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On the Simultaneous Perception of Sound and Three-Dimensional Objects

Michael P Blow (2014)

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On the Simultaneous Perception of Sound and Three-Dimensional Objects

Michael Paul Blow

Submitted in partial fulfilment of the requirements for the Degree of Doctor of Philosophy awarded by Oxford Brookes University

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Abstract

Although examples of work investigating the perceptual relationship and possibilities of sound and image are common, relatively little work has been carried out into multimedia works combining sound and three-dimensional objects. A practice-based investigation into this subject is presented, with original artworks and contextual material from sound art, sculpture, moving image and psychology. The project sets out to more examine the perception of multimedia work, specifically through the creation and analysis of artworks combining sound and physical objects. It considers three main areas of study: sound's ability to draw attention to, or modify, the existing properties of an object; techniques which encourage sound and object to appear cohesively as part of the same work; and a discussion of cognitive effects that may occur as a result of their simultaneous perception. Using the concept of the search space from evolutionary computing as an example, the case is made that multimedia artworks can present a larger field of creative opportunity than single-media works, due to the enhanced interplay between the two media and the viewer's a priori knowledge. The roles of balance, dynamism and interactivity in multimedia work are also explored. Throughout the thesis examples of original artworks are given which exemplify the issues raised. The main outcome of the study is a proposed framework for categorising and analysing the perception of multimedia artworks, based on increasing semantic separation between the sensory elements. It is claimed that as the relationship between these elements becomes less obvious, more work is demanded of the viewer's imagination in trying to reconcile the gap, leading to active engagement and the possibility of extra

imaginary forms which do not exist in the original material. It is proposed that the framework and ideas in this document will be applicable beyond the sound/object focus of this study, and it is hoped they will inform research into multimedia work in other forms.

Contents

Statement of Candidate's Objectives

The objective of this three-year study has been to conduct a practice-based research project into the artistic possibilities presented by multimedia artworks, specifically those combining sound with a physical object. The project is situated within the field of sound art and was carried out within the Sonic Art Research Unit at Oxford Brookes University, although it draws on research from fields as diverse as computer science, psychology and behavioural studies.

The aim of the study is to:

- create and exhibit a body of practical work to facilitate exploration of the research territory

- encourage new insights into the theory and practice of creating and presenting multimedia work

- create a publicly-available thesis that presents the findings of the research, discusses the methodologies used and documents the practical work created.

Author’s Declaration

I declare that, except where explicit reference is made to the contribution of others, that this dissertation is the result of my own work and has not been submitted for any other degree at this or any other institution.

Signature _____

Printed name __Michael Paul Blow_____

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Finally I am grateful to the Arts and Humanities Research Council for supporting me and other artists in our attempts to push forward the boundaries of artistic research.

On the Simultaneous Perception of Sound and Three-Dimensional Objects

"When information is brushed against information, the results are startling and effective."

McLuhan and Fiore 1967. pp.76-78

Introduction

This thesis addresses artworks that are presented in more than one medium, focusing specifically on the creation and perception of work presented as sound accompanying a physical object. What is considered is a specific form of multimedia audiovisual work that focuses on the qualities of three-dimensional, solid form as opposed to say, two-dimensional painting or film. With a few notable exceptions (such as Duchamp's *With Hidden Noise* (1916) and Morris' *Box with the Sound of its Own Making* (1961)), and despite a long history of synaesthetic and audiovisual experiments, it appears that little study has been carried out into the relationship between sound and physical objects in an art context. This is somewhat surprising, considering that much practical and theoretical work also exists in related areas; sound in architecture (Pallasmaa 2005. pp49-54, Blesser and Salter 2007), installation art (for example, much of Janet Cardiff's work (Christov-Bakargiev 2001)), films (from the long history of experiments in abstract visual music by, among others, Oskar Fischinger and John and James Whitney (Brougher 2005. pp88-179) and the Vortex concerts of Jordan Belson (Reddell 2010. pp125-136, Glöde 2010), to more mainstream directors' creative manipulation of the 'audiovisual contract' (Chion 1994. pp1-123)), in addition to work in psychology and communication studies. Many of these examples attempt to make a combined audiovisual event in which the whole is perceived as being greater than either part in isolation, or to exploit discontinuities between the media to create new readings of the material. Although framed as an investigation into sound/object artworks, the underlying

theme of this work is the study of the perception of multimedia work. The process of perception is key to reconnecting with objects and events which have otherwise become dulled and forgotten by over-familiarity. A strategy to enable this is: “… to make objects "unfamiliar," to make forms difficult, to increase the difficulty and length of perception because the process of perception is an aesthetic end in itself and must be prolonged. Art is a way of experiencing the artfulness of an object; the object is not important” (Shklovsky 1917, p.778).

Shklovsky’s aim in encouraging perception is to “make one feel things, to make the stone stony” (ibid). Multimedia work certainly has the ability to “make the stone stony”, especially when qualities sensed in one modality are reinforced by the other. But it can go further than revitalising known objects. By defamiliarising through unexpected combinations or conflicting information (to “increase the difficulty and length of perception”) it can create entirely new objects, ideas and sense impressions in the interplay between the senses. Multimedia perception looks at the way multiple messages can be combined or contrasted to create new opportunities for ‘meaning-making’ in artistic practice.

Is the lack of material in the area of sound and objects evidence that the question is not of interest? This is hard to believe considering the amount of work in similar areas. Is it then redundant? Considering there are qualities of three-dimensional objects which cannot be fully replicated by film or painting – three dimensional shape, interactivity, the fact that to appreciate the whole of an object from a single viewpoint one needs “faith in spatial extension and a visualization of that extension” (Morris 1993 p.6) - there would seem to be obvious scope for study. It may be that the two media have appeared so diametrically opposed in nature as to be uncombinable, and while it is true that they are usually qualitatively

different in some respects (materiality, temporality) they are certainly have similarities in others - spatiality, for example. Besides, ontological differences have never seemed to deter painters and filmmakers from exploring correspondences with sound. One of the aims of this study was to determine ways to control the perception of sound/object works and encourage the viewer to perceive them as one entity. It is clear that there is potential for study in this area, and with this in mind three questions were developed to guide the research.

- Question 1: To what extent and in what ways can physical objects be perceptually activated by audible objects?
- Question 2: What are the parameters controlling the interplay of audible and physical objects, and how is meaning created through their interaction?
- Question 3: How does interactivity affect the experience of the viewer?

