FLOW

INTERACTIVE SONIC ART:

THE CREATION AND USE OF RESPONSIVE STRATEGIES TO RE-IMAGINE THE PERFORMER/SPECTATOR RELATIONSHIP AND CREATE VISITOR INCLUSIVE SONIC ENVIRONMENTS.

Peter Shepherd.

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Declaration

I, Peter Shepherd, confirm that, except where other sources are acknowledged, the work contained herein is my own.
I am aware of Plymouth University's regulations concerning academic integrity, and submit this work in good faith in accordance with those regulations.

At no time during the registration for the degree of ResM, Computer Music has the author been registered for any other University award without the prior agreement of the Graduate Sub-Committee

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Abstract.

FLOW operates on two levels, firstly as an engaging live performance environment and secondly as a vehicle to discuss a number of philosophical ideas relating to sound as art.

As a performance piece *FLOW* exists to provide an inclusive interactive environment for musicians and casual visitors alike. A series of sensors allow those who enter the arena to make interventions in an immersive soundscape through their movements, opening up possibilities for the exploration of sound and gestural action within the space.

The piece challenges the conventional roles of performer and spectator and offers interactive technology as a means of uniting the two. The artist creates a re-imagination of the performance paradigm based on active engagement rather than passive observance through the establishment of a circular discourse between human and computer.

The following paper will also examine the nature of sound as art, suggesting that the poststructural ideas of Derrida and Deleuze and Guattari can be used as a conduit to define sonic emergences and morphologies within a Human/computer discourse, both in terms of timbral nature and spatial diffusion. Central to this is the concept that suggests the relationship between man and machine in interactive sonic art is one of energy transfer from organic fluidity to digital regulation and back to energy in the form of processed sound, according to the processes put in place. This leads into a final discussion of the nature of experimental compositional process, the choice between the determinate and the stochastic and the compromises between these that may need to be made to retain artistic coherence.

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List of Abbreviations (Alphabetical)

BEAST…… Birmingham ElectroAcoustic Sound Theatre
CPU…… Central Processing Unit
EEG…… Electroencephalogram (Machine)
FM…… Frequency Modulation (Synthesis)
GRM…… Groupe de Recherches Musicales
GUI…… Graphic User Interface
ICCMR…… Inter Disciplinary Centre for Computer Music Research (Plymouth University)
(Max)MSP…… Max Signal Processing
RCPS…… Royal Cornwall Polytechnic Society
RGB…… Red, Blue and Green Colour Spectra
VCO…… Voltage Controlled Oscillator
VR…… Virtual Reality

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Introduction.

The following paper is one of both concept and context. It examines the creation of an environment that responds, sonically, to the presence of people within its space via a number of different sensors and how such an environment relates to both the artistic and philosophical values that have preceded and inform it. Throughout the work an ongoing series of questions are raised, some explicit, such as challenging the conventional roles of performer and spectator and others far more esoteric such as questioning the metaphysical ontology of sound and the space it exists in.

The paper opens with a literature review that initiates the discourse to be discussed in detail later, pointing to the main sources of academic research that inform the technical, artistic and conceptual rationale and have led to the realisation of the project.

Following this, a technical review will describe the development of the sonification software and its integration with sensors that make interactive sound possible. The creation of this software in the Max/MSP program constituted much of my practical research and whilst I do not feel this technical development is the essence of the artistic and aesthetic grounding, it is a critical element of the realities of the project and as such fulfills an artistic context of its

own, that of software design as research. As an artist one needs a medium to work with and this is mine, albeit one whose elements I have to invent myself as both artist and developer.

A short chapter that discusses the performance of the piece at the Royal Cornwall Polytechnic Society (RCPS) follows. This is currently the only performance of the piece, though further showings are planned. In the future I would like to bring the piece to a venue other than a gallery, possibly an industrial space, in order to adapt the sonic nature of the piece to that specific environment either in sympathy or at odds with the surroundings. For instance if one considers a derelict factory site, whose sonic history is one of the repetitive mechanics and metallic timbre, one has the choice to either mimic that landscape or oppose it with a sonically less linear device such as birdsong or a seascape.

Subsequent to this series of reviews, the main body of the text will discuss the philosophical ideas that inform *FLOW,* in relation to 5 core aesthetic aspects of the project;

- Hauntology and the integration of old with new technologies.
- The re-imagination of the performer/spectator relationship and the conventions of performative art.
- Deconstruction and the creation of alternative situations informed by a re-examination of existing paradigms.
- The nature of sonic morphology within a responsive space, considered in relation to Deleuzian notions of territory, shifting assemblages and Rhizomatic structure.

- Indeterminacy within experimental composition as a fundamental device for emergent generative sonic developments.

As an artist I believe this aesthetic awareness is the most pertinent aspect of any project. The development of systems and the realities of bringing those to fruition in a performative situation are a challenging, often frustrating prerequisite to the realisation of any work of this kind, however, without a distinct aesthetic contextualization to reinforce the reality the project risks becoming diminished, from the artist point of view at least.

I believe wholeheartedly that the rationale of a work is crucial to the artist's understanding of what they are trying to achieve, both on a conceptual level and in how that work fits into the wider canon of ones artistic area. Such a contextualization serves to define the work in the artist's mind and thus allow that definition to reflect on those who experience the work, even though they may not explicitly recognize it as such. For instance, *FLOW* exists to challenge the traditional performative and spectator roles, something that, as the artist, I am obviously fully aware of. The visitor may or may not wholly realise this in any academic or technical way, and neither is it entirely necessary for them to do so. However, what is hoped is that they realize to some extent that they cease to be merely an observer and become an active catalyst in the environment that surrounds them.

Transferring this academic notion to populist reception is not always an easy process without explicit explanation, which, if given, may possibly inhibit visitor freedom through an imposition of implied rules. This is something I have deliberately tried to avoid unless specifically asked to do so as I feel that cognitive self-discovery is an important element in realizing ones changed role.

The deeper philosophical aspects of my aesthetic position are obviously not as penetrable for those who visit the installation and as such form a more academic background for my ideas. Philosophical theories can be complex ideas for anyone to understand and probably result in as many opinions and interpretations as there are readers, something, in the case of Deleuze and Guatarri particularly, that was possibly their intention all along. Again, it is not required that the visitor understands these concepts. They exist primarily as a reflective framework for the artist to define in his or her own mind *what* their creation is, *why* it exists and *how it fits* into the wider area of their chosen field. For example, my use of Theremins to control modern software creates a somewhat postmodern situation by introducing one of the earliest electronic sounding devices to contemporary techniques for sonic manipulation (*the 'what'*), in effect crossing temporal boundaries both forward and backward to create what may be described as nostalgia for the present (*the 'why'*) and in so doing entering the remit of what Derrida described as 'Hauntology' (*the wider philosophical 'wherefore'*).

This essay will pose a variety of questions that will be answered as they arise in the discourse of the philosophical aspects of the piece. However, there are certain core questions that I will return to over and again within the varying aspects of this work. These are;

- Will visitors accept and embrace the responsive possibilities of an interactive sonic art exposition? Does this inclusiveness make sonic art more enjoyable, less intimidating and easier to understand?
- Does the installation truly redefine the role of and relationship between performer and spectator and if so what are the newly assumed roles?

Does the artist become passive? Does the spectator become and active catalyst and as such an essential element? Is the piece still a performance or does it become an experience

- Does the use of highly visible and fascinating technology, primarily in this case the Theremin, add to the inclusivity and attractiveness of the piece or would more advanced, clandestine, sensors, such as infrared technologies, allow for more controlled interaction?

Project overview.

The primary informant for this essay will be my practical research project, *FLOW,* that not only functions as an investigatory device but also as a stand-alone sonic art installation in its own right.

The *FLOW* project is an immersive and responsive sonic environment. Immersion, in this case, relates to the impact the environment has on sensory perception and the degree to which a form of cognitive integration with the piece may occur, whilst Response or responsivity is simply used as an alternative and I would suggest less ambiguous term for interactivity, describing the actions of participant, sensor and software as a circular discourse of cause and effect.

The installation features a series of sensors to facilitate interactivity, allowing visitors to become active participants rather than passive observers of a spectacle. The piece aims to diffuse the singular focus toward a stage, as found in conventional performance to allow the space to operate in 360°. As visitors become more familiar with the possibilities and their role within the space it is

hoped that their focus will begin to become inward toward their own movements, perception and the details of the sonic landscape they are creating. The sensors employed are;

- Three single aerial Theremins sending pitch data to a decode patch that generates alternative sonifications of their volatile output signal.
- Four pressure mats that deliver simple on/off triggers to separate sonification patches running a series of momentary and time-limited playback possibilities.
- Two webcams responding to movement and colour, supplying a data stream to an FM synthesizer and generating a constantly shifting underlying dronescape.

FLOW premiered at the RCPS in Falmouth Cornwall on the 8th July 2016 and was active for 6 hours during which time there were approximately 50 visitors who all embraced the active participatory role in the piece.

For this performance the space featured three visual projections. I regard these projections as a non-critical aside to the project, in that its primary focus is sonic rather than visual. Whilst these elements could be said to extend the immersive properties of the space itself, I consider them rather as decoration than vital components. In hindsight I am ambivalent about their use and as such will not focus heavily on them throughout this discussion.

Chapter 1. Literature review.

1.1 Introduction.

The practice examined in both my practical and academic research concerns the development and realisation of interactive sonic spaces within the subject area of Computer Music. Both the terms 'interactivity' and 'Computer Music' are highly ambiguous and can have multiple possible meanings; Interactivity often being a vague term relating to any kind of human-machine collaboration and computer based music spanning a subject area ranging from modern electronic dance music through the algorithmic processes of experimental music and sound art to the development of brainwave analysis or even Biocomputer technologies for sonification, such as those being currently developed within ICCMR at Plymouth University, in the UK[1].

This review will outline the literature that informs my overall artistic stance, the experimental concepts that underlie my research and my rationale for wanting to create sonic spaces that react to visitor presence within them. I will then proceed to define for the reader what I feel my particular research into interactivity actually means and highlight some of the contemporary and historic concepts that underpin my ideas for responsive performance environments. Throughout this chapter I will briefly highlight the various texts that inform the contextual and philosophical foundations of the *FLOW* project as an introduction to their expansion in the later chapters of this paper.

[1] ICCMR Biocomputer research. http://cmr.soc.plymouth.ac.uk/research.htm

1.2 Computer Music or Experimental sonic arts.

Firstly it is essential to define my position in regard to the broad field of creating music with computers. From the outset I would like to dispense with the idiom 'Computer Music' in favour of Experimental Sonic Art, as I find the term too ambiguous and wide ranging and that it does not explicitly relate to the element of discovery or artistic experimentation which is my primary concern.

Philosophically I have difficulty thinking of my current practice as a strictly musical form, though by the definitions put forward by Cage, Varese and others it is still an organization of sound and as such could be considered broadly musical (Varese 1936. 17) (Cage 1937. 25). I feel that when one steps away from the traditional remits of coherent rhythmic, harmonic and melodic devices one removes oneself, to a degree at least, from the relatively narrow band of what Pierre Schaeffer describes as '*DoRéMi*' harmonic expression, moving into a wider artistic field (Schaeffer 1986. 2). Douglas Kahn, in discourse with the ideas of Roger Maren, discusses this in relation to the work of Schaeffer, Cage and Varese among others, stating that the use of alternative methodologies such as tape, record decks or in this case a software environment '*…does not necessarily nullify the value of the work. It simply places it outside of the domain of pure music*' (Kahn 2001. 114).

This is a debate that could, and does, run on and on and for which there is no real resolution, just opinion. In this regard my position is that conventional musical devices are simply one of a wide range of techniques available to contemporary sonic artists. I contend that all sound materials and processes, whether harmonic device, sonic object or a combination of these, should be

considered as available media and techniques, particularly in the post-digital age where sonic materials may be directly linked to visual or other stimuli, to facilitate the forward development of both music and transdisciplinary art as we move further into the 21st century.

My work follows the lineage of experimental sound art that began with the pioneering works of Schaefer's Music Concréte and the early synthesis experiments of Karlheinz Stockhausen and others that subsequently developed into the Avant Gard movements of the 1960's, before eventually leading to the popular and varied genres of electronic music available today.

It has been suggested in the past, at times antagonistically, that the experimental artist working within the sound field chooses whether to pursue the Schaefferian line of adapted and contextually repurposed recordings or the Stockhausen route of sound synthesis and wholly electronically generated tones (Palombini 1998). However, I feel that in an age, where digital audio generation and processing is ubiquitous, it is somewhat folly to limit oneself to one or the other. The possibility of a combination of the two readily exists, as indeed Stockhausen himself explored in earlier works such as 'Kontakte Part 1' (1958)[2]. I feel that what is now termed Electroacoustic music should place greater emphasis on what is done with sound after its generation or capture rather than the methodological origin of the sonic material itself. However, in certain fields, such as the aforementioned Brainwave or Biocomputer music, such methodologies are obviously the essence of the research and as such are probably more concerned with generation technique than sonic result, at least until that technique reaches a stage where it can be considered reliably

[2] Stockhausen. 'Kontakte part 1'. 1958 https://www.youtube.com/watch?v=KPCMTJBjz7g

instrumental (Hodgkinson 1986. 1).

In the field of sonic manipulation, the backbone of the *FLOW* project, the work of Curtis Roads on granular synthesis is highly pertinent. Granular processing engines create possibilities for the adaptation of digital audio recordings to become quasi-synthetic oscillators and generate clusters of sonic materials from a single source recording, allowing emergent sonic situations to materialize either with some artist defined regularity or through instigated stochastic triggering processes (Roads 1996. 168-171). This is often not a precise science and carries with it certain inherent sonic difficulties such as onset transient clicking and disjointed audio. However these digital errors have become somewhat embraced by contemporary composers and have given rise to entirely new genres of electronic music such as 'Glitchcore'[3].

In the preface to his most recent work 'Composing Electronic Music' (2015) Roads puts forward his own definition of the aesthetic properties that direct and construct contemporary experimental music, stating that electronic music…

- *Opens the door to any sound possible in composition, an unlimited universe of heterogeneous sound objects.*
- *Exploits the specific capabilities of electronic music technology*
- *Composes all timescales down to the micro and even sample level*
- *Accepts spatialisation as an integral aspect of composition*
- *Focuses on sound transformation as a core structural strategy*
- *Organizes flowing mesostructures (sound masses, clouds, streams) that emerge as consequences of new materials and tools*
- *Integrates the possibility of sounds that coalesce, evaporate and mutate on multiple timescales*
- *Plays with zones of morphosis - thresholds where quantitative changes in sound parameters result in qualitative changes to the listener*
- *Treats pitch as a flowing and ephemeral substance that can be bent, modulated or dissolved into noise*
- *Encourages microtonality but also free intonation*

[3] Circle Six. 'Glitchcore'. 2006 https://www.youtube.com/watch?v=MM0gB8FuCAw

- *Treats time as a plastic medium that can be generated, modulated, reversed, bent, granulated and scrambled – not merely as a fixed duration subdivided by ratios*
- *Weaves undulation of envelopes and modulations into the fibre of musical structure*
- *Applies the power tools of algorithmic methods but allows the freedom to edit and rearrange the results*
- *Addresses the issue of narrative in composition*
- *Considers human perception/cognition as a baseline for theory and practice.*
  (Roads 2015 xiv)

This précis, equally as applicable to more conventional structures as well as experimental forms is, in my view, the most definitive description of the canon for our current time and relates so completely to my own work that I adopt it wholly as both a reference point and manifesto. Roads outline also crosses over in many ways with Jonathon Kramer's fourteen-point description of postmodern musical concepts, particularly in terms of temporalities, perception and structural unity (Kramer 1996. 22) (see appendix 1). Together these two synopses have come to form much of the basis of my artistic position.

