveals that living creatures are not material entities separated from their surroundings but rather regulatory interfaces of interactions occurring between their internal and external environments. Life is an emergent condition whenever and wherever certain complex internal and external tensions meet one another and find some dynamic balance. (Bermudez, 1999)*

Perhaps we have moved past the Cartesian paradigm into a new, wholesome and immersive sense of presence, space and place?



*Figure 5 Ghost of Movement in Gestation Sound Gallery*



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