The project set out to address these questions using a combination of arts practice and academic discourse. Full details of the methodologies used are given in the conclusion, but in general the two elements proceeded hand-in-hand; theoretical ideas inspired practical work, and practical work informed the development of new concepts. It is worth here considering the terms used in the questions. The work takes 'physical objects' to mean a sculpture or found object, although this definition was broadened during the research to include buildings and other immediate surroundings which, when considered as a large containers, blur the distinction between objects and environments. 'Audible objects' are discrete or continuous sonic elements, usually presented on speakers or headphones, and without necessarily any causal relationship to the objects (i.e. they may or may not be sounds that the object might make). 'Activation' is taken

to mean a cognitive enhancement or transformation of the object by the sound. 'Parameters' are variable qualities of the components of the sound-object relationship (volume, distance, size and so on). 'Meaning' should perhaps be re-written 'meanings' – as every viewer may have a unique reading of the work; the sense of this question is the broader concept of how a personal experience or understanding of the work is transferred to the viewer. 'Interactivity' denotes the formation of a feedback loop between the user and the work; in other words, the user engages in a physical dialog with the work (e.g. lifting and tilting the shoe in *Pickup*) in a way which changes his or her understanding of the work, which prompts further engagement and so on. This definition of interactivity implies that the piece is not complete without the input of the participant, and highlights their own agency as a co-creator of their experience, which will be self-directed and unique. Finally, 'viewer', and other terms (spectator, user, visitor) are used to denote the audience that experiences the work. There is an obvious problem in that the work in this thesis is usually is listened to as well as viewed, and in fact no terms are perfect; perhaps 'experiencer' comes closest, but it is cumbersome and possibly presumptious. For the purposes of this thesis it is hoped that the reader will forgive the inaccuracy and grant that the work being 'viewed' is heard as well.

Multimedia, Multisensory, and Multimodal: a Note on Terminology

It is worth reflecting that the terminology multi -media, -sense or -mode simply refer to an interdisciplinary or combinatorial methodology irrespective of context. Many of the portmanteaux possible with the prefixes multi / cross / trans / inter applied to media / modal / sensory have been used, in disciplines as diverse as art (multimedia / intermedia), linguistics (multimodal / crossmodal), psychology

(cross-sensory) and logistics (intermodal). To minimise issues with terminology, throughout this thesis artworks designed to engage multiple senses are referred to as multimedia artworks. Although this term has its own connotations - in the digital realm, at least – of screen-based audiovisual computer work, it is an accurate description of the works presented, relates the work to more established multimedia practice (audiovisual installation and moving image), and avoids the associations and difficulties encountered with other terminology sometimes used in this area. Denoting a piece as multisensory, for example, moves attention away from the creation of the work, to focus on the viewer's perception of it; and multimodal / crossmodal, which have been adopted by communications studies to mean multiple channels used simultaneously to convey meaning (e.g. speech with hand gestures or tone of voice), carry an emphasis on one mode simply reinforcing the other, which limits the scope of interplay between the media and is unhelpful to the development of the current discussion. Use of these terms is thus restricted to areas where they are appropriate, i.e. in relation to perception or behavioural / scientific studies.

Contribution to Knowledge

This thesis discusses strategies for making multimedia art, the possibilities it offers the artist and the processes by which it is made and understood. Building on existing work in arts practice, art theory, psychology and communication studies the work aims to bring new insights into multimedia art practice and evaluation. The specific contributions to knowledge of this research are:

- a new framework within which to situate, evaluate and create multimedia works, specifically a sound/object continuum used to categorise a range of multisensory perceptual interactions (Chapter 4),
- extending Connor's[1] work in applying an existing table of multimodal animal behavioural interactions (Partan and Marler 1999) to multimedia artworks, with a more detailed analysis of each interaction and a new category of distraction (Chapter 3),
- using the concept of multi-dimensionality from evolutionary computing to illustrate the increase in creative possibilities arising from multimedia practice (Chapter 3),
- a series of artworks and papers which practically investigate the collision between the sonic and physical, the harmonies and tensions between the two media, and the possibilities and challenges that engaging with multiple media offers the practising artist (case studies throughout the thesis and Appendix 1).

Why combine the senses?

At the outset it is worth asking what is to be gained by addressing both the sonic and visual senses. After all, many exceptional artworks only utilise a single sensory modality. The answer is that presenting sound and vision simultaneously gives us opportunity to create new perceptual relations. We can investigate the power relationship between audio and vision and the predominance of sight. We can

[1] Andrew Connor proposed the use of Partan and Marler's table to read multisensory works in a presentation at Sight Sound Space and Play 2011, and subsequently in personal correspondence. I have borrowed his use of the table and extended it to provide my own applications of the table's categories to multisensory work, plus added the new category of distraction.

note how different soundtracks change our perception of an image or object. We can create pieces in which the audio and visual elements fuse to create a single sensory event. We can encourage the brain to make up its own narratives, in an attempt to draw a line, however curved, between seen and heard. We can use the qualities of one medium to draw attention to elements of the other, and we can create impossible objects where sight and sound are telling us contradictory things. Multimedia offers a rich environment in which to create new and original work, to test the balance of the senses, and explore the limits of perceptual integration. It can be argued that the point of a multimedia piece is not the senses themselves but the space between them that is created by their interaction, the phenomenon Michel Chion calls 'added value' (Chion 1994 p. 5). The Marshall McLuhan quote at the start of this thesis continues, "When information is brushed against information, the results are startling and effective. The perennial quest for involvement, fill-in, takes many forms." (McLuhan and Fiore 1967 pp. 76-78).

There is a long history of mappings between the senses. Aristotle proposed a system equating colours with notes of the musical scale. Athanasius Kircher and Isaac Newton did the same in 1646 and 1672 respectively (Jewanski 2010 p. 339). Other similar schemes followed, and in the late 19th and early 20th centuries a number of colour organs were created based on different mappings, but by 1916 the colour red had been assigned to every note of the C major scale in one scheme or other (*ibid* p. 345, Daniels 2011 p. 18). All of these schemes ignored some fundamental perceptual issues concerning the two media – in 'Modern Chromatics', Ogden Rood noted "When two musical sounds are mingled, we have accord or discord, and the ear of the practiced musician can recognize the separate notes that are struck; but, when two masses of colored light are

mingled, a new colour is produced, in which the original constituents can not be recognized even by the eye of a painter" (Rood 1879. p. 304). These concerns, and the obvious lack of agreement displayed in the numerous colour-note schemes, led to an admission that "a fundamental difference exists between the sensations of vision and hearing, and that any theory of colour based on our musical experience must rest on fancy rather than fact" (*ibid*).