Though the focus for *FLOW* is to create an environment where interactivity is primary there obviously needs to be a series of sonic materials for that response to become manifest. The piece uses a diverse range of sounds from Plunderphonics[4] (Oswald 1985) and field recordings to FM and subtractive synthesis. The work employs a diverse range algorithmic delivery methods, all of which can be directly related to Roads guidelines listed above, such as microtonality, elastic time granulation and Bark Scaling, which are ultimately

[4] Plunderphonics refers to the re-use and repurposing of existing sonic materials as first defined by John Oswald in 1985.

delivered into the performance space by a 5.1 speaker array to provide spatial dynamics.

Leaving aside for a moment the technical aspects of Roads aesthetic, for me as an artist, his final point is possibly the most salient, that of the consideration of human perception and cognition as the baseline for both theory and practice within experimental electronic music. This is vital and introduces the aspect of philosophy to the subject that has to run parallel to the practicalities. Here, I believe, Roads is bringing forward the postmodern idea of subjective response, something Kramer describes as '*Locating meaning and even structure in listeners more than in scores, performances or composers*' (Kramer 1996. 22). This is a core concept behind *FLOW* as a tangible installation. From the outset my underlying desire has been to delegate ongoing control and interpretation of the sounds and their morphology to the subjective perception and cognition of the visitor as primary catalyst or performer rather than imposing any artistic regime upon them other than the provision of source sounds. Thus, the way a visitor perceives the effect of his or her own gestures defines the direction the piece as a whole takes, whether that be a choice toward, say, a rhythmo/harmonic hegemony or something more chaotic.

1.3 Sonic morphology.

The focus toward perception and cognition leads into a second philosophical rationale for *FLOW* and something that I will expand on greatly later in this paper, namely the Deleuzian ideas of nomadic milieu, territories and the '*Chaosmos*'.

In '*A Thousand plateaus, Capitalism and Schizophrenia'* (1980) Deleuze and Guatarri posit that the apparent chaos of the universe actually consists of an infinite number of constantly shifting assemblages or 'milieus' that are themselves formed from component parts and rhythms of existence. The authors state that

> *"From chaos, Milieus and rhythms are born…. We have seen elsewhere how all kinds of milieus, each defined by a component, slide in relation to one another, over one another. Every milieu is vibratory, in other words a block of space time constituted by the periodic repetition of the component. Thus the living thing has an exterior milieu of materials, an interior milieu of membranes and limits and an annexed milieu of energy sources and actions-perceptions.* (Deleuze and Guattari 1987. 264).

The way milieus shift and mutate generates a certain chaos in the moment of change or *'becoming'* before finding a position of stabilization that exists until a new becoming is initiated, creating a constantly shifting landscape between stasis and emergence, harmony and discord. The authors put forward the idea that, whilst in the state of becoming, components that have left their previous territory enter what they term the Chaosmos, a position of nomadic flux between the collapse of an existing assemblage and the formation of a new territory. It is here, in this flux, that they claim true innovation or originality can occur, where fresh ideas, ideologies and in this case sounds and morphologies between sounds are created (Deleuze and Guatarri 1987. 264- 265).

These ideas have very much impacted my artistic vision, causing me to largely disregard traditional musical rules in favour of an entirely less regulated approach that allows these shifts and realignments to occur freely. Tonally I work across the entire audio spectrum regardless of accepted harmonic or melodic devices and find the potential for nomadic flux between convention and

discord both artistically inspiring and satisfying. Sonically FLOW extends these ideas even further by introducing new potential volatilities via interactive sensors and participant actions to impart energy into computational processes and create a state of constant sonic morphology.

During development it became important that the piece had a 'resting state, a position of sonic dormancy from which emergences might occur, when the space was unpopulated and largely unresponsive. To my mind, and this may initially come across as slightly counter intuitive, this resting state represents Deleuze and Guattari's Chaosmos, a position of relative stability that exists prior to and in the wake of interventions by visitors within the space. The Chaosmos does not cease to exist when interventions occur, rather it becomes agitated and elastic, in a state of volatility, with new milieu and territories being ephemerally created in response to visitors' movements and decisions before returning to a position of stability upon their exit.

1.4 Interaction.

Interactivity is an imprecise term and we really need to establish what it actually means to us as sonic artists and musicians in the post-digital age where we are no longer limited to solely human to human response but are able to interface quite readily with bespoke technologies in real time to create entirely new performance models.

For the purposes of this study, and indeed responsive digital arts in general, I contend that interactivity be considered an ongoing discourse between human and computer or human and human where a computer is used as a catalyst for

that communication. However, within this there are differing operational levels. The interaction between a human and, say, an input tool such as a keyboard or computer game controller can be considered a fairly low response situation, whereas the discourse within a virtual reality game or a digitally created environment could be said to be at reasonably high level, requiring response to and from object or device in order to create both subjective and objective emergent progressions (Hugill 2008. 124). Further to this, the use of EEG machines to conduct brainwave analysis and subsequently supply control data to systems could be said to be the current zenith of our knowledge and indicative of future possibilities (Andelkovic 2010. 1-4.).

Interactivity within a performance environment can also be ambiguous. Taking conventional music performance as a datum, it is safe to say that the artform has always been one of human-human interaction. Musicians have, by necessity, always been responsive to both the ensemble and audience, with the former manifesting itself in, possibly, added nuance in playing style or response to specific instruction by the conductor with the latter resulting in perhaps greater exuberance as appreciation increases or even defiance in the case of a less than friendly audience.

Computer programming environments may introduce a new kind of interaction to the performative situation, that of the response between the active-sentient who energizes the system through free will and human choice and the non-sentient software that can only interpret the incoming data stream and manifest the results according to rules implemented by the artist/developer. This has opened up an entire new array of performance possibilities to the musician, from the development of new or extended instrumentation to the field that we are

concerned with, that of responsive digital environments (Winkler 1998. 4).

Ben Carey, referencing the ideas of interactive music pioneer, Joel Chadebe, highlights that the responsive process is not solely one of the actuality but must also be considered from the developer point of view. Carey suggests that the consideration of responsive intent and the development of bespoke systems to facilitate such response is already an act of interaction, albeit one of future objective. I believe this to be a highly salient point. From the genesis of such a bespoke system the artist/developer must question how the system elements, both physical and discreet, will perform the desired functions. The development of processes that facilitate responsivity and the nature of that response are entirely critical aspects of the system, and as such must be considered interactive in themselves, even in the developmental stage before any true interaction begins (Carey 2016. 27).

The development of any successful responsive environment requires four simultaneous (or near simultaneous) actions and reactions to establish the essential circular discourse between the elements;

- The human action; the stimulation for reaction and data generation, imparting energy into the system.
- The haptic or kinetic action; the creation of a useable the data stream.
- The decoding action; transforming raw data into useful parametric control and the subsequent encoding of this into sonification devices.
- The sonic manifestation: the return of the imparted energy in the form of the sound heard.

Referring this back to Carey and Chadebe, all these factors have had to be

considered from the very outset of development. Certainly individual software patches may have been created without the need for external intervention but even in these it is critical to consider, at the developmental stage, which points of ingress will yield the most efficient results and how the raw data may be interpreted to produce a coherent sonification. Thus we have a quasi-quantum situation where as a developer one is working with both interactivity and the potential for interactivity, Schrodinger's response if you like, with the system only truly being interactive when subjected to intervention but still existing in a state of potential responsivity up to that point.

The above is obviously only available to the system aware developer. To the performer, whether musician or otherwise, these actions can be distilled into just two manifest processes, those of cause and source, the cause being the interaction with the sensors, the source being the sound heard ((Emmerson 2011. 179). This action is analogous to that of traditional acoustic instrumentation where the musician imparts energy to a string or tube and a resultant sound is transmitted. Within these cause and source operations *FLOW* offers a series of possibilities to the performer;

- Multiple sonic options: Available through a distinct repertoire of triggers, each operating its own algorithmic process.
- Performative options: Transformational response choices from movement.
- Emergent sonic options: The specific auditory effects of decisions made when interfacing with the sensors.

Behind these tactile possibilities there also exists within *FLOW* a more esoteric

flux that operates wholly within the ambient background soundscape and whose responsive possibilities are not readily apparent to the visitor, the use of webcams to control a constant yet volatile drone system through the sensing of color and movement within the space.

Whether the use of this technique can be considered true responsivity as it doesn't explicitly and visibly engage the performer provides a further point of discussion. That of performative intent;

Is it entirely necessary for the visitor to be completely aware of the nature of their interaction and if they aren't fully aware of the response their activity causes does that make the system more one of *reaction* than *interaction* in that the system still responds but the human intention to create that response may have become obscured or diminished? (Jacucci *et al* 2006. 4).

This is an interesting debate. In this case I feel that yes, the webcam response is reactive, but it sits within a field of interactivity and as such can be considered part of the responsive system as a whole. This argument forms part of my rationale for using Theremins rather than more covert devices such as Xbox Kinect units, which would be far less overt and tactile and could risk accusations of the entire system being reactive. I believe that for a system to be truly described as interactive there must be awareness for participants that their actions are the catalyst for changes and as such the instruments for that catalytic conversion need to be conspicuous to some degree.

1.5 Aesthetics, Derrida versus Deleuze and Guattari

The final two sections of this review both focus on the core artistic and

philosophical ideas that contextualize and motivate *FLOW*.

From the outset of this project I have been exploring the idea of deconstructing the traditional performance paradigm, that of a singular focus toward a stage and distinct division between the performer and spectator. The artistic vision of *FLOW* is to create a diffused 360° performance environment in which visitors become the active in the generative nature of the piece rather than being passive observers of a spectacle. My reference to traditional performance refers primarily to the convention of the separate areas for performance and observance that is the predominant model, certainly for musical events. However, I accept that this is a generalized description and other models do exist, such as those found in much experimental work where the spectator is allowed a certain freedom to wander amongst the work as it happens. Nevertheless, I feel that, even in such a framework, a certain schism still exists between those inside the performance and those who observe and my motivation was to disseminate this as much as possible.

The idea of deconstructing an existing model instantly brings to mind the work of Jacques Derrida, who, in his 1967 work 'Of Grammatology', suggested that something can only be defined by examining its binary opposite. In very simple terms, Derridian logic might conclude that the voice is a voice because it is not a written work - but in order to ascertain this one would need to analyse the nuance, detail and implication of the written in order to ascertain that it is not a voice and ascribe a hegemony to the spoken over the written word (Lawlor 2006 ch.5). Derrida originally explored these ideas as an examination of language and linguistics, but in the years since the term has come to refer to the examination and re-imagination of many aspects of art, culture and indeed life itself (Hugill

2008 170).

This analysis of binary opposites to give plausibility of definition to the object of study informs *FLOW* on a number of levels; Performatively I seek to subvert the traditional model by delegating active duties to those who visit. Sonically and Musically I strive to disrupt convention of fixed harmonic forms by implementing alternative methodologies such as pitch and time volatility and reject compositional instruction in favour of allowing participant definition to drive the piece. Finally, temporally, the piece employs 'live' processes to create emergent structures from sound samples using granular cutting techniques, somewhat analogous to William Burroughs's '*cut up technique*' that formed new prose from existing work by separating it into individual phrases and rearranging the pieces (Burroughs 1963. 345-347).

Derrida contended that deconstruction should not end with the exposition and acceptance of binary opposition, claiming that to do so would lead to a situation of cynicism, stasis and negativity. Rather, he proposed that oppositions should inform and create new ideas that push the subject matter forward into an alternative model or direction (Derrida 1981. 41). This idea of fresh emergences appearing from ideas in flux brings us to what I regard as a far more salient version of deconstruction, the ideas of Deleuze and Guattari.

As I have introduced earlier in this review, Deleuze and Guattari expand and reconceive the Derridian ideas in the positive, claiming that in the act of deconstruction multiple new situations may be created with any artifacts not being lost but becoming part of universal cosmic atmosphere that ensures the potential for new development is always in process (Deleuze and Guatarri 1980). Again this is central to *FLOW* as a sonic and performative situation in terms of

the core morphology of the sound within the space, its generation and spatial distribution, and, of course, the transitory actions of those who enter and become the catalysts for change.

1.6 Re-imagining roles.

The underlying basis for the idea of reworking the performance paradigm of *FLOW* is inspired by Jacques Ranciere's short 2008 essay, '*The Emancipated Spectator'* in which he calls for a re-engagement of the audience with the source material and players within the theatre (Ranciere 2008. 21). Having been variously over the past 25 years a performing musician, sound engineer and now sound artist, witnessing the artist/spectator relationship from both sides of the stage curtain, this idea of a reversal, or at the very least a blurring, of traditional roles, both fascinates and excites me. I feel that with aspects of interactivity becoming more prevalent in everyday life in the 21st century the contemporary experiment performance model should seek to embrace inclusivity wherever possible.

Ranciere, speaking of engaging the spectator inside the performance, suggests,

> *"He will be shown a strange, unusual spectacle, a mystery whose meaning he must seek out, then will be compelled to exchange the position of passive spectator for that of scientific investigator or experimenter."* (Ranciere 2008. 4)

For the purpose of this study it is necessary to substitute, for the most part, Ranciere's stage play for that of sonic interaction, but the theory holds water. By embracing the visitor and making them integral to the machinery of the performance, we have the opportunity to reinvigorate not only the visitor

themselves, but also the performance, making it active and inclusive for all who chose to engage with it. This serves to not only to provide an engaging satisfaction for the visitor but also, hopefully, breaks down the somewhat aloof academic atmosphere that can often surround gallery expositions. By investing the participants inside the piece we bestow them with an active role and in doing so open the possibility for subjective insight, rather than attempting to externally force an understanding of what can be somewhat abstract artistic concepts.

Chapter 2. Technical Review.

2.1 Introduction

As stated, the genesis of interactive art lies in the development of the systems that materialize responses into an artistic reality. In a sonic system this begins with the development of a method for introducing external factors into a digital system and the creation of devices that can convert this data into sound. Once this is achieved the artist then has to define which points of ingress within the sonifier will be made available to external response.