Despite the efforts of Scriabin, who "held that each mode corresponded to a particular shade of colour, and each modulation to a nuance of this shade" (Popper 1968 p. 157) and others, definitive colour-note relationships appeared a seductive dead-end. However, early 20th century painters abstracted - along with their canvases - the concept of sensory correspondences, broadening the field to explore the relationship between visual art and musical parameters such as rhythm and timbre. These qualities appear much more applicable as cross-media mappings. To quote just two examples, Klee's *Fugue in Red* (1921) directly interprets the repetition, sense of time and development of a musical fugue in terms of repeating and overlaying geometric shapes, and Kandinsky's *Impression III (Konzert)* (1911), painted after visiting a Schoenberg recital, depicts the music flowing off the stage and filling the space around the listeners as a sea of yellow.

Synaesthesia

Research into synaesthetic experience, where stimulation of one sense causes involuntary response in another (such as a blue square being seen when a particular sound is heard) was fashionable around the time of Kandinsky and Klee's experiments, but died off by the mid 20th century due to its entirely

subjective and unprovable nature. As Cytowic notes, “Although medicine has known about synaesthesia for three centuries, it keeps forgetting that it knows” (Cytowic 1996. p. 17). Without today’s neuroimaging technology, and fighting the rise of dogmatically objective behaviourism, it was neglected for decades and has only recently undergone a resurgence. It is worth making the distinction between true synaesthesia and synaesthetic effects, or what Spence calls ‘crossmodal correspondences’ (Spence 2011), as they are of distinctly different importance to our discussion. True synaethesia is a medically-recognised neurological condition in which stimulation in one sense results in a perceptual response in another. A recent study estimated the incidence of synaesthesia in the general population to be as high as 4.4%, and argued that, based on enhanced perception and memory in synaesthetes, “such advantages make it conceivable that synaesthesia has been selected for by evolutionary pressures” (Simner et al., 2006). For each synaesthete the effects will be unique, consistent over time, and outside of voluntary control (for a fascinating firsthand account see ‘Two Synaesthetes Talking Colour’ (Motluk 1996)). True synaesthesia may be inspirational to the artist (several are known, or suspected, to have been synaesthetes including Scriabin, Messiaen, Nabokov, Ligeti, Hockney and Kandinsky) but it is impossible to recreate the sensation experienced by the artist in the audience’s perception. Crossmodal correspondences on the other hand are generalised mappings between two senses that occur to non-synaesthetes (for example, a feeling that ‘this sound and this shape, or colour, belong together’), or the creation of a new sense impression by the simultaneous reception of information in two senses. It is these correspondences that are of interest in this work as they can be nearly universally consistent to non-synaesthetes (e.g. the Bouba/Kiki experiment discussed later), allowing us to escape the subjective impasses created by the

colour-note schemes and the personally unique synaesthetic mappings. The artworks discussed in this thesis are not synaesthetic, but they do explore crossmodal correspondences. An artist wishes to create some sort of sense impression in the audience, and the truth is that for this purpose true synaesthesia is of no use. By disregarding synaesthesia as a phenomenon and focussing instead on cross-sensory mappings and perceptive collisions, the artist is able to work with general proximities between the senses, opening up and exploiting gaps between the seen and heard, reactivating the viewer's imagination and engaging them in co-creating the work.

Research Context

Intuitive Mappings

This section sets out to define the space within which the project is located, starting with a more detailed discussion of the crossmodal correspondences introduced previously. Spence notes that "people consistently match high-pitched sounds with small, bright objects that are located high up in space" (Spence 2011), revealing ubiquitous correspondences between pitch, size, physical location and brightness (Spence has also worked in less conventional crossmodal correspondences such as musical notes and odours (Crisinel and Spence 2012)). Certain colours are often thought of as being associated with particular types of sounds; bright colours for high pitch and dark for low; in 'Concerning the Spiritual in Art', Kandinsky uses colour and timbre almost interchangeably, pairing red with "a sound of trumpets, strong, harsh and ringing" (Kandinsky 1977, p.40) and blue with flutes, cellos and double bass (*ibid*. p.38), and futurist Carlo Carrà talks of

painting “Reds, rrrrreds, the rrrrrreddest rrrrrrreds that shouuuuuuut” (Carrà 1913 p.54). It is difficult to say if these effects are universal but there is some evidence for intuitive sound-shape mappings. Ramachandran and Hubbard’s ‘Bouba Kiki’ experiment (a restaging of an original experiment by Köhler (1992. p224)) asked participants to match two shapes, one rounded and one spiky, with the words ‘bouba’ and ‘kiki’. 95% of respondents chose the rounded shape as Bouba and the Spiky one as Kiki, lending credence to the idea of sound-shape correspondences as a basis for language and suggesting “that there may be natural constraints on the ways in which sounds are mapped on to objects” (Ramachandran and Hubbard 2001, 2003).

Language and Materiality

Language provides a key to our multisensory appreciation of sounds and objects. In English, many of the words used to describe sounds also describe the physical attributes of an object; *round*, *thin*, *fat*, *piercing*, *fuzzy*, *dark*, *bright*, *gritty* – the list goes on. In some cases, such as *hollow*, it is reasonable to suppose that the sound is so named because its qualities match those typically associated with the sounds produced by a hollow object. *Thin* and *fat* sounds are those containing a small or large range of frequencies respectively, inhabiting varying amounts of sonic space in the same way real objects inhabit physical space. In other cases, a more abstract mapping seems to exist; a *fuzzy* sound and object are equated by the concepts of being indistinct, shifting, boundary-less, cosy. The single adjective is unpacked into a multiplicity of associations, which call to mind Merleau-Ponty’s description of the multi-sensory perception of an object’s ‘specific nature’:

"One sees the springiness of the steel, the ductility of red-hot steel, the hardness of a plane blade, the softness of shavings. The form of objects is not their geometrical shape: it stands in a certain relation to their specific nature, and appeals to our other senses as well as sight. The form of a fold in linen or cotton shows us the resilience or dryness of the fibre, the coldness or warmth of the material […] In the jerk of the twig from which a bird has just flown, we read its flexibility or elasticity […] One sees the weight of a block of cast iron which sinks in the sand, the fluidity of water and the viscosity of syrup. In the same way, I hear the hardness and unevenness of cobbles in the rattle of a carriage, and we speak appropriately of a 'soft', 'dull' or 'sharp' sound" (Merleau-Ponty 1962. p.267).

Merleau-Ponty here touches on a fundamental issue; the qualities of an object project from its materiality and form and cannot help but be revealed in the way it behaves. By assigning sounds adjectives that relate to physical objects, we are really talking of the 'specific nature' of those objects that are revealed by sound.

Case study: *Piano Arrangement (Low – High)* (p. 148)

Exhibited: *Audiograft*, Oxford 14/02/11 - 20/02/11

A practical experiment into the relationship of language to sound, *Piano Arrangement (low-high)* was inspired by a panel discussion at Sound and Music's *Off the Page* conference 2011, and by a practical intervention shown at the event by musician Sarah Nicholls. Sarah had taken the frame of her piano and mounted it vertically behind the keyboard, which allowed her direct access to the strings for extended playing techniques and incidentally swapped the position of the low and high notes on the keyboard (Nicolls 2009). The action relates to this work

both in the intervention into the instrument itself and in the re-mapping of pitch in space. However in Sarah's piano the re-mapping was performed for practical reasons and the change in spatial relations was more coincidental than designed – a means to an end and not an end in itself - in contrast to *Piano Arrangement (Low – High)*. Conceptually the piece can be compared to the Fluxus group's absurdist interventions into musical equipment. They created and performed many provocative and symbolic instrument-related works in the 1960s and 70s, often in response to a score or set of instructions, George Brecht's *Solo for Violin, Viola, Cello or Contrabass* (1962) for which the score reads "polishing", to the fluxus "piano activities" (1962) which resulted in the piano's destruction (Higgins 2002 pp.49-51). The spirit of Fluxus informs Christian Marclay's *Guitar Drag* (2000) and instrument-based sculptural works which present, among other things, a guitar with a u-bend neck, an massively long accordion and drumkit extending to the height of the room (Marclay 2003 pp. 114-119). These works raise questions about how instruments are limited by our expectations and by our physiology; what sort of sounds could you make if you played the piano with a hammer, or if you had arms long enough to play a 30ft accordion? The action taken in *Piano Arrangement (Low – High)* is of a similar spirit, upending a piano to make it practically unplayable but jolting us out of our cosy assumptions about what an instrument is and what it represents. The work also exists in a context of international research on sound symbolism as the basis for language, with increasing evidence that across cultures, and from an early age, sound and shape are perceived as related (Maurer et al. 2006).

Piano Arrangement (Low – High) began with research into instruments with a pitch-spatial mapping where high notes are higher in physical space than the low notes. A piano does not have this quality, but the linearity of the keyboard makes

it a prime candidate for presenting the idea. The easiest way to achieve this is to tip it on its end, with the low (bass) notes towards the floor and high ones towards the ceiling. In this piece a piano is thus arranged, physically and harmonically, low – high. The name is essential to the work, framing the action as an investigation into the words we use to describe sound and how these relate to the physical world, using a very simple provocative, and sculptural, action. It is of course a pun on the term 'musical arrangement' and raises questions such as: why do we use spatial analogy ('low' and 'high') in music? What is the gap between music and the words we use to describe it, and what might we find there? What do we mean by a 'round', 'sharp', 'hollow', 'thin' sound, and (why) is there a consensus of understanding?

Physical Mappings

So far we have looked at analogies between sonic and visual phenomena, where despite intuitive correspondences, no consistent, physical relationship exists. However there is a more direct form of audiovisual relationship – cymatics, the technique of directly visualising sound through the vibration of physical material, explored and popularised by Hans Jenny in the 1960's (Jenny, 1967). In cymatics, sound vibrates a material (usually either a fluid or granules such as sugar, salt or powder placed on a metal or glass plate), causing patterns to be formed in the material corresponding to the areas of maximum and minimum vibration in the sound. The patterns are a virtually instantaneous rendering of sound in a visible medium, and change with frequency and volume. Jenny experimented with patterns in fluids and smoke, as well as replicating and extending the work of Ernst Chladni who had undertaken the first systematic investigations using a

metal plate strewn with powder, now known as a Chladni plate (Daniels, 2011 pp. 13-18). A related device is the *Ruben's tube*, constructed using a pipe, sealed at the ends, with a series of holes along the top (Ficken & Stephenson, 1979 pp. 306-310). The pipe is fed with gas, which escapes from the holes and is lit, resulting in a row of flames along the top of the tube. If a sound is played into one end of the tube, the flames change in height depending on the pressure waves generated at various points inside the tube.

Film and Sound

As previously mentioned visual music films explore relationships between abstract shapes, colour and sound, sometimes by directly manipulating (painting, scratching) the audio track of the film; for example early work by Oskar Fischinger in Germany and America and Nikolai Voinov and the Multzvik group in Russia, the Whitney brothers and Jordan Belson in the 60's (whose work, and others, is explored in Brougher 2005), Guy Sherwin's Newsprint (1972) and recently the work of Max Hattler (http://www.maxhattler.com/). With synchronised sound and visuals these films excel in creating an single multisensory experience – Michel Chion's 'synchresis' (Chion 1994 pp. 63-65). More interpretive use of sound can be found in Tarkovsky's *Stalker* (1979), in which he gradually-builds a rhythmic accompaniment to the railcart scene in using the sounds of the cart itself, blurring the boundary between diegetic or non-diegetic sound. In this case sound and visuals interact in less obvious ways, and gaps are created between the seen and heard which engage the viewer's imagination. This is a major theme of this thesis and something I will return to later.

Installation and Sound Sculpture

Extending the idea of audiovisual relationships into three dimensions leads to sculptural and installation art. In the 1960's and 70's, as sound became a more common element in gallery art, and with the rise of computing technology, Fluxus and John Cage's reimagining of sonic practice, Nam June Paik's *Random Access* (1963) and David Tudor's *Rainforest IV* (1973) explored the sonic affordances of household junk and audio equipment. Nicolas Schöffer's CYSP1 (1956) and Edward Ihnatowicz's *Senster* (1970) were cybernetic sculptures that responded to sounds in the environment. More recently Janet Cardiff has extensively used objects alongside audio in a series of intricate works. Her installations and soundwalks weave together multiple narrative threads presented on many loudspeakers or binaurally on headphones, out of which the audience has to make their own story, accompanied by video, found objects or sculptures (Christov-Bakargiev 2001).

Pure sound installations dealing with spatiality or site are often termed 'sound sculpture'. As sonic art broke away from music a focus on the physics of sound appeared; room resonances in Lucier's *I am Sitting in a Room* (1971), and standing waves (which have the perceptual effect of 'solidifying' the sound and creates a non-corporeal physical object which the visitor can walk around and through) in LaMonte Young's *Dream House* (LaBelle 2008 pp. 73-75). The term is also used for a sculptural object built with the express purpose of creating sound. It is usual in these sound sculptures, which occupy territory between kinetic sculpture, sound art and musical instruments, that the artefact produces the sound itself, through being activated (struck, bowed, blown) by audience, motors or weather, meaning the physical object and sound object are linked by a causal process. The works of

Harry Bertoia, the Baschet brothers, Peter Appleton and Max Eastley are canonical examples of the genre, which was the subject of the group show 'A Noise in your Eye' at the Arnolfini in Bristol in 1985. Sound sculptures that are designed to be played assume a democratising quality, where musical training – or at least, learned instrumental skill - is rendered obsolete. The Baschet brothers expressed this as core to their philosophy:

“The reserve and timidity which exists when one faces the keyboard of a piano for example, disappears. Everything being unknown, there are no teachers to give advice or to point out mistakes. We say 'Go ahead, nobody knows how to play it, discover for yourselves! '” (Baschet 1968 p. 7).