There are many programming environments available to allow this kind of development such as Csound, SuperCollider and my own personal choice Max/MSP. This graphic software environment allows the user to design and produce bespoke software devices to perform a wide range of tasks, generally within the audio or visual realm. The beauty of such environments, whether they are strictly code based or graphic, is that one is not limited by impositions made by commercial hardware manufacturers as to the make-up of the final device. As such, one could develop, say, a granular sample engine that is then subject to subtractive processes or even implements FM synthesis in its post-granulation stage. The developer retains total control of all operational possibilities and future developments as needs or desires arise.

This ongoing versatility is vital in the creation of interactive systems where ongoing access to all parameters is an essential consideration. This not only leaves the artist/developer free to influence to any part of the patch but also to

adapt this influence in line with any forward developments throughout the project, something that is often not possible with ready-made packages.

Throughout the developmental course of *FLOW* approximately 80 devices and versions were created to facilitate the sonification necessary to make the project a reality. Many of these have been cast aside as either impractical or unsuitable, with the ones selected having been so for their ability to perform with specific sensors in a glitch and error free manner to supply the sonification results Intended. The following review relates primarily to the final elements that make up the masterpatch that controls the installation and will be split onto 3 separate areas;

- Theremin signals; providing active and fascinatory entry into the interactive possibilities of the space.
- Impulse triggers; that deliver specific and ephemeral sounds responding to foot pressure and presence within the space.
- Webcam colour and movement sensors; that monitor the space to deliver subtle changes to a volatile 'dronescape'.

All patches are available in the additional materials accompanying this document.

The main informant texts for this technical research have been *Electronic Music and Sound Design Volumes 1 and 2* (Cipriani and Giri 2009. 104-106, 357-361, 377-380, 497-501) (Cipriani and Giri 2013. 120-129, 253-255, 365-369, 532-537) and *Max/MSP/Jitter for Music* (Manzo 2011 243–245, 277-284) plus ad hoc YouTube tutorials such as the '*Delicious*' series by Cycling74 developer Sam Tarakajian and those by De Montfort lecturer Dr. Peter Bachelor, links to which are available in the bibliography of this document.

2.2 Theremins.

Theremins work by the creation of an electromagnetic field around an external aerial that becomes a kinetic catalyst for sound generation. Disruptions to this field create capacitance with the interference distance with the aerial forming the twin poles of the capacitor. This regulated voltage is then used to control a variable VCO and blended with the signal from a fixed oscillator, the difference between the two producing the fluctuating pitch we hear (Theremin world, Date unknown).

The use of Theremins as proximity triggers posed some interesting questions both in terms of decoding the incoming analog signal through pitch tracking devices and applying that highly volatile data stream to a sonification device. These two development areas ran hand in hand throughout the creation of the piece and were subject to further refinement right up to the time of performance, with the optimal scaling of the incoming signal being highly space reliant.

There can often be a great disparity between experiments conducted in the confines of the development studio and the reality of any installation in its intended environment, particularly, in this case, the sheer increase in size of the working space. In my small studio the opportunity for the Theremins to stabilize completely with no external interference to the aerial field was not realistically possible, as a result my data stream in that environment was always in a state of flux, whereas, in a much larger space, stabilization was much more prevalent. This factor was important in terms of the resting state of the piece and calibrating the optimal parametric position for that stable state took up a deal of time during my set up day, requiring a definition of the frequency point at

stabilization and scaling the response parameters to rest at the most sonically appropriate point.

2.3 Pitch tracking.

The first task in creating a useable system for employing the Theremins was to define a method of pitch tracking the analog output of the device(s) to facilitate a reliable stream of discrete data. Max/MSP has a number of standard and third party software packages for just such a task and I conducted a short survey of these to determine which would best serve my needs.

4 externals[5] were chosen to test against each other; *vb.pitch~*, a third party external developed by Volker Böhm[6], *Fzero~* and *Retune~*, both cycling74[7] native objects and *Sigmund~* that was originally developed by Miller Puckett[8] and recently updated to 64 bit by Volker Böhm.

These objects were fed a simple variable sine wave to emulate the Theremin action and assessed according to the following criteria with the factors being nominally scored out of 5 according to my requirements.

- Smoothness of operation. Rated according to any 'number choke' or leaps in the resultant data.
- Ease of implementation. A subjective view according to how simply the object works within my patching structure

[5] External is a name given by Cycling74, the company that developed Max/MSP for a small patch that fulfills a specific purpose. This allows users to employ a subpatch as a single object rather than an entire source code in order to perform specific tasks.
[6] Volker Böhm is a musician and developer working primarily with programming environments and traditional instrumentation. http://vboehm.net
[7] Cycling74 is the name of the development company that produces Max/MSP.
[8] Miller Puckette was the original developer of the Max programming environment.

- CPU efficiency. Measured using a simple test patch to give a representative datum.
- Encountered problems. Defined by any issues experienced when using the object.

Full results of this survey are available in the appendices of this document (Appendix 2) however the diagram below (Fig 1) shows the comparative results of the test. From this I concluded that either *Fzero~* or *Retune~* were the objects best suited to the task and after more targeted experimentation I found *Fzero~* to be the simplest, most cost effective (in terms of processor expense) and stable object for my needs.

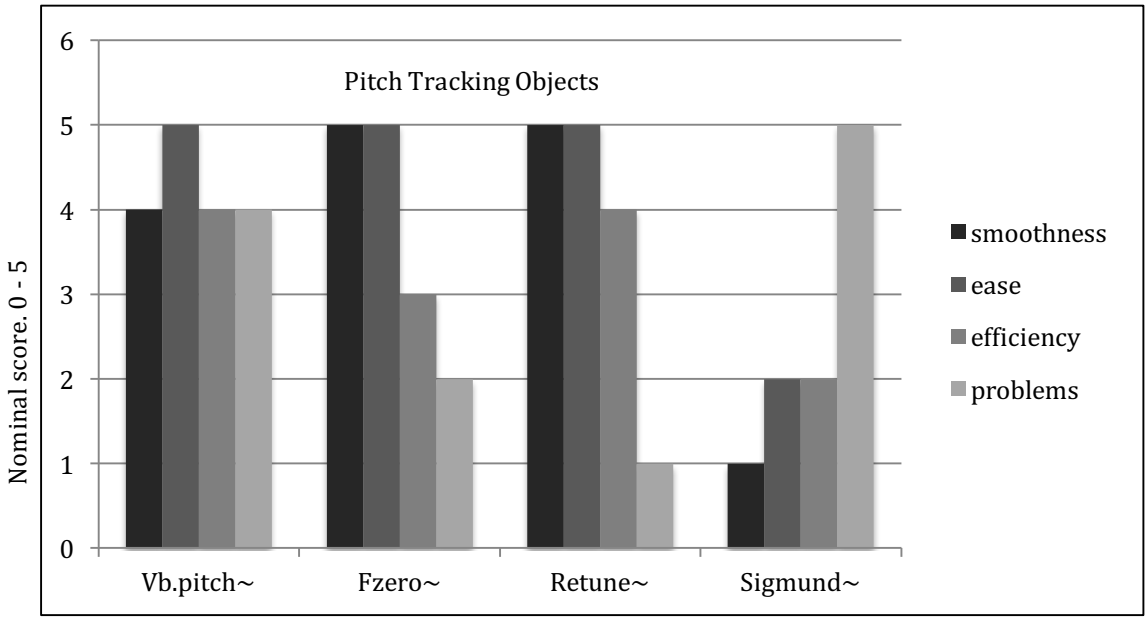

Fig 1. Comparison between the four chosen pitch-tracking objects

2.4 The re-sonification patch

Being an instrument in its own right the Theremin obviously has its own voice and I inbuilt the facility to use this in the patch. However, my primary objective

was to take this voice and use it to control a new set of sonic processes. To that end what was required was a re-sonification patch.

The Theremin is unique instrument in that not only is it proximity sensitive, which is unusual in itself, but also that its signal output never stops. These characteristics allow for both a resting and volatile state to operate dependent on activity within the space making it an ideal sensor for my requirements.

Running parallel to my pitch tracking research was the creation of a re-sonifier that would turn these audio streams and consequent post pitch tracking data set into an alternative audio reality. This required the development a patch whose parametric control would need to fall somewhere between the deterministic and stochastic approaches to emergent sound. These twin algorithmic processes can be said to provide the governing rules of most if not all generative music systems, with the former being described by Roads as *carrying out rule based compositional tasks* and the latter *integrating random choice into the decision making process* (Roads 2015. 346)[my emphasis].

However Roads proceeds to explain that these seemingly opposing terms are actually a lot more ambiguous than they would at first seem, both being based on conceptual decisions made at the developmental algorithmic level. Thus a control system may be deterministic in its overall response, operating to a defined set of rules between parametric boundaries, but within that field there may be stochastic process in operation, in that movement between the restraints may be randomized (Roads 2015. 346).

This framework was perfect for my objective in decoding the Theremin signals. The sounding patch needed to have a defined parametric formula for its ability to

perform effectively but within that retain a certain freedom to operate randomly, not least because of the volatile nature of the data source.

With these guidelines in mind as the basis of my control functions I initially developed a granular system using field recordings and plundered sounds as my source, scaling the incoming data stream to determine start points of the granular trigger across the duration of the sample using the *Groove~* object in Max/MSP. This worked to an extent but the constant volatility of the incoming stream proved too much for the playback engine to cope with. No matter how much I experimented with the grain windowing[9], the incoming data speed was just too volatile to make it stable without the problem of onset/end clicking, the curse of digital audio when a waveform is started or finished in the middle of a cycle rather than at a zero crossing point.

These frustrations led me to abandon the granular aspect of this engine in favour of solely targeting playback speed and pitch as my fluid parameters, a much simpler process to implement. The advantage with this system is that it gives a certain sonic coherence that would have been lost had I used a granular approach. I was able to employ sounds such as a drum loop that would play start to finish with constant variability whilst retaining the recognizable characteristics of the original sound, which in hindsight I think is preferable to a more obscured granular approach.

The resulting patch from this research practice is actually quite simple in its coding and operation with the pitch tracked input data variously scaled for each Theremin source to best suit the chosen playback sound. The patch fulfills its

[9] Windowing simply refers to a simple amplitude envelope applied to a granulated sound to ensure that its attack and decay phase start and end at a zero point to prevent onset and end digital clicks.

function well and imposes a relatively light load on the CPU, something that is a major factor when attempting to run such a large masterpatch. The scaling of the input stream was carefully calibrated for each sound in order to optimize both the potential volatility and the most favorable sonic position when the installation returned to its resting state. For example, the decode patch employing a rhythmic device as its soundboard was scaled so that in the resting state playback settled at a reversed tone approximately one third of normal playback speed with potential to emergence from this point when a catalyst was present. Thus what remains alludes to a sense of rhythm without being an explicit rhythmic device, which I felt might risk becoming monotonous and contrived.

2.5 Impulse Triggers.

The second series of patches to be discussed are those of the impulse triggers, dedicated pressure sensors that deliver simple 'on' commands to their responding patches in order that they should play for a specified period of time. These sensors were constructed from a floor mat with a contact microphone attached to its underside. The receiving patch was then set to respond if the input gain exceeded a defined threshold. To achieve this, an algorithm was implemented using the '*if*' object within Max/MSP, a relatively simple mathematic formula that operates on the basis of command and response, in this case the formula being *if A (input level) > B (threshold level) then send bang*

(trigger play)[10]. There was a certain amount of experimentation needed to ensure an efficient and reliable trigger but once this was achieved the system worked well in the development studio. Problems would be experienced later but these are detailed in the performance review below.

I allowed myself 4 impulse trigger mats within the space and targeted their outputs to 4 separate sonification patches;

- A patch playing a series of randomly generated sine tones whose frequency followed the laws of Zwicker's Bark Scale (see below).
- A granular playback patch with variable grain size, speed and pitch defined by stochastic processes initiated with every new trigger.
- A simple playback unit again with variable speed and pitch algorithms.
- A multiple playback system allowing for a random choice of 6 different samples.

2.6 Bark scales.

The Bark scale, proposed by Eberhard Zwicker in 1961 and named after Heinrich Barkhausen, is a method of dividing the audio spectrum into critical bands according to perceived loudness. It has been described as '*a frequency scale on which equal distances correspond with perceptually equal distances*' (Hermes, date unknown), meaning that critical frequency bands are defined by their impact on the human auditory system rather than any particular musical relationship. The system splits the audio spectrum into 24 frequency bands that

[10] In Max/MSP a bang is a simple monetary on/off switch, the object is a graphic button but responds numerically with 0 being off and 1 being on

manifest as predominantly logarithmic up to approximately 500Hz, becoming increasingly linear after that. Zwicker defined these bands as

BARK NUMBER	LOW FREQ (Hz)	HIGH FREQ (Hz)	BANDWIDTH (Hz)
1	0	100	100
2	100	200	100
3	200	300	100
4	300	400	100
5	400	510	110
6	510	630	120
7	630	770	140
8	770	920	150
9	920	1080	160
10	1080	1270	190
11	1270	1480	210
12	1480	1720	240
13	1720	2000	280
14	2000	2320	320
15	2320	2700	380
16	2700	3150	450
17	3150	3700	550
18	3700	4400	700
19	4400	5300	900
20	5300	6400	1100
21	6400	7700	1300
22	7700	9500	1800
23	9500	12000	2500
24	1200	15500	3500

Fig 2. Bark Scale. Critical Frequency bands (low/high cut off point and width of band in Hertz)

The Bark scale can obviously have a much greater scientific application, such as acoustic analysis of an architectural space or frequency mapping the physical impact along the basilar membrane within the ear (Bosi 2002. 182). However, for my purpose it simply supplies a useful division of the frequency spectrum to allow a stochastic algorithm to operate, each trigger initiating a series of play points, over time, to create something akin to a granular cloud. Of course, any division of the frequency spectrum could have been used, such as the conventional 15 or 31 band divisions used in graphic equalization models, nevertheless, Zwicker's scale, discovered in the course of my research, provided an existing and convenient model to adopt.

The sonification patch was created using three sub patches each containing 6 critical band groups with the trigger set to initiate continuous play for a randomly selected period between 3 and 6 seconds. I elected to only use the first 18 bands as I felt that above this the sine wave tones would be too high frequency to be useful, similarly I established a low frequency cut off point at 40Hz in band 1 as below this the sound would be largely inaudible. The output signals were then fed into a modulating amplitude envelope in order to increase timbral interest and run through a variable panning algorithm, a method of causing spectral movement between speakers, in order to make the resulting tones spatially dynamic.

2.7 Granulation and playback.

The next two operators to discuss are very similar in nature, the patches being variations of each other. The first is a granular playback system, using the *single, variable grain extraction* technique, where the initial trigger sets in motion an emergent series of random grain, pitch and speed selections within the chosen sample over a variable period of time (Miranda 1998. 111). The second is a straight playback engine with a random speed/pitch selector, the parameters again being delineated by the initial trigger response.

Both of these relatively simple patches are centered on the *Groove~* object, which I have found to be the most versatile playback method within Max/MSP. The function allows for simple access to the granualisation point via the start/end inlets using floating point numbers rather than having to be sent a list of messages as is the case with other objects such as *Play~,* whilst speed and

pitch parameters are determined from the first inlet and can either be directly linked or separate operations.