Max Eastley’s exhibitions of multiple motorised sound sculptures combine sonically to create a long-term, room-sized composition, a technique also employed by Haroon Mirza, the highest-profile British artist currently working in sound and sculpture. Swiss artist Zimoun creates minimalist assemblages of boxes, motors and spinning wires, which interact to generate emergent behaviours and sounds. In part these sculptures seem to derive a lineage from Naum Gabo’s perspex and monofilament constructions, which engage with three dimensions in a way that echoes the propagation of sound waves across space (Cabrera 1995). In 1920 Gabo even created a motorised work, *Kinetic Construction (Standing Wave)*, which visualises the mechanism of sound. It consists of a flexible, vertical steel rod vibrated by a motor at its base. The frequency of the motor is adjusted to create a standing wave in the metal, the moving points of maximum and minimum deflection creating a visually static, sculptural form.

There are then a myriad of responses to the collision of sounds and physical objects. However sounds created by sound sculptures are directly related to their

materiality and form (Merleau-Ponty's 'specific nature'), and their aesthetic is at least partly governed by function. This is both a strength – in terms of intuitive engagement caused by the inextricable bonding of sound and object - and a weakness, as material, shape and sound are constrained by physics. To explore beyond this boundary a division is needed; the sonic and visual elements of the work need to be split apart, to originate as different objects but presented in such a way as to be perceived as the same work, in order to render a new interpretation. Stephen Feld termed this joining of sounds and objects from different sources 'schismogenesis' (Feld 1994), in response to R. Murray Schafer's term for the complete separation of a sound from its parent object, 'schizophonia '. This process, of breaking a sound from its referent object but then recombining it with another, is the paradigm shift that opens up new possibilities for interpretation and which moves us toward the main concepts of this thesis and the focus of the next section.

Sounds and Objects

We focus now on works that combine a physical object and sound in order to explore the qualities of each or the perceptual relationship between them. In 1916, Marcel Duchamp made *A Bruit Secret* (*With Hidden Noise*), a ball of twine between two engraved brass plates. He gave the construction to Walter Arensberg who "put something inside, after loosening the plates" (Cabanne 1971 p. 54). Only Arensberg ever knew what the object was, so it can only be perceived through sound and by direct manipulation – making the work both sonic and interactive. The work contrasts the mechanisms of aural and visual perception, and even the name plays with the assumed hierarchy of the senses – as the object

is actually only partially hidden, revealed in its materiality (if not its specificity) by its sound. The work makes the point that perceiving sound implies movement, in contrast to the passive and static touch of the eye. A sound/object work from the Gutai group of Japan is Saburo Murakami's *Hako* (1956), consisting of the ticking of a clock emanating from cracks in a wooden packing crate. Like Duchamp's work, divorced from its visual, the sound becomes unspecific; we know the ticks are counting time, but we do not know which time, or whether the sound is a real clock, a looped recording, or a bomb. What the implication of a clock does is to make explicit the role of time as a foundational component in the ontology of sound.

In a seminal work both referencing Duchamp's piece and extending the role of time in Murakami's work, *Box with the Sound of its own Making* (1961) by Robert Morris combined a wooden box with the sounds of its construction in a piece that Brandon LaBelle describes as “part-minimalist sculpture, part-performative action, and part-conceptual game” (LaBelle 2008 p. 81). A major influence for this project, Morris’ *Box* uses sound to convey narrative, bringing a sense of the physical object’s history and origins that might otherwise be overlooked, and which visually might only be perceived in imperfection, scratches or wear. Sound and object work together to create a multimodal sense impression, linked using proximity both physical (the sound is inside the box) and semantic (sounds of sawing and hammering wood). The sounds draw attention to individual details of the box, the joints and screws, and each time the piece is experienced, the object is simultaneously remade and deconstructed in the imagination of the viewer. *Box* touches on many of the concerns of this research and acts as a departure point for their more specific investigation.

Small Music: the work of Rolf Julius

Rolf Julius has been one of the most respected artists working in sound and physical installation over the last four decades, his understated materials and quiet sound becoming trademarks of his thoughtful work. Often combining sound collages of buzzes, clicks, hard-to-discern voices and natural sounds with materials such as rocks and bowls of water or pigment, his pieces display a desire to explore the relationship between sound, form, material and colour at its most intuitive and meticulous. Julius started using sound whilst working as a photographer in the mid 1970's. In an early soundwork, *Dyke Line* (1979), he exhibited six photographs of the curved top of the earthwork, with a speaker at either end, playing a composition he had made with an iron bar, at which point "all of a sudden the small curves started to move up and down, they began to dance!" (Julius 2005). His subsequent work broadened to include installation and video, but always with a low-fi, minimal aesthetic and humble materials; small speakers, stones, flower pots, pigment, water, concrete dust, placed amid tangles of wires on the floor. He experimented with sound and location, playing piano recordings outdoors in *Concert For A Frozen Lake* (1982). His compositions, too, broadened to include electronic noises, natural sounds, hard-to-discern talking, pauses, buzzes and whistles. Julius practised what he called 'small music' - his pieces are quiet, forcing the visitor to listen, a tactic most evident in his installation on a busy Brazilian street, *Big Gray* (1994), in which the act of listening to the small sounds forced the visitor to block out the noise of the big city. Julius' work was about multisensory perception and crossmodal correspondences (he was adamant that it wasn't about synaesthesia), and he was acutely aware of the potential of the sensory elements to create something greater than the sum of their parts. It is the study of this mysterious 'extra', created in the interplay of sound and object,

which is the focus of the work in this PhD. Using Julius' work, the *Box with the Sound of its Own Making* and the concept of sonic art with a physical component (not pure sound, and not sculptural instruments) as touchstones, the remainder of this thesis will explore the creation and perception of this unusual form of art.

Existing PhD Projects

A search for published PhD theses in this area proved fruitless, although it did turn up Alex McLean's 2005 Master's thesis on the subject of sonic Gestalt (McLean 2005). However, throughout the course of this research I have been fortunate enough to meet several other doctoral students who are working in the area of audiovisual relationships: Andrew Hill (Leicester deMontfort), Sam Horseman (Huddersfield), Andrew Connor (Edinburgh), Rob Mullender and Iris Garrelfs (CRISAP, London College of Communication), and Lewis Sykes (MYRIAD, Manchester Metropolitan).

Outline

The remainder of this thesis will describe in detail the concepts that have driven the research, illustrated with case studies of practical works made during the period of study. Chapter 1: *The Extended Object* considers the reason for making multimedia works, and shows how sonic material can extend the viewer's understanding of an object. Examples are given of objects extended in time and space, and of sound's role in the ontology of an object. Having established that there is useful territory for exploration in multimedia works, chapter 2: *Crossmodal Reinforcers* draws on research in psychology to discuss methods by

which sound and object can be perceptually linked in the imagination of the viewer. Chapter 3: *Perception of Multimedia Work* looks at the possibilities arising from these mappings. Existing research in communication studies is used as a platform from which to explore the concepts of enhancement, emergence, association, dislocation, and distraction. In chapter 4: *The Multisensory Continuum*, the knowledge gained through the preceding chapters is applied to propose a framework of sensory interactions based on increasing semantic separation between the elements. The final chapter discusses the findings of the project in relation to the research questions, as well as a more detailed look at methodologies and application of the findings to future work.

Chapter 1

The Extended Object

This chapter discusses the practice of 'extending' objects using sound – where the viewer's experience and understanding is enhanced by the perceptions of sound and physical thing combining to produce extra layers in the reading of the object. Extending an object can take a wide range of forms, which fundamentally derive from the ontology of sound as a temporal and spatial medium. In fact the interaction of audible and visual information can be complex and engaging and bring to the listener far more than just dry facts. The concurrency of vision and hearing allows a combined multisensory percept potentially greater in scope and power than supplying additional information through one medium alone. The expansion may simply enhance our original understanding of either media, or the collision of audio and visual information may create an entirely new imaginary object. An extended object, then, is defined here as one in which the experience of the object is redefined by its pairing with sound. It may be expanded in the viewer's understanding or imagination in time, space or narrative. Hidden information may be made apparent, or the audiovisual construct may suggest a new reading unobtainable from one sense alone. The remainder of this chapter examines these areas in more detail and describe practical works by which they have been explored during the course of this research.

Sound, Space and Time

Sound often speaks to us of space. Detailed sounds, dim and distant sounds, echoes and tonal changes all build up a mental perception of the environment - “we stroke the boundaries of the space with our ears” (Pallasmaa 2005 p. 51). A whisper with no reverb appears intimately close to our ear; a long echo seems distant. We are used to hearing sounds reflected from surfaces, and we find an anechoic chamber – where external reverberation is eliminated – strangely unnatural, as we hear our own voice solely through the tissues of our head. Sound can also bring time into an object, making us aware of the process of its construction, the duration of its existence, things that have happened during its lifetime, or the decay, over long periods of time, of an apparently immutable object. These conflations speak of the differences in the ontology of sounds and objects; the solid and slow-changing physical form versus the fleeting, and energetic audio (before the reader objects it must be acknowledged that the forms are not always this opposed; fluids and transparent forms echo aspects of sound in the same way that sonic drones and standing wave patterns contain qualities of the solid; but in general solid and audible media are qualitatively different).

Sound is fundamentally temporal. A sound wave propagates through a medium by expanding its wavefront; in each instant, the wavefront increases in size and decreases in amplitude. Time is required for the production, dissemination and appreciation of sound. Sound takes time to travel through its supporting medium; we see the flash of the distant firework before we hear its boom, and the time it takes is medium-specific. The act of listening unfolds in time as the waves born in those instants of creation sequentially reach our ears. Manipulation of rhythm in

music seems to affect our perception of time. Physical things are also subject to time, but often the effects are often unnoticed or act on different timescales than we usually associate with sound – at least when it comes to the processes of creation and destruction, accretion and decay, and natural cycles. Sound is used to relate the construction process in Morris' *Box*, and it is obvious that sound can be used to add both a (hi)story and a sense of process – creation, change, destruction - to an object. To explore these ideas (and perhaps find new ones) a solo show *Time Machines* was staged in the second year of study.

Time Machines Exhibition

The aim of this show was purely to explore ways in which sound and object could be used to evoke a deeper sensibility of time. The pieces presented, though by no means a comprehensive exploration of the territory, touched on themes including the slowing of time, narrative, memory, diurnal cycles, creation and disintegration, and repetitive patterns. The show consisted of 6 works and some of the pieces are described in detail elsewhere in this thesis; here I focus on two that are particularly pertinent to the current discussion.

Case Study: *Bleigiessen (Bending Time)* (p. 151).

Exhibited: *Time Machines* solo show, Oxford 13/09/11 - 16/09/11

Part of the German New Year's Eve tradition is the game of Bleigiessen - melting lead in a spoon held over a candle and then throwing it into a bowl of cold water. The molten lead at once explodes and solidifies, forming into a variety of shapes

from which fortunes are told. A piece that shares form and name, if not size, with this piece is *Bleigiessen* (2005) by Thomas Heatherwick studios. Heatherwick used the technique to create a public sculpture, but it seems simply for shape and that he was unaware of the connotations of fortune telling until after he had finished the piece. A contextual reference which more closely echoes the process and interests of this work is Richard Serra's *Splashing* (1968), in which he created forms by throwing molten lead against the gallery walls, sometimes peeling them off and displaying them in lines on the floor (Causey 1998 p. 135). Any splash work carries within it a sense of frozen violence in the implicit trace of motion and time, and a record of both human and environmental action on the material. It also results from the collision of the material and the situation into which it is thrown, and in the finished object there is a trace of the now-vanished forming medium - the gallery corner's in Serra's case, or the water in this work. Serra's list of sculptural actions, *Verb List Compilation: Actions to Relate to Oneself* (1967-1968) (available at http://www.ubu.com/concept/serra_verb.html) was an inspiration for *Bleigiessen* and as part of a strategy to create ideas I reworked it for a sound context, replacing the actions relating to physical material with corresponding actions relating to sonic material. The use of the software *Paulstretch* by Paul Nasca to lengthen the audio allowed the work to not only record time, but to play with the temporal relations between the elements of the work, to recreate, change and replay time, and to explore how intimately related sound and time are. This process has the potential to totally alter the perception of a piece of audio, a point made famously by *U Smile 800% Slower* (2010) by Nick Pittsinger, a glacial version of *U Smile* by Justin Bieber turning the pop song into a thirty-five minute ambient symphony.

I used the same process as the fortune-telling game to create larger metal shapes, with about 200g of casting metal melted over a stove and thrown into a bucket of water. The sound of this explosive act had a beautiful quality similar to a horseshoe being quenched – a mixture of a falling pitch, white noise and final clunk of the solid metal hitting the bottom of the bucket, all of which lasted about a second. I recorded it using two hydrophones in the bucket, made from piezo microphone discs dipped in plasti-dip rubber paint (Collins 2009 p. 36).