Few problems were encountered in the final patch development, however the omnipresent problem of windowing was once more a tricky issue to negotiate, not least due to the volatile nature of the granular selections. This was resolved using a function and line~ object combination linked to the grainsize parameter in order to make the envelope always follow the chosen timeframe of the playback, sloping in and out in the same proportionate manner regardless of the chosen granular time. Once again a panning system was added to the output stage of both patches to provide spatial dynamics.

2.8 Multiple playback engine.

The final operator of this section of the masterpatch was similar to the patches described above but employed the *Polybuffer*~ object. This allows the user to load a library of sounds from a folder into a storage unit for instant recall using one of the proprietary playback engines. Sounds are triggered according to their specific number in the list and accessed when the input receives that number.

The impulse trigger was set to operate a random choice from six samples in the Polybuffer with each initiation, allowing access to a variety of different sounds from a single source patch. This added a very dynamic and shifting soundscape to the piece as a whole that was further enhanced by the possibility of live loading a new folder of sounds, adding further variable opportunities over the course of the performance.

Again this was a fairly simple patch to implement, I initially used the *Play~* object as my playback engine but later changed this to *Groove~* due to its flexibility. One important issue to address when implementing this patch was to ensure that the individual buffer objects would play through from start to finish even if a new trigger was received to avoid both discontinuity and audio clicks from early termination. This was achieved by substituting the loop attribute of the *Groove~* object with a 0 message that fulfills the single play operation without being curtailed by a second trigger, then running the signal into a function/Line~ envelope to ensure smooth onset and tail off.

Similarly to the patches above the individual *groove~* operators were also subjected to stochastic speed/pitch variability whose parameters were delineated by the initial trigger impulse, further increasing the sonic variation of the playback regime.

The six output signals were targeted to pairs of speakers through a random choice algorithm combined with a panning unit to ensure not only spatial dynamism but also a level of indeterminacy as to where the sound would appear within the soundfield of the space.

2.9 Webcam sensors.

The final patch to be considered is that of webcams, tracking motion and colour within the space. This is probably the most complex patch in the entire system, both in terms of its response trigger and its accompanying FM synthesis sonifier,

The use of video technology for the creation of responsive spaces is not a new idea, being notably developed during the 1980's by the artist David Rokeby who

suggested the camera as the 'seeing' eye with the cable connecting it to the computer the optic nerve and the computer the brain that decodes the information (deLahunta 2008. 267).

In *FLOW* two webcams constantly monitor the space, the output signal from these cameras was split into red blue and green spectra (RGB) using the Jitter video functions within Max/MSP to provide usable data streams, with extra controls added for brightness, contrast and saturation. This second parametric level was an important aspect as it allows calibration of the camera signal to a specific bias. For example, with a negative contrast figure the response becomes predominately blue/black whereas with a positive figure it becomes increasingly red/yellow. Additional brightness and saturation calibration allowed for biasing the background toward white, creating a more defined output stream.

This decoding algorithm gave me a total of 6 separate data streams, RGB from each camera, to target toward points of ingress in the sonification patch, a re-engineered and simplified version of a six-operator FM synthesizer patch that I had built earlier in the year. Incoming data was focused toward various parameters of the instrument, such as the Carrier and Modulator frequencies and the centre frequencies of three bandpass formant filters, allowing a wide range of sonic volatility when the sensors detected changes within the space.

In order to make this patch respond in the optimum way with the sonification unit a lot of scaling of the input data was required and this presents something of an artistic dichotomy. An argument could be made against this technique as being one that is not using the raw input data stream to directly create sound but is molding that data to a particular purpose and as such it becomes more of a catalyst than an autonomous sounding data set. However, I feel that the sonic

operation of the piece has to be primary and that the minutiae of operation should be subservient rather than dictatorial to this objective. Ultimately the incoming stream was volatile, changes were registered when visitors moved within the space and those variations caused sonic shifts, meaning my overall objective had been achieved albeit in a debatably compromised manner.

2.10 The masterpatch and spatialisation

All of the above patches were brought together into a performance masterpatch with a dedicated GUI, implemented in presentation mode for ease of use. I instituted simple compression units (sourced and re-engineered from the Max/MSP examples library) on all output channels prior to final level setting. This compression was intended to fulfill a 'limiting' role, reducing the possibility of level spikes during performance and had to be calibrated with care to prevent the introduction unwanted elements such as pumping or excessive signal degradation. High pass filtering was introduced to the majority of outputs in order to prevent low frequency overload to my surround system, though these were obviously bypassed on the send to my sub speaker. Finally I implemented an external effects system using *vst~* running third party units, to allow the addition of delay and reverb to the final sounds. It is entirely possible to build such algorithms within Max but they can be very complex to make sound convincing and have a high CPU load. For such tasks I prefer to use commercial units to save both time and processor power. These external units have been omitted from the DVD versions of the patches to ensure they run on any system,

the units themselves being specific to my own effects library and not necessarily available to other users.

All outputs were assigned to what I would describe as a quasi surround-sound array, working in a 5.1 configuration. Though there is some cross panning between different outputs as described earlier, the system lacks the absolute spatial integration that is an integral to a true 5.1 array. The reasons for this compromise are twofold. Firstly the development of such an integrated system stood to further increase CPU strain, which was already running at circa 75%. Secondly I felt it unnecessary to dedicate development time to a more advanced system when a certain amount of twin pole dynamic panning could be simply implemented. A true 5.1 system is a development of its own. Controls would have been required not only to direct 5 way panning but also the instigation of azimuth and radial automation. This would have simply been too CPU heavy and I feel the compromise reached is justified to maintain the overall functional integrity of the patch.

To reinforce the volatile patches in the final performance state I also composed a six-minute, primarily low frequency, dronescape in true 5.1 that was run on a loop and underpins the entire piece as a constant part of the chaosmos. This was the only part of the installation not to use Max/MSP having been written in Logic and replayed using Twisted Wave in surround sound, serving to enhance the overall feeling of a true ambisonic environment, despite being deliberately kept at low level in the performance.

The masterpatch performed well throughout the performance with no crashes. I was pleased with its ease of use and found myself making very few parametric

changes to the system in operation, a small amount of level and compression trimming being all that was required.

I inbuilt a number of override triggers to allow me to interact with visitors in the room when I felt it appropriate to do so and this worked nicely. I was also able to drop in live sonic changes, such as changing the folder of sounds available to the multi playback engine, to allow some variation of the sonic landscape throughout the day. This was a function I had always intended but had been nervous about instigating due to the possibilities of catastrophic system failure, however, the changes worked smoothly and allowed for further interaction from my control position.

Chapter 3. Performance review.

3.1 RCPS Performance 8/7/16.

The premiere of *FLOW* at the RCPS building in Falmouth was a great success. I ran the piece over 6 hours from 12pm to 6pm and had over 50 visitors throughout the day, with many positive comments left in my response book (Appendix 3).

I encountered a range of problems during the set-up, mostly concerning the pressure pads and getting them to reliably trigger the intended patches and samples within my master patch. The primary problem with my chosen method of using contact microphones attached to floor mats as pressure triggers was that the gain level over much larger distance was significantly reduced due to unbalanced cable signal loss through capacitance, the electrical cable becoming, in effect, a storage device rather than one of transference. This situation was exacerbated by not having a dedicated gain stage on the 4 receiving channels of my audio interface, having already given priority to the Theremins on the more comprehensive channels for this.

As a solution I elected to recalibrate the response of the trigger, causing it to act at a much lower threshold, however, this also brought with it the problem of increased volatility, with a lower inception point making it more susceptible to accidental triggering. This issue was further exacerbated by the carpeted floor of the space (as opposed to the hard floor of my development studio), which created an erratic 'bouncing' effect resulting in an increase in casual triggering from outside of the intended pad area. Unable to alter the fabric of the space I

spent quite some time with my assistant finding an optimum input level for each pad to stabilize the system. This worked but only to an extent. During the performance I noted that, with a few people in the space, accidental triggering was commonplace whilst, conversely, deliberate attempts to trigger were often a hit or miss affair due to the aforementioned cushioning effect creating two bangs in rapid succession the second cancelling the 'on' action of the first.

Though disappointing in terms of my pre-planned vision of the piece I could only embrace these issues as an extension of the interactive variability of the piece. It could be argued that the pressure sensors didn't work as intended and in that the system failed, but there was still potential to trigger as intended and the added casual volatility could even be said to have introduced an extra level of indeterminacy to the piece.

All other technical aspects of the piece worked well, albeit with some small adjustments being needed to the sensitivity scaling of the incoming Theremin signals to optimize the sample playback speeds and pitch. The electromagnetic fields of the Theremins are quite narrow, only extending to approximately 2 meter diameter from the aerial and this had concerned me during development, however, this issue became negligible in reality as visitors soon embraced the need to move close to the aerial for maximum effect and also explored the subtle nuances of sound at the limits of the pick-up field, something that I find particularly interesting.

The webcam colour and movement tracking devices worked particularly well once I had calibrated the optimal levels for brightness, colour and contrast within the space, providing exactly the variable FM drone effect that I had

envisaged; relatively benign in the resting state but increasingly volatile once people entered the space and quite extreme with multiple occupancy.

The performance itself proved very interesting with many of the visitors fully engaging the interactive elements, some remaining in the space for periods up to an hour. I had previously envisaged visitors would spend 10 – 15 minutes exploring and to find them remaining for longer and engaging fully both with their own experience and also collectively as impromptu ensemble players was very satisfying, proving, I believe, a certain validity to the ideas of interactive sonic spaces as an alternative to more conventional performance art methodologies.

Though the essence of the piece is that I, as the artist, remain hidden and transfer performance duties to the visitor I did assume a position where I had line of sight to the space. This opened up the possibilities of being able to interact with visitors from my control position without being invasive within the space. I had installed trigger points, primarily as test devices, into the patch and was able to use these selectively when there was an appropriate moment to do so. However, a couple of the respondents did comment that they felt like they were being watched and as such were possibly intimidated by my presence. A potential solution to this in future could be the use a third webcam on a separate computer to allow visual monitoring of the space and possible interaction whilst remaining visually absent.

The final aspect of the performance to be discussed is that of the visual projections employed. I chose to use multiple projections using an clip plundered from the movie 'Limitless' (Burger 2011) of the main character sat at laptop with all manner of binary code superimposed on top. This was enhanced in max/MSP

with extended contrast dynamics and blended with a video of close up eyes that has become somewhat of a trademark visual device in my work (see DVD for details).

The rationale behind using this visual was a play on the idea of the absent performer, the character with laptop becoming the visual focus but projected onto 4 separate surfaces to, again, diffuse the focus. In hindsight I am ambivalent about this use of visuals, on the one level it did enhance the space visually and add a certain postmodern irony to the underlying concept, however, I'm not altogether sure that participants picked up on the irony and I feel that the projections may actually have served to detract from the sonic landscape somewhat.

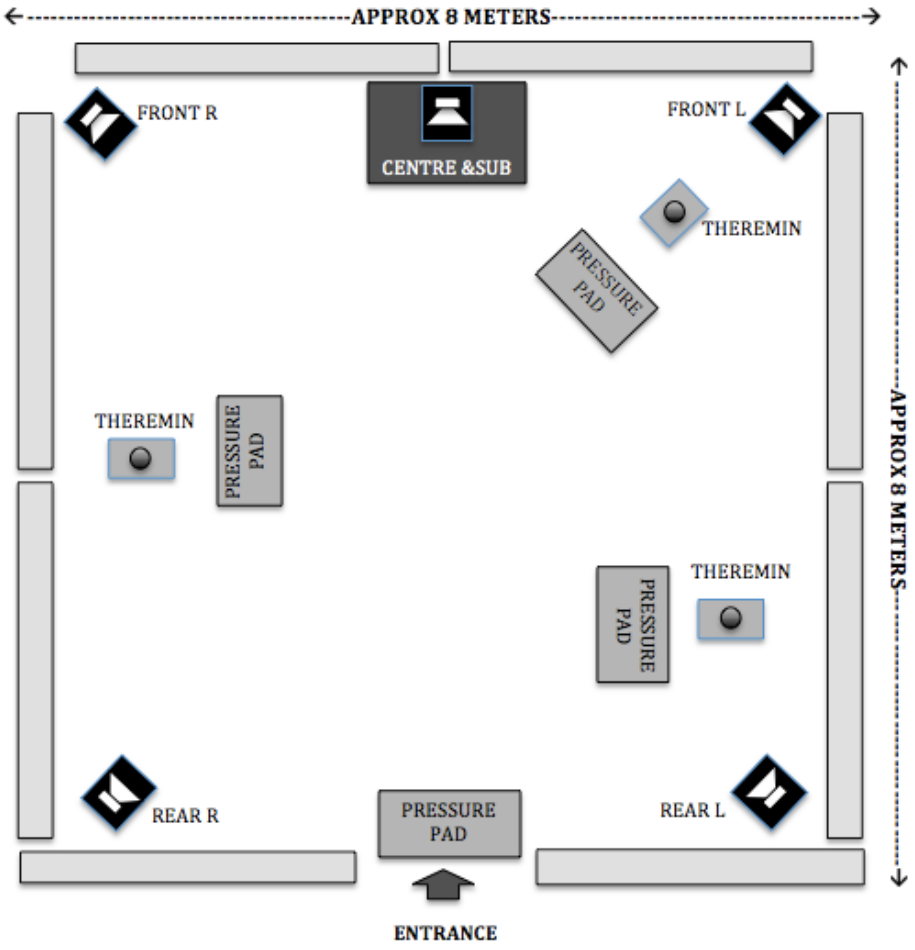

Fig 3 Plot of the performance set up for Flow at the RCPS building, Falmouth. 08/07/2016

Chapter 4. Aesthetic and contextual considerations.

4.1 Introduction.

The following chapter expands the aesthetic themes introduced in the literature review above, discussing, in detail, the ontological foundation and philosophical inspiration that informs the *FLOW* project. The chapter will open a discourse that examines choice and rationale behind the technologies used, frames the specific contextual and conceptual references that make the project what it is and accommodates a broader discussion of sonic art and its position in relation to wider performance practice.

I recognize that interactive artworks such as mine are not new or unique but this chapter will attempt to put forward how I believe my approach, intention and realisation make my work distinctive in the field.

4.2 Hauntology, cutting into the past to reveal the future.

The use of vintage technology to interface with contemporary software environments has been an essential element of *FLOW* since its inception. The temporal confusion caused by the juxtaposition of the Theremin, an instrument that in many ways epitomized early modernism, against a contemporary work that employs the most up to date processing technologies and owes a lot to postmodern theories of subjective cognition and the rejection of convention, presents a philosophical clash that I find quite delicious in its nature.