During a period of researching audio software I had discovered a program called *Paulstretch*, which can be used to seamlessly stretch audio files to many times their original length whist maintaining the original pitch. This functionality opened up intriguing possibilities for the show *Time Machines*, as it allows direct manipulation of time in sound. For *Bleigiessen*, I used *Paulstretch* to 'slow time' by stretching the audio recording of the sculpture's creation. It was used to make the recording last approximately 1 minute 40 seconds and converting it from a sort of metallic chirp into an intense, slowly evolving drone quite at odds with the tortured and dynamic form of the object. In the show, the metal sculpture was presented on a plinth with the slowed recording played from an MP3 player over headphones.

The references to time in *Bleigiessen* were not simply in the manipulation of sound. The work is rooted in a tradition of fortune telling, and the physical object alone carries a contextual history man's attempts to predict or control time. Like *Box*, *Bleigiessen* records and replays the process of an object's creation, but departs from Morris' piece in that the audible element is manipulated, giving a slow-motion impression of what is in reality an almost instantaneous event. By this, it reveals a specific contrast in the two media; the ephemerality and

malleability of sound and its nature as a temporal medium is contrasted with the solid, static quality of the sculpture. And yet the lines of force from the explosion are written in the tendrils and dynamism of the shape, which betray that the object too once flowed. My hope was that the extended sound would slow the imaginary creation of the object; that the visitor would be inspired to see the metal flowing in slow motion from molten drop into the tendriled shape before them on the plinth, evoking a deeper sense of time and process into their visual appreciation of the object.

Narrative Binds Sound and Object

A major finding through exhibiting *Bleigiessen* concerned the narrative nature of sound and object. It was obvious that the object's immobility contrasted deeply with the sound's narrative arc, with its beginning, middle and end. This disassociated sound and object, and led to the conclusion that the perception of a narrative, or sense of movement, is a key factor in their binding. To be fully integrated similar amounts of movement should be perceived in both media. They should be *equally dynamic* – a moving object accompanied with an evolving sound or static object with a constant sound. It might be argued that this is simply a re-statement of the fact that movement and sound are causally linked, but this self-evident truth is obfuscated in the context of gallery exhibition by the use of immobile objects, looped sound recordings, headphones and hidden speakers. It should also be noted that certain shapes – fragmented conglomerations, spirals, spiked shapes, sweeping curves – have their own dynamism, and possess a sense of movement even when physically standing still (for example, Boccioni's wonderful *Unique Forms of Continuity in Space* (1913)). Careful attention should

be paid to the narrative and dynamic elements of both parts of an audiovisual work, if they are to be perceived as one.

In *Time Machines* the piece presented sound on headphones to ameliorate sound interference with other work in the show, but it seems they worked against the multisensory binding desired in these works. In this case the headphones, although useful from a practical point of view, created an internal soundworld that was separate to the external sculpture and a barrier to the perceptual integration of sound and object (it is possible to overcome this to some degree by using physical proximity and interactivity to create a causal link between the two components). *Bleigiessen* certainly worked in engaging visitors, but the experience informed emerging thoughts about multisensory perceptual reinforcers – techniques with which to bind audio and visual – which are the subject of the next chapter.

Case Study: *Sundial (Solar Drums)* (p. 163).

Exhibited: *Time Machines* solo show, Oxford 13/09/11 - 16/09/11

We can expand our temporal understanding of objects by sonifying changes and events occurring in them over time. In this piece, the object which is expanded in our understanding is the environment; as the weather and position of the sun change, different drums are played using solar motors, and the sonic composition changes. Sonic art powered by solar energy has some precedent. Alvin Lucier's *Solar Sounder_1* (1979) was designed to explicitly reflect the seasons and revolution of the Earth, (Lucier and Margolis 1982). Felix Hess used solar-powered oscillator circuits driving piezo discs in an installation called *How Light Is Changed*

into Sound in 1996 (Hess 2001 pp. 48-53), and more recently Craig Colorusso has created *Sun Boxes,* a collection of 20 sound-producing boxes each powered with a solar array (Colorusso 2012). Environmental power allows the opportunity to create long-term weather-driven compositions such as Max Eastley's aeolian instruments (Gibbs 2007 pp. 48—53) and Jem Finer's rain-powered *Score for a Hole in the Ground* (Finer et al. 2008), an example of a permanent outdoor work designed to reflect, sonically and visually, the environment in which it is situated. The most relevant works for a discussion of *Sundial* are Fluxus artist Joe Jones' solar-powered kinetic works, culminating in *Solar Orchestra* in 1982 (Friedman 1998 p. 61), and Christina Kubisch's *Clocktower Project* (1999). Both these works embody a use of weather as score. Jones symbolised this by placing the solar panels on a music stand, which fed motors activating the various instruments in his solar orchestra. This is the same technique used in *Sundial (Solar Drums)*, with the exception that there is a conscious effort to reflect the path of the sun physically and compositionally using the semi-circular shape of the drum kit. The direct electrical link between the solar panels and the motors means that the activity of the instruments instantaneously changes with the amount of sunlight. Kubisch's work, on the other hand, is more poetically interpreted. A string of light sensors around a clock tower is used to trigger recordings of the bells that once rang in the tower but had fallen into disuse; the recordings are played by a computer in response to the readings form the sensors and the time of day, "[t]hus, a sunny summer morning generates loud, distinct, metallic tones, while a gray afternoon in winter brings about softer, somewhat melancholy sounds" (Mass MoCA, n.d.).

Any work with weather – the most famously chaotic of systems - at its heart must acknowledge the work of John Cage and his use of aleatoric systems, "composing

in such a way that what one does is indeterminate of its performance" (Cage 2011 p. 69). A weather-driven work exists in a state of multiple potentials, at any time able to change unpredictably in response to fluctuations in the forces driving it.

Sundial (solar drums) presents a drumkit surrounded by solar panels and electric motors. Each motor is powered by one solar panel and has a flexible plastic armature attached, which spins and strikes its drum when light falls on the panel. There is one motor per drum and one for each cymbal. The piece is set up facing south and with the solar panels facing outward from the kit; in this way the path of the sun and the curve of the drumkit cause the drums to be activated sequentially as the sun moves across the sky, from the hihats in the morning to the floor tom in the evening. Panels on which the sun shines directly (rather than obliquely) create more voltage and play their drums faster, adding further sonic complexity. The path and strength of the sun can be perceived in the composition and volume of the drums, and the work creates an audible sundial which sonically expands the viewer's understanding of the environment.