The Theremin, often quoted as the world's first truly electronic instrument, was invented in 1918 and first demonstrated in 1920 by Lev Sergeyevich Termen, more commonly known as Leon Theremin (1896-1993). The instrument has long held the fascination of both Musicians and the wider public for its seeming ability to produce sound from thin air. From the subtle instrumental style of Clara Rockmore in the mid 20th century[11] to the bombast of Led Zeppelin in the 1970's[12] and the ethereal beauty of Portishead's 'The Mysterons' of the 1990's[13] its haunting, tone and choreographic gestural playing style has captivated audiences for nearly 100 years (Baron & Buffington 2016). This otherworldly device, regarded by some as a toy or a 'one trick pony' and revered by others as a mystical noise-making machine, maintains a distinct link to the genesis of electronic sound generation.

It is this temporal fluidity, cited by both Roads and Kramer in their respective précis of electronic and postmodern music, which I'd like to introduce first in this rationale of the aesthetic ideas that contribute to the *FLOW* project.

In 'Spectres of Marx' (1993) Derrida first put forward the idea of' Hauntology, somewhat jokingly creating his own linguistic play on the French pronunciation of 'ontology', to describe his claim of the metaphysical influence the past always has in the present. In the text Derrida borrows from Hamlet (Act 1 scene v) stating that '*Time is out of joint*', and motions that the now is always responding to and adapting elements of the past, whether consciously or otherwise, in influence or opposition. He suggests that a thing, be that an object or ideology,

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[11] Clara Rockmore. Nocturne in C# Minor, Released 2006 orig. Date unknown https://www.youtube.com/watch?v=ghWdgcYIcSk

[12] Led Zeppelin, Whole Lotta Love, live, Earls Court, 1975. https://www.youtube.com/watch?v=hwgLnWHJsN8

[13] Portishead, The Mysterons, Released 1994. https://www.youtube.com/watch?v=t3baifH7bhI

remains a thing regardless of its position in the temporalities of space and time and that in remaining, has the potential to cast its spectre across time, (Derrida 1993 3-7).

Derrida was, of course, relating here to the fall of Communism and the so-called triumph of Capitalism, an idea most famously described by Fukuyama as '*The end of history'.* Fukuyama claimed that the disintegration of communism and the soviet bloc led to the end of ideological evolution, and that what is now termed neoliberalism would occupy the void left by communism, becoming the overwhelming ideological model (Fukuyama 1989 1-5). Derrida counters by claiming that ideology can never escape the ties of the past; that it will haunt the present and reappear as spirit found form at some juncture, specifically in the case of 'Spectres' that the ghost of Marxism would forever influence western society, even from beyond its perceived grave (Derrida 1993. vii-x). This seems a particularly pertinent idea in modern European political discourse where it could be argued events in Greece with the rise and subsequent fall of the Syriza movement somewhat proving Derrida's point, demonstrating that, to an extent at least, there remains a theoretical, if not practical, desire for Marxist principles in the post-capitalist corporatocracy of the early 21st century (Watson 2015).

The political and philosophical notion of Hauntology has since been adopted into many areas of early 21st century art and culture, Derrida's original theory having been reinterpreted to describe the introduction of nostalgic elements and plundered historic materials into contemporary artworks, often in combination with very ultra-modern technology. All of which leads to something of a 21st century adaptation of the Dadaist idea of the readymade repurposed which also

provides a quite beautiful irony when considered in relation to the appropriation of Derrida's original idea (Fisher 2013. 16).

I regard my use of the Theremin as a control catalyst for contemporary software as a classic Hauntological device, particularly considering its somewhat arcane appearance and need for a certain degree of choreographic gesture in its operation. It could, of course, be argued that many traditional instruments could be used in a similar way, and that argument would be equally valid. However, I feel that, on an aesthetic level, the Theremin's sheer fascinatory draw, mystery and, more pragmatically, ease of use for both those with a musical bent and the casual visitor, makes it the ideal device for my purposes.

4.3 Breaking through the fourth wall.

Conventional music performance strategies have something of an ecclesiastic air about them. A definite schism exists between performer(s) and spectators, the former running through an often fixed repertoire delivered with an either predetermined or ad hoc, adrenalin driven display of postulating and ego, whist the congregation gather and howl with appreciation or sit in rapt awe at the technical and interpretive excellence on display. The spectator is there to admire, the performer to display, with these roles being clearly defined and accepted by both parties. This scenario can be a wonderful thing for both sides of the fourth wall, the imaginary theatrical barrier between artist and spectator, uplifting and fulfilling for both protagonist and observer Nevertheless there definitely exists two distinct sides to the assemblage and in most cases the schism exists. Certainly, within this paradigm, there can be moments of

interaction, generally, but not always, dictated by the performer. Acts such as encouraged rhythmic clapping or even an impromptu sing-a-long can be great fun, broaching the separation like Alice thrusting her hand through the looking glass, but the interactivity on display is somewhat contrived and ephemeral with the accepted roles being quickly re-assumed. Of course, it could also be claimed that the performer needs the spectator as an affirmation of their work. Nevertheless, I feel this also makes the case of division, in effect the players using the separation as a necessary performative device, creating a situation of 'you are there because we are here' and vice versa.

Jacques Ranciere in his 2008 work 'The Emancipated Spectator' calls for a re-engagement between the performance and audience. The work is informed by and in retrospective discourse with Guy Dubord's 'The Society of the Spectacle' written in 1967 but even more pertinent today with the ubiquity of the Internet, social media and 24 hour instant news. Dubord claimed that we live in an age where cultural and socio-political emphasis rest in representation (populist image or encouraged perception) rather than reality (truth), that there exists a primacy of the *'sign over the signified'* and that the Media (and now Internet) has replaced religion as Marx's opium of the people (Dubord 1967. 4). Ranciere shifts this to the theatrical environment, though he retains an undercurrent of political observation, often leaving ambiguity as to exactly which *theatre* he is referencing, the playhouse or debating chamber. The author puts forward his vision for theatrical emancipation suggesting that

> *"What is required is a theatre without spectators, where those in attendance learn from as oppose to being seduced by images, where they become active participants as opposed to passive voyeurs."*
> *(*Ranciere 2008. 4*)*

Ranciere references both Brecht and Artaud as supplying possible methods for achieving spectator liberation; the Brechtian concept of epic theatre, instigating spectator consciousness through the use of devices such as direct address and stage instruction as part of the theatrical action to integrate them on an intellectual level, and the Artaudian idea of moving the theatre to the spectator, surrounding them to physically draw them inside the action in order to create integration through proximity and multiple parallax views (Jones 2009. 248-250). Both concepts break through the fourth wall to an extent, in my opinion Artaud more successfully, but I suggest both fail to truly emancipate the spectator, who remains an observer, albeit more involved than conventional theatre dictates (Ranciere 2008. 8).

Ranciere seems reticent to express what he envisages the spectator is to be emancipated from, and this I feel is a critical point, whether the spectator feels a need to feel engaged on any other level than that of observance.

I contend that, in the post-digital age, this emancipation is not an intrinsic need for performance to engage, but an inclination from the spectator to *be* engaged, a digital evolution if you like, certainly in terms of cultural activities, somewhat in defiance of Dubords assumption of complete passivity.

As the possibilities for human-computer interaction become real time realities on a popular consumer level, so they are being embraced. Take, for example, virtual reality (VR) systems, Which when the first surfaced in the late 1980's were both physically and technologically cumbersome and limited to specific specialist venues. Today VR systems exist that can utilize the mobile phone[14].

[14] For further information on contemporary VR systems see http://www.samsung.com/global/galaxy/gear-vr/

This relatively cheap, portable and suitably complex technology is attractive to the consumer (though whether this is consumer demand or marketing temptation is a moot point) allowing the potential for a certain culture of interaction to develop.

Thus, in my opinion, Ranciere's emancipation ceases to be one of necessity but of desire for greater engagement. I suggest that if the possibility for interaction readily exists and is presented as an option, it will be adopted. Returning to the performative environment, this opens the possibility for the driving force to come not from the stage but from the spectator's aspiration to be involved, something I feel that as artist/developers we should strive to embrace and facilitate.

I view the challenge of interactive performance art to be the creation of such a system or state that can fully integrate the spectator inside the work itself, to the extent that they cease to be observers and become protagonists and interpreters of the possibilities before and surrounding them. We should invite them to be physical as well as intellectual and emotional catalysts and in so doing become both performance and spectacle.

This repositioning of roles raises another issue, one of semantics but nevertheless importance. So far through this essay and indeed this process I have referred to the performance cohort as 'visitors' whereas in an interactive performance strategy we should consider them more than that, as active participants, as the musicians that bring life to the performance. In defining them as visitors I believe the artist is creating a secondary, somewhat covert, schism, maybe not a new fourth wall but certainly a fence, a device that serves to distance them somewhat from the inclusiveness that is sought. When the visitor

becomes the player and an integral part of the artwork, we must consider them equal and possibly even superior, as they are the principles now. They may be working with the tools we provide but it's their choices, their discoveries and their artistic embrace that shapes the emergent sonic landscape that without them can only exist in stasis.

So where does this re-imagination of performative roles leave us as artists? If we delegate all performance duties to our participants does that make us merely curators? Composers in absentia? Or conductors? Or do we retain the artistic credo albeit from a parallax position? The simple answer is that we are all of these; we are curators, overseeing our work as custodians of the system we have spent months creating, we are composers, the rules of the composition are ours with the volatility of response being premeditated by our decisions, and we are conductors, directors of the performance overall, to whatever degree we decide.

Nevertheless, we are still the artist, or possibly, as Ben Carey claims, the artist/developer (Carey 2016. 2). The root decisions and sonic materials are still defined by us, the methods of their emergence and their parametric restraint is still our decision, it is still our work even though our involvement may have shifted away from the traditional performative engagement. However, within this, we may have relinquished the right to call ourselves the artiste, a subtle yet important difference.

In order to validate this I think we have to first examine what it means to be an artist and indeed produce art as works. I assert that the artist is one who has the imagination, insight and inspiration to produce an object, concept or performative rationale that can justifiably be described as art, together with the specialized abilities to make those ideas a reality. What sets the artist aside from

the artisan however is, I believe, the contextual awareness behind these ideas, the ability to imagine ones concept in relation to an existing canon of work or to step fully aside from the known and create something of true originality. Above all we have to create an entity that has the potential to provoke, inspire and in some way satisfy (or dissatisfy) those who experience it on some level other than the practical or pragmatic day-to-day existence of life.

Choreographer Dr. Sarah Rubidge discusses the artistic presence of interactive installations in the context of being artworks in themselves and suggests there are two main plateaus of this structure that define pieces as works of art regardless of whether it is the artist or other who is active within; firstly that of the installation as a coherent physical, digital and often aesthetic entity, albeit requiring activation to bring it to life, and secondly that of the imaginary, the birth of activity within the structure and the perception, cognition and subjective reaction to that life given by the participant(s). Rubidge continues by highlighting a tertiary strata, that of the performance space itself and suggests that on entering the space the visitor instantly becomes participant engaging with all three of these strata simultaneously, at which point the installation does indeed become an artwork in itself (Rubidge 2001. p 1-3). Further to this I contend that there also exists a fourth strata, that of the reactions of the participant giving an ontological confirmation or rejection of the work through their engagement or dismissal of the piece. As artists we would obviously like everyone to enjoy and involve themselves in our creations, however, rejection can also inform, If for example a visitor should enter the space an immediately leave or, as was the case with one visitor to FLOW who left declaring that she couldn't handle it and it was freaking her out, we can deduce that the installation

is either not working as an engaging art form or possibly that it is working very well and inspiring extreme perceptive and cognitive reactions.

4.4 Engagement or entertainment?

It's important to also look at what is created by breaking through the imaginary wall. Is it still entertainment, as we would qualify it in a conventional musical context? Or is it an enhanced experience where the gestural possibilities take enjoyment to a different plane of engagement discovery and fascination? The physical presence of performative entertainment is revolutionized, the spectator has become the player yet remains (hopefully) entertained by discovery despite that they are generating the entertainment factor themselves.

Further to this I believe we have to look at what we are trying to achieve in the wider field of experimental music and sound art. Are we seeking to entertain at all? Or is our intention from the outset to engage in an entirely different manner, that of provocation to thought and a return to what Schaeffer described as the primacy of the ear, the cognitive analysis that one undertakes when in a state of deep listening that alternates between questions of form, source and meaning? (Chion 1994. 29-34).

In the case of soundscape art in its purest manifestation, I believe that yes, entertainment is somewhat discarded for a deeper, more internalized engagement, its essence being entirely sonic without the need for visual stimuli or movement which may even detract from the reduced listening experience. Hildegard Westerkamp considers this internalization to be a confirmation of ones being and subjective awareness of ones surroundings. Describing the

immersion into the soundscape she muses

> *"Soundscape work without the journey into the inner world of listening is devoid of meaning. Listening as a totality is what gives soundscape work its depth, from the external to the internal, seeking information about the whole spectrum of sound and its meaning".* (Westerkamp 2003. 121)

Westerkamp and others such as R. Murray Schafer and Paul Rodaway, all concern themselves with the soundscape in its most unadulterated form, the capture of passages of sonic time for later replay in a relatively unaltered way. This is somewhat at odds with my own practice. My personal methodology considers all sound materials, be they recorded in the field, plundered or electronically generated, as available media that can be sculpted and shaped as desired, and may indeed, in their final form, bear little or no resemblance to their original condition. Nevertheless, I feel that I am still justified in using the term soundscape to describe my created spaces with the need to prioritize and internalize the sonic information remaining a vital aspect to the reception of my own praxis. I create immersive sonic works and for these to realise their full potential there has to be, at some level, a degree of auditory consummation by those who perceive it, even though any meaning they bestow may be based on subjective interpretation rather than experiential source or form reference.

However, here we reach something of a dichotomy as regards interactive soundworks. Responsive performance has to, at this juncture at least, until we can directly interface the mind, engage some kind of physical activity in order for it to function as an interactive work. This inevitably results in a certain loss of aural focus; in much the same way that a conventional musician may listen in an entirely different way whilst in the act of playing, compared to the spectator who is hearing a much more comprehensive sonic image. Further to this I contend

that we are not truly working in the Acousmatic realm, a paradigm that Larousse (French dictionary) defines as *"referring to a sound that one hears without seeing the causes behind it"* and originating from the Pythagorean legend of tutelage from behind screens, that the student would only hear and focus on the voice rather than the tutor (Kane 2014. 24). On the listening level *FLOW* fulfills this definition with a distinct removal of the sound from its original cause, however, the piece exists not to be observed but to be acted upon. On a physical level, particularly with its overt encouragement and draw toward the Theremins, there exists a direct correlation between cause and effect, the movement and the sonic changes that performative gestures create. Therefore I feel what we have falls somewhere between the Acousmatic and the 'Acousmanual'.

Ultimately what this means is that the requirement to fully engage with and become consumed by the sonic materials becomes somewhat unavoidably compromised by the need for physical engagement and the distraction that this may cause. This becomes important in the perception of the gesture to sound model in that developmental care is needed not to make the results of gestural and aural interaction too obscured, that the cause and effect maintain a reasonable connection so as not to detract completely from the aural experience.

Possibilities do exist for other technologies to be employed to re-enter Acousmatic fold, such as infrared devices like the Xbox Kinect that present a far more furtive method of sensing and as such may inspire a far less conscious form of gestural interaction and a return to auditory primacy.

Here we reach a delicate balancing act, on one hand the need for deep auditory engagement, on the other a need to connect physical cause to sonic effect. The difficulty with using more clandestine technologies as the responsive base is that

one stands to lose the physical awareness of the interactive possibilities and as a consequence diminish a large aspect of the performative engagement of the piece. If participants do not realise the sonic effect of gestural interactions they may simply drift through the space none the wiser to the possible effect they are inducing. However, making interactive elements explicitly demand gestural action may serve to diminish the cognitive immersion and need for full sonic engagement.

Gareth Paine in his essay 'Gesture and morphology in Laptop performance' (Paine 2009. 214) explores these arguments from a slightly differing standpoint, citing Kim Cascone's questioning of the validity of Laptop music as a performance strategy simply due to its lack of performative presence. This is something that I have also questioned and which formed the genesis of the *FLOW* idea. As a spectacle laptop performance can be highly tedious, often comprising an individual staring at a screen that is generally obscured to the spectator while their hand moves a control unit such as a mouse. For me the question has to be raised, why have the individual there at all? Of this Cascone suggests

> *"Spectacle is the guarantor of presence whereas laptop performance represents artifice and absence, the alienation and deferment of presence"* (Cascone 2000. 95)

I interpret this as inferring that the computer musician becomes something of a Pythagorean model broadcasting into a space from a position of detachment and as such I feel clandestine sensors would also fulfill a similar role. Cascone goes on to propose that we need some kind of counter strategy of engagement to provide the performative emphasis and stimuli and bring computer based performance into the realms of entertainment. I concur with this fully, though

my solution is probably quite a long way from Cascone's own. It is the essence of interactive art to create a performative element and I suggest that employing explicit sensors goes some way to making this a viable possibility, hopefully alleviating alienation and reintroducing the performative presence to which he refers (Paine 2009. 218-219).

We are in a new age where the possibilities exist and should be explored for experimental interaction. Even within popular musical this has been done to a certain extent by the likes of Bjork. Her semi-interactive album 'Biophilia' (2011) allows listeners to access a series of apps to enhance and help visualize the themes of the recording. Whilst not interactive in real time this model does extend the remit of fixed media into a more flexible model. The old forms of musical expression, whilst obviously still valid and great fun for both sides of the wall, are no long the only way to provide this artistic presence. The development of alternative strategies, such as responsivity as a fundamental aspect of the performative environment, could begin to counter claims of computer music performance as a counterfeit artform, which is, in essence, what Cascone is saying.

Paine also points to sonic diffusion and spatialisation as a further method for the creation of a presence in gestural practice, citing the work of, among others BEAST[15] and GRM,[16] in order to both give an intimacy and intensity to the sonic landscape. For my practice this is a vital dynamic element, serving to further engage performers inside the performance arena in an almost Artaudian way, by literally surrounding them with sound and providing a spatially dynamic basis

[15] Birmingham ElectroAcoustic Sound Theatre
[16] Le Groupe de Recherches Musicales.

for the sonic immersion and reduced listening I have detailed above.

As the artist/developer one also has the opportunity to focus certain actions toward specific points or areas of the soundfield allowing further opportunities for experimentation and focused (or even diffused) listening. However, as briefly stated above, within this we also risk confusion for the participant, something that may have both positive and negative connotations; if the spatialisation field is too wide the soundscape may appear dynamically huge but may diffuse the correlation between the gesture and effect, too narrow or ill targeted and the gestural action could lead to isolation from the rest of the soundscape or simply cease to make any sense despite having points of definite focus. For example, if one triggered a pressure plate and the sound only appeared in a single speaker behind the participant the connection between cause and effect may be lost entirely. Similarly if one interacts with a Theremin and the sonic result is diffused throughout the space the gesture and result may become confused or lost in the overall sonic landscape. Restraint and planning has to be considered when moving from the Blumlein[17] image to a multi-speaker array but if handled with due care and forethought the resultant immersion can be a perfect addition to both the experience for the participant and the overall sonic presence of the soundscape. (Paine 2009. 226-229).

Finally, what happens to human-human interactions if, as I have stated above, the art we produce revolutionizes the social experience and sense of shared commonality amongst spectators of the spectacle that comes with a conventional performance. If interactive works replace the players in a traditional

[17] From Alan Blumlein, credited with devising the original recording and playback technique for the stereo image field. http://www.dpamicrophones.com/mic-university/principles-of-the-blumlein-stereo-technique

performance with participant performers who, as we have seen, are sonically focused inwardly and physically concerned with engaging the sensors, do we stand to lose the human-human interaction that makes music a social artwork?

In some ways I feel we must! In refocusing toward personal experience the cognitive presence has to be internalized rather than social, it becomes an unavoidably individual thing. This communitarian paradigm is where we must depart somewhat from Ranciere's position. He states that

> *"The less the playwright knows what he wants the collective of spectators to do, the more he knows that they should, at any rate, act as a collective to transform their aggregation into community" (Ranciere 2008. 16)*

Ranciere concerns himself with the theatre and the use of defined imagery and explicit text to portray ideas and inspire social interaction. This kind of shared communal experience may be something we have to sacrifice in order to achieve a state of internalized reduced listening, a certain degree of disassociation becoming an inevitable consequence of forcing cognition inward.

Nevertheless, opportunities do still exist, should the participants choose to explore them, to rise through this isolation, in much the same way as any musician does when playing within an ensemble. However, this differs from Ranciere's vision of social action being inspired by the playwright or director rather it has to come from the protagonists themselves without explicit instruction or encouragement. In such a situation the participants are compelled to adopt a duality of sonic concentration and to some extent enter the realms of musicianship, to recognize that ones own actions and those of other members of the ensemble are also an interaction and that a certain social awareness is required to bring the two sides of the duality together if the players wish to

produce a coherent communal response.

With traditional musical structures, of course, there exists a defined set of rules such as scales, modes, rhythms and harmonies that the ensemble will necessarily adopt to a greater or lesser degree. In the case of employing sounds as objects regardless of harmonic content these rules become a lot more vague, if existing at all, but the potential to work together still exists. It is still possible to create sympathetic sonic progressions with ones fellow participants and in this the communal feeling could be restored, the participants simply needing to be able to listen and make on the spot decisions as to what combinations work the best without any conventional harmonic rules to guide them. This takes us back to a subject discussed earlier, that of perception and cognition. The potential ensemble players need to be in a similar cognitive space and adopt some kind of communal perception in order to create a soundscape that achieves a sense of cohesion. Conversely, interesting things may also happen if the protagonists' cognitive mood is at odds with each other, though for an observer this may result in a somewhat cacophonous landscape that may be difficult to accept. Personally I quite enjoy such moments of discord and chaos.

4.5 Crossing borders into new territories.

FLOW challenges many of the conventions of performance and music, much of which is discussed above. The following sub chapter will examine the Deleuzian ideas of component, assemblage and territory as suggested in 'A Thousand Plateaus' and how these relate to the sonic structures and performance methodologies that make up the *FLOW* environment. The sounds I will discuss

relate to those used in the performance at the RCPS installation but these could be easily substituted for a new set of recordings and electronic generators according to any given position. This sonic mobility was a quite deliberate aspect of the design and allows the piece be adapted to any specific situation.

It was R Murray Schafer who first defined the term soundscape in his seminal work *'The Soundscape, Our sonic environment and the tuning of the world'* (Schafer 1977), concerning himself primarily with the environmental sonics of the world around us and its relentlessly shifting day to day cacophony. The author encourages us to stop and just listen, to enjoy the ephemeral beauty and momentary discords that make up our sonic landscape, whether that be an oasis of peaceful ambience in a city park ripped apart by a car alarm or the clamour of avian evensong underlined by the drone of a low flying aircraft. Schafer likens the phonographic capture of environmental soundscape to that of a photograph, life being in constant flux with any recording being a perfect snapshot of a moment in time, unique and complex (Schafer 1977. 3-12). However it is to Paul Rodway that I turn to for what I consider the most perfect précis of the soundscape that may be applied to my practice as much as the environmental picture he intends. He states

> *"The soundscape is a sonic environment which surrounds the sentient. The hearer or listener is at the centre of the soundscape. It is a context, it surrounds and it generally consists of many sounds coming from different directions and of differing characteristics…soundscapes surround and unfold in complex symphonies or cacophonies of sound."*
> (Rodway 1994. 86)

Environmental phonography differs somewhat from Pierre Schaeffer's Music Concrete and its focus toward sonic collage through the use of what he termed 'sound objects', used not as photographs but as paints and brushes to create

new sonic situations. These objects may have retained their original character but were subjected to manipulations that accentuated their natural rhythmic or melodic elements and placed them in an entirely new contextual framework, such as can be heard in *'etude aux chemins de fer'* (Schaeffer 1948).

The tools available to us in the post-digital age make it entirely possible to combine these two approaches and also introduce purely electronic elements such as synthesis and real time granualisation, to create a sonically inclusive approach to electroacoustic composition.

The introduction of volatile of interactive cause and effect methodologies into this inclusive soundscape causes it to become reinvigorated with fresh human energy, creating a situation where emergent states and morphological sonic changes become possible. Consequently this newly energized system may develop into a constantly shifting sonic landscape, directly controlled by human activities and choices or lapse into stasis when that energy withdraws.

Deleuze and Guattari posit that the world around us is constructed of a potentially infinite number of social, political and cultural environments that he terms milieu, which in turn are made up of components, individual entities, ideas or aspects, and rhythms, the way in which those details interact with each other within their milieu[18].

Rather than being fixed and unchanging, the milieu are in a constant state of flux with ideas, individuals and even sub groupings shifting constantly, both

[18] It's important to note that we are not necessarily talking here about conventional musical time rhythm (though we could be) rather a rhythm of existence and micro community within the assemblage.

rhythmically, within their own assemblage and in combination with other groupings. Deleuze and Guattari term this onset of change a 'becoming' and its morphology the de and re-territorialisation of existing and creation of new milieu. Outside of these defined (albeit ephemeral) milieu the authors propose that there is some kind of universal glue that whilst always in flux maintains a certain degree of stability to the assemblages that it contains. This they describe as 'the Chaosmos', the milieu of all milieus, suggesting it comprises ideas and rhythms that don't readily fit inside or are in transit between specific milieus. This is a territory where artifacts from the fluidity of milieu exist in a state of potential until they either find their place in an existing or entirely new assemblage or remain as elements in the non-aligned stasis in a constant state of potential or becoming.

These are difficult concepts to wrap ones head around or even find an analogy for but consider a child blowing bubbles on a summers day, the bubbles representing the milieu and the atmosphere the chaosmos, the bubbles float in the medium of air that surrounds them, similar but separate. Yet those bubbles also contain elements of the atmosphere and may burst releasing their contents back into the atmosphere or even combine mid air to form a new bubble that may be larger or a new shape entirely.

The Deleuzian cosmological model is entirely non linear. The authors maintain that there is always potential for multiplicity of interpretation, representation and transformation. There is no point of origin, no limitation to the direction of growth and no adherence to any specific point of entry or exit. This Deleuze and Guattari describe as the Rhizome, analogizing the botanical model of the same name that, contrary to a root and branch system, has the potential to grow and

reproduce in any direction even if separated from the main body.

The philosophical Rhizome operates outside of the constraints of conventional growth patterns and standardized logic. This freedom allows for expansion, development and mutation, according to whichever way the indeterministic actions of milieu happen to shift at any particular time, actions that may have a minimal effect or may send chaotic ripples through the local or global milieu (Deleuze & Guattari 1987. Ch. 11).

Transitioning these ideas into an artistic, and specifically an interactive art context takes a mere slide of the imagination. They have come to form fundamental framework for my approach to this and previous works, embracing nomadic sonic morphology and Rhizomatic structures as essential compositional and developmental devices.

As I have highlighted in my literature review the Deleuzian Chaosmos of *FLOW* is formed by the resting state of the piece. However this equilibrium is still in a state of flux and potential; the webcam dronescape remains volatile, even if just due to the light of the projectors, as do the Theremins whose magnetic field is always subject to voltage fluctuation and consequent slight signal drift, whilst the looping underscore drone runs through its own repertoire, a constant background of stability that underpins the whole piece. On top of this virtual stasis there always exists a tension with the potential for multiple emergent shifts in the soundscape always just a movement away.

Once the environment is activated by the entry of a participant player this equilibrium is broken, a becoming has been initiated. The Bark scale generator begins to spread a series of sine waves, creating an entirely new tonal and spatial dynamic within the space. Players graduate toward the Theremins and begin to

introduce rhythmic, temporal and timbral variations. The assemblage becomes increasingly excited, nomadic shifts being created in the near static field to create multiple new variations and emergences. New sonic milieus come to the fore with every response, even the smallest movement possessing the potential for a new becoming toward fresh emergent sonic shapes and timbres.

Artistically this raises an interesting and vital aspect of the soundscape; Bold gestural statements toward the Theremins may create very obvious, 'first line melodies', ostentatious and bombastic, taking all the glory. However, it is the small, possibly accidental, movements, those that happen at the very limit of the Theremin range that provide the essence of the piece. This peripheral interaction puts the chaosmos into deeper, more constant flux, changing the sonic shape of the entire environment, regardless of more prominent actions. It becomes increasingly ephemeral and constantly volatile, like a shifting sea of sound upon which ships of deliberate intent can operate as tangible focus points. As with all music, I suggest, it is often that which underpins the whole that forms the heart of the matter, the basis upon which more overt structures can be built. In *FLOW* this is the musical chaosmos, the milieu of milieus that gives credence and validation to the more overt and deliberate emerging sounds.

I propose that the becoming of a new emergent milieu that occurs when a participant enters the space is the injection of organic energy into the impotent circuits of computer and software. This vitality sets up a circular discourse, human action imparting dynamism into the software, opening the motion of digital process, the results of which return energy to the human in the form of sound.

Pioneering interactive artist David Rokeby speaks of this invigoration of the

digital realm in his series of works entitled 'Very Nervous System' (VNS) that first appeared in the mid '80s and continued in various iterations up to the mid 90's, suggesting that

> *"Because the computer is purely logical, the language of interaction should strive to be intuitive. Because the computer removes you from your body, the body should be strongly engaged. Because the computer's activity takes place on the tiny playing fields of integrated circuits, the encounter with the computer should take place in human-scaled physical space. Because the computer is objective and disinterested, the experience should be intimate".* (Rokeby ca. 1990)

This exchange of energy is *the* vital component of the interactive system and could also be said to relate to aspects of the aesthetic rationale that informs *FLOW,* not just energizing the sonic milieu but also vitalizing and being vitalized by the new performance model. The participant is now the energetic catalyst, the most volatile, unpredictable element in the performance, driving the emergences toward new territories according to their own cognition and perception of the audio space.

At this point we may see the development of an assemblage of participants, whose number dictate the level of potential energy imparted into the system. A single participant leads to a relatively small degree of spectral flux, a situation that increases with the coming of new catalysts. Here the streams of becoming begin to interact with themselves; the more participants leads to a milieu of performers, possibly an ensemble working together but not necessarily so. With a populated space morphologies become increasingly volatile, a milieu of energies is formed. In this state it may not be entirely certain whether any individual sonic milieu exists or whether every component is in flux, all elements assuming a state of deterritorialised becoming, not just in terms of their

temporal and timbral characteristics, but also their dynamic occupancy of areas of the space. Here territories take on a more literal meaning, certain sonic assemblages target toward specific speaker pairs, their panoramic or point dispersal being dictated by the same energy transfer that controls their tonal characteristics.

As this subchapter demonstrates, *FLOW* is the subject of numerous Deleuzian interpretations; the nomadic milieus of sound and spatial dynamics, the assemblages of participants and their energy giving interactions, that energy itself and the overall rhizomatic soundscape that is created through the various processes and actions in place. The framework is not perfect; in the majority of cases the source sound remains unchanged rather than open to participant selection and introducing such variation could be a possible future development. The Rhizomatic structure is disturbed by the unavoidable need to turn the system on or off at some point rather than it being a constant, though whilst in operation the piece is entirely open to participant choice as to the structures they create, and there is a certain hegemony in terms of the Theremins which are obviously an attractive draw for participants both visually and sonically. However as an aesthetic position I believe Deleuzian concepts provide an appropriate and effective model.

4.6 indeterminacy and experimental processes

Musical indeterminacy relates to a lack of explicit direction given by the composer as opposed to the generally strict determinacy of instruction employed in a conventionally written score. It could be argued that a

conventional score does still have indeterminate qualities in as much as one could rarely portray the given instruction in the exact way that was intended by the composer, but this is more the realm of interpretation rather than a deliberately nebulous process. Indeterminacy can take many forms and may constitute the whole or part of the composition or process that leads to performance. In contemporary experimental and electronic systems this has often come to mean the deliberate and algorithmically constructed instigation of stochastic (random) or aleatoric (rule based) processes, which, as is the case with *FLOW*, are often parametrically limited in their operation.

To highlight this variation in indeterminate possibilities I would like to look at John Cage's essay *'composition as process: indeterminacy'* (Cage 1958) that examines the role of the performer role in a series of works. In this paper the author compares the determinate and indeterminate rules imposed by the composer on numerous works but for the sake of brevity I will look at just the first three here.

Cage opens his argument with the predetermined and structured score of Bach's *'The Art of Fugue'* in which he offers that the performer is only in a position of adding musical colour and nuance due to the rigidity of the score, but, without any explicit instrumental dictation, retains a certain freedom of interpretation. The second piece examined is Stockhausen's *'Klavierstück xi'*, here Cage notes, the performative element is not that of colour but of giving form to the two page graphic score that has no explicit direction other than tempo and dynamic. In the third example the author highlights the scant notational and durational instructions supplied in Morton Feldman's '*intersection 3'* suggesting this piece falls somewhere between determinant and indeterminacy with only

certain tonal and rhythmic decisions made by the performer but the instrumental choice determined by the composer, something Cage likens to a photographer being given the tool and asked to use it creatively (Cage 1958. 178). The final piece I would like to include in this, though it is not covered in the original essay, is Cage's own '*4'33*', quoted by many as being the ultimate in indeterminate composition. Here the entire piece centers solely on the ambience of the space in which it is performed, with no notational, instrumental or overt musical form given, other than overall duration. Cage's concept behind this was that such a freedom of expression would result in any sonic happening within the space being the moment of impulse that defines the performance, all sonic elements being entirely unplanned and as such completely indeterminate and unrepeatable.

The examples above all display levels of indeterminate instruction. Bach supplies all the musical information but leave the choice of instrumentation open. Stockhausen provides a variety of options for free interpretation in whatever manner the performer chooses adopt, Feldman instructs toward instrumentation but gives minimal direction over musical form, whereas Cage provides for no externalized structure or guidance whatsoever other than that the piece should end at a predetermined time

This search for indeterminacy as the result of chance processes defined Cage's career as an experimental artist and he openly declared that the end result of his works might not be predictable beforehand, stating

> *"That composition is necessarily experimental. An experimental action is one the outcome of which is not foreseen. […] A performance of a composition which is indeterminate of its performance is necessarily unique. It cannot be repeated. When performed for the second time, the outcome is other than it was."* (Cage 1958. 184)

Brian Eno however, disagrees somewhat, suggesting that '*the primary focus of experimental music has been toward its own organization and toward its own capacity to control variety and to assimilate natural variety'* (Eno 1975) - that it is the processes that the artist sets in place and motion that work toward a range of possible outcomes, albeit possibly unique and unrepeatable but still falling within a certain degree of predictability or determinacy. Both artists shun the traditional instructions of musical convention and both place little credence on the precise 'finished' nature of a piece, with the differences in their philosophical approach being that Cage thought complete indeterminacy was possible and desirable whilst Eno does not.

I believe Eno's position is particularly pertinent in terms of the processes in contemporary experimental computer based music, especially in programming environments. In such systems its very often necessary to parametrically inhibit stochastic processes in some way, whether that is by installing some algorithmic aleatory such as a Markov chain or placing constraints on the upper and lower points between which stochastic process can occur. Yes, it is entirely possible to make a completely random sound generator, however, it may not be desirable or even practical to do so, and as such the results will necessarily be determinate to some degree.

Despite this, we are still in process, still exploring the paradigm of experimental music as laid out by Cage, Eno and others where the methodology inherent to composition or sound generation is often single most defining factor of a work, something that Michael Nyman describes when he suggests

"[Experimental composers]... Are more excited by the prospect of outlining a

> *situation in which sounds may occur, a process of generating action (sounding or otherwise), a field delineated by certain compositional rules"* (Nyman 1974. 211).

In the case of *FLOW* indeterminacy is schizophrenic. It lies entirely hidden, yet operates in plain sight. In much the same way as Feldman's *'intersection 3'* the instruments are determined and offered openly but no instruction to their usage is explicitly given. The very nature of the Theremin with its instrumental fluidity instantly provides a high level of sonic indeterminacy. The participants themselves form an indeterminate factor, encouraged to explore the space and see what happens but with no prior briefing as to how the elements may react.

These are performative levels, strata that both the artist and the performer know. However, beneath this visible and tangible environment lies a hidden indeterminacy that exists in the software. This level of stochastic volatility is entirely covert to those who perform and their only knowledge of it is through their own auditory reception. To the performer it is the voice in the mind that the individual is aware of but has no understanding, whilst to the artist/developer it remains a fundamental of the system design, albeit one whose control they have delegated.

Thus we have two levels of indeterminacy, the first a volatility of data and its interpretation to provide sonification, determined yet indeterminate, hidden yet audible and secondly an entirely unpredictable element in the ad hoc performance cohort who are free to interpret the space and the emergence of new sonic landscapes as they chose. On one level the installation subscribes to the Cageian idea of complete freedom whilst on another is subject to Eno's idea of controlled variety and parametric restrain.

Sonically this presents us with what could be described as a 'shimmering milieu' containing defined components whose rhythms are constantly in a state of emergence, even in their most stable state. Meanwhile the most indeterminate factors, the participants, instigate entirely stochastic states through their movements, exciting the components and causing new emergences that neither they nor the artist can predict.

To close, I return to Nyman and his description of experimental processes in relation to the factors of indeterminacy, when he states

> *"Experimental composers have evolved a vast number of processes to bring about 'acts the outcome of which are unknown' (Cage). The extent to which they are unknown (and to whom) is variable and depends on the specific process in question. Processes may range from a minimum of organization to a minimum or arbitrariness, proposing different relationships between chance and choice, presenting different kinds of options and obligations"* (Nyman 1974, 211)

Chapter 5. Conclusions.

5.1 Introduction

FLOW opens a circular discourse. Not one of proposal and argument but of movement and response. Protagonists inject energy into semi dormant systems to initiate processes, which then deliver energy back to the performance space through the speakers.

The temptation when using computers for composition is to sanitize everything, to shift every note and nuance to an exact place and time, to be consumed by the absolute lattice of horizontal rhythm and vertical harmony (Wishart 1996. 11). In its most disciplinarian form this process serves to remove the minute human inaccuracies from recordings and performances and in doing so risks diminishing the unquantifiable artistic energy that gives human creativity its vibrancy (Eno 2016).

Responsive systems can allow us to open a physical and cerebral interaction with the computer by injecting humanity back into the program material, instilling a certain vitality into the passive and ruthlessly efficient non-sentient machine in order to bring computer/laptop performance to life. Certainly in any modern digital system there will still be sterile 'computer only' processes. However, the creation of volatile data streams, fuelled by sentient external sources, allows the ingress of an organic fluidity that is impossible to synthesize, based as it is on free will and human cognitive choice. To this end I suggest that, in a responsive environment such as *FLOW*, human interventions present a very high level of indeterminacy. Every individual will react and interact uniquely, in

such a way that it is impossible for the artist and possibly even the participant, to predict in advance, bestowing into the computer the aforementioned vital energy in a completely idiosyncratic way.

5.2 Synopsis of the aesthetic properties of the project

Traditional performative frameworks are cast aside in *FLOW*. The piece exists to do this, to disrupt the schism between auditorium and audio-maker. Spectators become participants; freed from the role of the passive observer they become the catalysts that drive the creation of new emergent sonic structures.

This new paradigm is wholly reliant on visitors entering the space and assuming an active role. Without their presence the piece can only exist in a state of near stasis. Entry brings about a vibratory rhythm, an excitement of components, breathing life into that which is resting. Participants become invested with an artistic mission and challenged to become the creative moment.

FLOW is not temporally fixed in the post-digital age as a form of neo-modernism but explores the past as an element of the present, embracing both the Genesis and Revelation of electronic sound.

We live in a world of metaphysical spectres, where that which has supposedly gone still manifests itself into the here and now. Digital ubiquity and the vast archive it presents has enabled us to bring shadows of the past into contemporary culture as fundamental artistic devices, whether that be employing nostalgic images, historic recordings or, as is the case with *FLOW*, the use of what is largely regarded as historic technology to interface with a contemporary software environment.

The sounds and timbres that make up *FLOW* are not those of fixed composition and definition but of shifting multiplicities and territorial schizophrenia. Sonic structures exist but shimmer, their elements spatially, timbrally and temporally in a state of constant volatility.

New sound assemblages are created with every movement, unique and unrepeatable yet all the while stabilized by the universal ambience that exists to clarify the changes that catalysts bring. Milieus of sound mutate, shift and impose aspects of themselves onto neighbouring objects. Ephemeral territories are born in the moment, exist and then fade, to create an ongoing generative soundscape that reinvigorates the arena.

Indeterminacy and restraint are critical aspects of both the human interaction and the software that make the installation a reality. Data streams are generated in a state of stochastic freedom then harnessed and restrained, still free but given boundaries to ensure useful function.

To allow complete indeterminacy may be a beautiful theoretical idea but in reality may cause a state of discord that defeats coherence and promotes chaos. For some this is desirable. Noise, as a compositional device, can be highly immersive if the listener can overcome the initial lack of cogent communication to discover the fascinatory strata within and maintain that engagement without becoming jaded by it (Reynolds 1990. 55). However, it becomes an artistic and aesthetic decision whether to allow such abstraction to occur. Primarily I choose not to, restraining stochastic processes to maintain clarity, yet even within this the possibility for chaos still exists. If the number of catalysts reaches a certain point data streams become overwhelmed, the vibratory rhythms become too volatile for coherence to exist, all milieu disappear and the piece becomes

entirely fluid. Nevertheless, this disarray is transitory, as catalytic actions decline so order returns.

The opportunity to combine electronically generated and recorded sound in real time afforded by digital technology opens a new world of sonic potential where reducing sound to a molecular level induces a new kind synthesis.

Real-time sonic granulation allows us to turn any minute snippet of sound into a quasi-synthetic source introducing a new level of sonic schizophrenia. Here recorded sounds assume wholly electronic character, at once synthesis but not synthetic. Sources become completely obscured and oscillations develop, taking Schaeffer's tape splicing experiments to another dimension, not an extension but a reduction, the dissection of objects to molecules. Meanwhile, inside this reduction, the possibility for extreme temporal, pitch and timbral manipulations, subjected to either indeterminate or predictable processes, allow single sound recordings to take on a multiplicity of manifestations.

The above provides a précis of the contextual and philosophical aesthetics that inform the *FLOW* project as described in detail in the body of this paper. The project is a bricolage on numerous levels; sonically, physically, aesthetically, temporally and spatially, a collection of ideas, techniques and sonic materials brought together to form a tangible whole.

It is my belief that this aesthetic awareness and information is the most critical aspect of this work and indeed, any artistic project. The machinery of a system and the pragmatism of its physical and digital methodologies are essential and visible aspects of any installation but mean little without a firm philosophical rationale to reinforce and contextualize the work. The aesthetics behind *FLOW*

are not easy. Its many strata overlap or move in seemingly tangential directions, much the same as the sonic actuality of the project. Ideas have been borrowed, adapted and subverted to fulfill my artistic ambitions, however its my contention that they result in a cogent artistic position that serves to underpin and frame the actuality of the installation.

I firmly believe that *FLOW* has created an alternative performance paradigm and that this is one of populist engagement that embraces visitors and allows them to become fundamental to the work, something, I suggest, is proven to an extent by the respondent comments (appendix 3). I do not claim this as an original notion but feel this installation goes someway to demonstrating that responsive environments can present a forward motion for musical and sonic performance ideas as we move deeper into the 21st century.

5.3 Answers to questions posed

Finally I would like to look at the performance in relation to the questions posed at the outset of this paper;

- Whether visitors accepted and embraced the responsive possibilities of an interactive exposition? Did the inclusivity make sonic art more accessible, less intimidatory and easier to understand than more static installations or sonic art performance.
- Did the installation succeed in breaking down the theatrical 'fourth wall'?
- Did the use of highly visible and fascinatory technology add to the inclusivity and attractiveness of the piece or would discrete sensors such as Xbox Kinect allow for more predictable interactive response?

Any conclusions of this type from the artist are inevitably anecdotal rather than grounded on any evidential base. However I will use, as reinforcement, references to comments left in my response book to provide an element of proof. I do have a slight mistrust of such opinion collection, particularly if respondents are known to the artist, as there exists a risk that they may be simply telling you what they think you want to hear rather than giving an objective and considered opinion. Nevertheless, there were a number of people who attended the performance who I wasn't acquainted with and as such I feel this can be considered an evidential guideline at the very least. The opportunity to respond was left intentionally open rather than being a formalized questionnaire to allow greater freedom to express opinions rather than directing respondents to specific inquiries. Whilst this may seem counterintuitive in relation to the specific questions above, my reasoning was to garner opinion of the project as a whole and interpret the responses from that point, rather than direct commentary to defined areas.

Firstly lets consider whether the installation encouraged engagement and if the performers came to understand and embrace their role.

For the most part I believe both of these objectives were achieved. Only three participants throughout the day sought any instruction as to how they were to use the space, with these given only very basic instruction, including the caveat that they should listen as much as offering movement, in order to give equal weight to both cause and effect.

An interesting discussion occurred when a sound engineer friend expressed that he felt there should be explicit instruction given. I countered that I would find that somewhat contradictory with essence being for the individual to

explore and use the sound materials to create their own sonic territory through interaction. This did cause me to wonder whether modern culture has become so prescribed that the sense of discovery and experimentation for oneself may have possibly become somewhat diminished. However, the majority of participants did engage without direction, with one explicitly expressing a joy at the discovery aspect of the piece (Appendix 3 xiii), so hopefully my fears on that level are unfounded.

Several younger people, the youngest being just 18 months old, attended the performance and their sense of fascination and interest was hugely gratifying. This, I believe, demonstrates that the installation did promote an inclusivity free of many of the staid restrictions that can often accompany gallery expositions, the teenage participants, especially, interacting both in the intended way and also quite vocally as part of their own interpretation. Of the adult respondents it was pleasing to read that some wanted more interactive elements (Appendix 3. iv). This was something that I had considered in development but was wary of swamping the environment both sonically and in terms of interactive possibilities, feeling that too many sensors could be as counter-productive as too few.

One participant did note that some of the elements were not as responsive as they possibly could be and this bears further research (Appendix 3. viii). I suspect that the author was referring to the pressure pads, which, as I have stated earlier, didn't work quite as planned. The positive of this comment is that it does demonstrate that participants were not only engaging on an entertainment level but also one of deeper listening, with recognition of device failure indicative of this to an extent. Further to this it was also pleasing to hear

people indicate how they would like to see the installation extended, such as linking the visual elements to the sonic changes (Appendix 3. xx) and the desire of one respondent to see this kind of work integrated with dedicated dancers (Appendix 3. xii).

I believe that to an extent the piece did break through the imaginary fourth wall of conventional performance, however it occurs to me that what has been created has transcended such ideas. The installation could be said to have become an inclusive experience with performative elements rather than simply a reworking of the traditional model. The idea of performance as spectacle has been subverted to such an extent that it ceases to be such. Though passive reception may still occur, as one respondent expresses (Appendix 3 xxvi) the piece predominantly succeeds in encouraging active involvement (Appendix 3. ii). In hindsight, to describe *FLOW* as a performance at all seems a rather weak description with the piece having been variously described as an exhibit, an experience and an interactive space (Appendix 3 xi, xxii, xxviii)

Finally, I would like to briefly conclude on the nature of the technologies used. This has been explored in greater detail in the body of this paper, however I believe it warrants further underlining here.

I feel that the use of highly visible sensor instruments facilitates a far more engaging environment than a more surreptitious approach. Certainly much more advanced technologies exist but these work in a more clandestine manner and I believe this could possibly become an inhibiting factor when seeking to engage people in an interactive environment. I posit that, for interactivity to function at a performative level, particularly when dealing with casual rather than trained performers, its desirable, if not essential, for participants to realise *how* they are

interacting as well as *what* influence their actions are having, in order to retain their engagement. This is particularly pertinent in relation to the use of Theremins, which have their own inherent fascinatory attraction for the visitor entering the space. I feel that providing such explicit sensor technology has made *FLOW* accessible and engaging for both informed and casual visitors in a way that more clandestine technologies may have failed to do.

5.4 Possible futures. Developments and potential

As a viable artistic installation *FLOW* functions well, it achieves its aim of bringing the spectator into the performance as an integral player in the piece and its explicit sensor technology invites interaction with its sonic elements. However, as noted in the technical review of this paper there is room for improvement both aesthetically and technically, particularly in relation to the impulse triggers. A possible solution involving infrared beams as simple on/off signifiers could be a viable resolution to the somewhat unreliable physical trigger method and for these particular elements a more clandestine approach could actually be beneficial. One respondent did suggest that the floor mats could be said to be somewhat visually incongruous (Appendix 3 viii), and this is something a covert trigger system would eradicate, though once again, to do so may risk a disconnect between physical cause and sonic effect.

I feel that all other technical aspects of the piece worked well though I am tempted to redesign and simplify the sonification patch that responds to the webcams. I feel that the piece would benefit from a more 'rounded' sounding default setting, possibly employing a subtractive synthesis generator, with

potential for more extreme changes rather than the somewhat harsh timbre that FM synthesis brings to the Chaosmos. If anything I feel that this aspect of the piece was underused due to its sonic limitations and further development would be desirable if this aspect is to fulfill a greater role in the overall sounding of the installation.

The second performance of *FLOW* will be at the '*Somextro Exposition of New Music'* at Falmouth University in October 2016 and will feature an entirely new set of sounds, based around a Concréte sonic sculpture of Falmouth and its surrounding area, in-line with the sonic mobility of the installation. This adaptability has always been an important aspect of my design, allowing a tailoring of the piece to any specific place or situation, either as an artistic decision or to fill a specific brief.

To this end, I have been in also been in discussion with a local art gallery with a view to potentially installing the Theremin sensors as a method of adding a sonic dimension to conventional painting exhibitions. If this idea does come to fruition I would aim to design out the dedicated computer aspect of the piece in favour of an embedded system using Arduino boards or similar in order that the installation be wholly autonomous. Such a development would be the essential next step in increasing the mobility of the concept to allow it to be installed and left at any site.

Finally, in terms of further academic enquiry and possible pragmatic uses for my research into responsive spaces, the possibility exists for development into other areas such as that of Music Therapy. Any expansion in to this field would have to be conducted in collaboration with Therapeutic specialists and require a refocusing of my own research to take in such works as Amelia Oldfield's

'*Interactive Music Therapy – a positive approach'* (Oldfield 2006).

Such a development could represent a possible future advancement into PhD studies, however, these ideas are entirely speculative at this stage and I feel further expansion is unnecessary here.

Appendices

Appendix 1. Jonathon D Kramer. Postmodern Concepts of Musical Time.

"While postmodernism is a difficult concept to define rigorously, it is possible to characterize postmodern music by some or all of the following traits. It

1. Is not simply a repudiation of modernism or its continuation, but has aspects of both.
2. Is on some level, and in some way, ironic.
3. Does not respect boundaries between sonorities and procedures of the pats and present
4. Seeks to break down barriers between "highbrow" and "lowbrow" styles
5. Shows disdain for the often-unquestioned value of structural unity.
6. Refuses to accept the distinction between elitist and populist values.
7. Avoids totalizing forms (e.g. Does not allow and entire piece to be tonal or serial or cast in a prescribed formal mold)
8. Includes quotations of or references to music of many traditions and cultures.
9. Embraces contradictions.
10. Distrusts binary oppositions.
11. Includes fragmentations and discontinuation
12. Encompasses pluralism and eclecticism.
13. Presents multiple meanings and multiple temporalities
14. Locates meaning and even structure in listeners more than in scores. Performances or composers".

Appendix 2. Pitch tracking survey.

Criteria for assessment of the objects were as follows with the factors being nominally scored out of 5 according to my requirements.

- **Smoothness of tracking operation**. Rated according to any 'number choke' or leaps in the resultant data. (High score = greater smoothness)
- **Ease of implementation**. A subjective view according to how simply the object works within my patching structure. (High score = greater ease)
- **CPU efficiency**. Measured using a simple test patch to give a representative datum. A sinusoidal signal with variable frequency is fed into the object and the resultant CPU roughly averaged for comparison. (High score = more efficient)
- **Encountered problems**. Defined by any issues encountered using the object (High score = more issues)

Vb.pitch.

Vb pitch tracks the incoming signal accurately using the normalized square difference method, the comparison of the incoming signal against a fixed datum. The tracker is easy to implement and has a low CPU impact, however the object periodically outputs infinite numbers causing parameters further down the chain to lock up and as such is too volatile to be of practical use.

Smoothness 4.	Ease of implementation 5.	CPU efficiency (1- 4%) 4.	Problems 4.

Fzero~

The Fzero object uses fft analysis to ascertain the fundamental frequency of the incoming signal by measuring the spacing between incoming wavelet peaks. This results in an accurate estimation of the fundamental but the tracker is limited to that fundamental frequency and its peak amplification average, somewhat restricting its usefulness. The object was stable without any of the infinity issues I encountered with vb.pitch. However, being an fft analysis object it is considerably more expensive in terms of CPU.

Smoothness 5.	Ease of implementation 5.	CPU efficiency (3-6%) 3.	Problems 2.

Retune~

Retune~ uses Ztx technology, an adaptive wavelet analysis and comparison system, to accurately determine pitch information. Unlike the other three tracking methods the object allows both mono and polyphonic operation; it is simple to implement and produces reliable results. Most

importantly for me in this project the object is very CPU efficient measuring only 1-3% with the test signal.

Smoothness 5.	Ease of implementation 5.	CPU efficiency (3-5%) 4.	Problems 1.

Sigmund~.

Similar to Fzero, Sigmund uses fft analysis and outputs the resultant data as sinusoidal components. Sigmund is far more flexible than the previous two methods, allowing users to define average pitch, notes at onset of incoming signal, continuous amplitude envelope, and peak-amplitude. The object did not behave very consistently with frequent load fails and data jams.

Smoothness 1.	Ease of implementation 2.	CPU efficiency (3-6%) 2.	Problems 5.

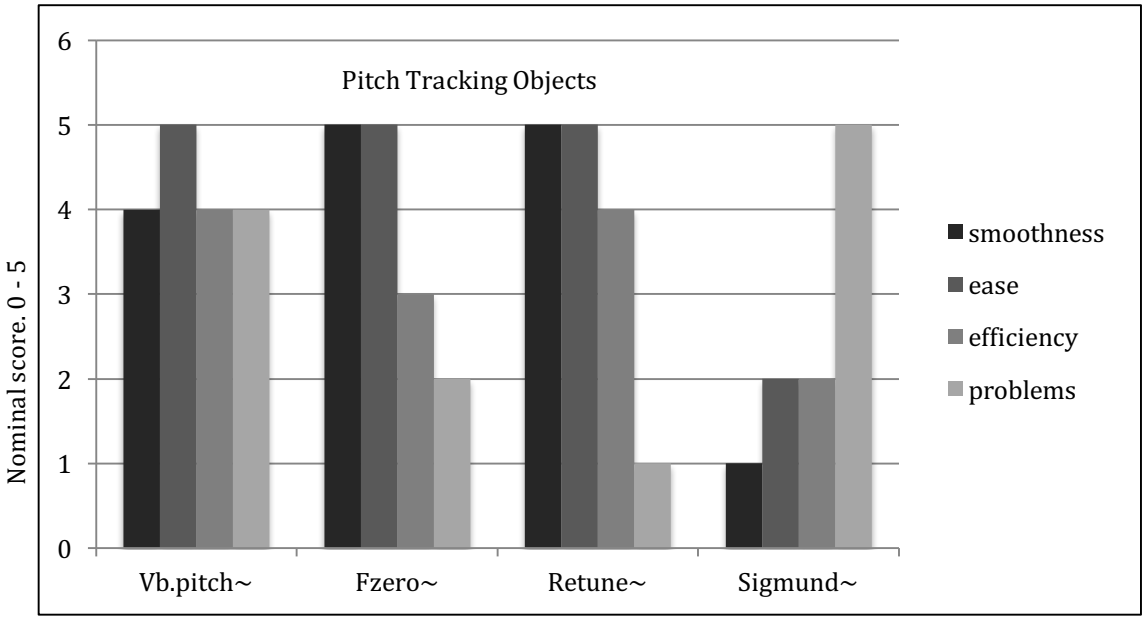

Fig 1. Comparison between the four chosen pitch-tracking objects

Survey Conclusions.

As the simple chart above displays, all pitch trackers tested have their merits and pitfalls. Vb.pitch is smooth easy to implement and efficient but is too volatile to be considered. Fzero~ is very smooth and easy to use but has increased CPU whereas Retune~ is equally smooth and efficient but carries less problems, however, if the tracker does not 'see' a signal it defaults to zero which causes certain problems. Sigmund~ is the most complex complicated and uses even more processing power. Tracking was very jittery with the datastream freezing then leaping forward. Problems were also encountered with the object itself not always being recognized by Max as an external, possibly due to a bug in the software.

Appendix 3. Respondent comments.

The following comments are transcribed verbatim though handwriting issues may possibly mean some errors exist. Visitors were encouraged to respond but not required to do so. Both praise and critique were encouraged. I have omitted any personal details submitted in order to maintain anonymity.

- Weird! I bet children would love it, would be good to do it with several of them to see who what would emerge.
- Nice use of space sonically and visually the size of the room provides a good acoustic backdrop for the piece and the closed in projected walls provide the feeling of a closed off area forcing the audience to become participants. The Theremins are really cool tools

for interacting between human and computer and require no technical or musical ability to enjoy the installation.

- Loved it, reminds me of being at Liverpool Psyche fest again; it's great to be able to create sounds yourself. Falmouth needs more installations like this.
- Really interesting and enjoyable. Would like to see more interactive live performances like this. Would've been great to have more effects to play with.
- Really enjoyed this - pretended I was in Hawkwind.
- Extremely psychedelic! Jolly good.
- I found the one on the right (Theremin) most satisfying as I could stand in front of the projection and influence the visuals as well as the sound. I wanted to be on my own in the space to feel the whole all encompassing mess of it.
- 8.intersting work, didn't always feel that responsive - mats could be hidden and visuals more responsive to movement.
- Nicely vibrational, sounds from a dream... Messes with what we expect from sound. Brilliantly put together and good to feel baffled.
- Interesting installation interactivity very subtle. Interested to see how it impacts on future sonic work. Good to hear more sound art at the Poly.
- I found it very interesting and fascinating especially all the different sounds you can make just be moving your hands. Very good, great experience.
- I love this interactive space. I think it would be interesting to see a space like this used by an interpretive dancer. I would also love to see an interactive space like this set to 'Pandora' the planet on the aviator movie. Overall excellent experience.
- Lovely piece, joyous trying to learn the moves, thank you. More please!
- This is great fun and a bit confusing - kind of how I like things to be. Would have liked the images to also react to your movement's maybe. Great.
- Excellent - noise and transience and more noise and resonance = hours of sonic fun to be had.
- Great work, a master of weird.
- Fantastic, even better as it freaked my missus out.
- Very interesting + fun. Nice to be able to take part in the piece
- Great work. Would love to have visuals and sound linked
- Love the interactive idea. It would be great to see a visual representation of the sounds. This would explain it to visitors better.
- Well done! Love trying to work out how my movement is influencing the sound - well interesting.
- Great stuff, love the soundscapes
- Awesome!! Love it!
- Great display and sounds! I love the drums
- Most exciting and interactive experience, loved all really. More please.
- The sensation of being watched is unnerving - easier to work out what's going on when you watch someone else - weird.
- Enjoyed the ambiguity - give up trying to 'get it' and enjoy, play, have fun. Started to see the rods (Theremin aerials) as weird little beings, a great way to move differently and observe others moving in space. Would love to experience moments of less noise - a silence.... But maybe I should have just stayed longer.
- Great exhibit, loved the assault on the senses and so did our 2 and 3 year old

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