Objects Extended in Space

Sound is a spatial phenomenon and much sound art has focussed on this quality. The importance to sound artists of engaging with space is that it allows a reconsideration of how we perceive sound and music; not just a succession of pitches in time, but a phenomenon grounded in physics, resulting in standing waves, echoes, resonances and other spatial phenomena. Alvin Lucier noted:

"Sounds have specific spatial characteristics. Those of short wave length (high frequencies) are directional; longer ones (lows) spread out. Sound waves flow

away from their sources roughly in three dimensional concentric spheres, the nodes and antinodes of which, under certain circumstances, can be perceived in a room as clearly as those of a vibrating string on a violin. […] Conventional acoustic engineering practice has historically defied these phenomena in an attempt to deliver the same product to everybody in the same space. Accepted as natural occurrences to be enjoyed and used, however, they open up a whole new field of musical composition." (Kelly 2011 p. 112)

These concerns illustrate the desire of sound artists like Lucier, LaMonte Young and Max Neuhaus to transcend the temporal focus in the perception of audio material as a means of defining sound art as a discipline distinct from music. By focussing on space, sound artists immediately align themselves with sculpture and installation, and make a claim on the territory of fine art.

Boundaries

Rolf Julius took great pains to match the sounds and objects he used, carefully selecting the right sizes, colours, sounds and volumes for the elements in order to create a unified work. An idea of the care he would take can be gleaned from this quote in the gallery brochure accompanying his posthumous show at SoundFjord gallery in London in 2011:

"My problem with the glass plate onto which I had sifted gray cement pigments: the glass was $1m^2$ in size and the cement color a little too dark for the gray sounds I had prepared for the piece. I could have purchased a lighter kind of cement, but decided to change the color of the music by reducing the tape speed until the two grays matched. But what about the size of the surface, how do color surface and

sound surface relate to each other? And how dense were the musical molecules? I had the feeling my music would just barely be enough for an 0.8m^2 plate. So I had to make corrections, I had no choice but to purchase a smaller plate of glass" (Julius 1995).

Julius' actions raise interesting questions about the size and boundary of a sound. The volume of a sound is not simply a measure of loudness, but of physical volume occupied by the soundwaves. A sound's physical size increases with volume; with more energy it spreads further and fills more space. This would indicate that the volume of a sound in a multimodal work should be carefully controlled to match the size of the object it is presented with if the desire is to create the best possible match. Personal experience of Julius' work at SoundFjord Gallery in 2011, the Goethe Institute Tokyo in 2012 and Oxford Brookes Audiograft Festival 2013 would seem to bear this out – the physically small works were accompanied by sounds often requiring the listener to kneel on the floor to hear. But what happens at the edge of the sound? The boundaries of objects tend to be hard, physical, immovable, impenetrable, with a sudden transition from inside to outside. Those of sounds, by contrast, are usually soft. They are shifting, being affected by reflections and wind, and fade out with a gradual transition from sound to silence. It is not always immediately apparent when we are outside or inside the sound. These contradictions and tensions offer intriguing possibilities for multisensory practice.

Thoughts on the Aesthetics of Sounds and Objects

Sound Art is in a state of transition. For many years, and since its inception as a practice, the term has been used to define a space of operations; a fence put up

to keep out what sound art is not (the *not music* and the *not silence*, to paraphrase Rosalind Krauss (1979 pp. 36-37)). Sound art had an identity which was defined in relation to other more established forms, and which assiduously tried to avoid those forms in order to carve out a niche 'in-between'. Early sound art largely focussed on the medium and its phenomenological and physical possibilities (Schaeffer's reduced listening, Lucier's resonances, Young's drones and standing waves) as a way of reclaiming the ear and the act of listening as a legitimate portal for artistic expression. However it would be wrong to assume that aesthetic considerations were of no consequence; even if the aesthetics derived from physics they transcend simple demonstration. Lucier's *I am Sitting in a Room* (1969) for example, with its avowed intention "less as a demonstration of physical fact, and more as a way to smooth out any irregularities my speech might have" belies a desire to create order out of imperfection. The piece becomes a journey from Lucier's 'irregular' stuttery (and representational) speech to stacks of quite beautiful abstract harmonies (Seth Kim-Cohen (2009 p. 186) describes them as a 'shimmering electrical pulse'), and the transformation in aesthetic between beginning and end of the work is striking.

Once the medium-specific points had been made the discipline found itself faced with a problem; was it simply a small corner of practice investigating properties of sound, or did it have something to offer beyond this restricted definition? A growing sense that and "[t]he ear is an aesthetic organ, not only a receiver of phenomenon" (Mullane 2010) led to a wave of artists who attempted to incorporate the medium into the wider territory of fine art. It is perhaps no surprise that the first Turner prize to be awarded to a sound artist went to Susan Philipsz, whose work engages with the familiar and established artistic subjects of site and memory, deftly using the ephemerality of sound as a metaphor for loss

(in, for example, *Study for Strings* (2012)). The aesthetic of sound art expanded to become a critical tool, and started to operate between the audible media and the socio-political context in which it was presented. As Nicolas Bourriaud writes in Relational Aesthetics (2002 p. 41), "If a work of art is successful, it will invariably set its sights beyond its mere presence in space; it will be open to dialogue, discussion, and that form of inter-human negotiation which Marcel Duchamp called 'the coefficient of art'".

Another way the form progressed was through increased hybridization with other media. In fact, this had been going on since the beginning, as sonic sculptures, Morris' *Box with the Sound of its own Making* (1961) and Tudor's *Rainforest IV* (1973) collided sculptural and aural concerns. However these didn't address sensory correspondences as such; what was different about Rolf Julius' work was that it explored aesthetic (not physical) links between sonic and material qualities. In this respect it could be argued to derive its lineage more from the visual music of Fischinger and Belson than any previous history of sound art. Julius' mention of the 'musical molecules' (above, in 'Boundaries') is intriguing; it is tempting to suppose that by this he was referring to small sonic elements, the number and speed of repetition of which he thought of as correspondent to the density of physical material. There are other correspondences which have which been apparent through this project; in *Pod*, where the deep drone speaks to the colour and shape of the inflatables, and the volume of the sound and object must be matched, and in *Arpeggi*, where the space-age material and electronic sounds correspond, and the semiotics of sound and object both bear resonances of surveillance equipment. Other aesthetic and physical qualities remain to be explored and offer tantalizing ideas, for example boundaries to volume as

mentioned above, weight to pitch, brightness to tone, fracturedness to rhythm, fuzziness to reverberation , and so on.

I would argue that correspondences such as these are only part of the story. What they do is point the way toward an aesthetic of sound and object that we can only understand by examining the space between the senses. What is notable in multimedia work is that the full effect of the work is not transferrable by one sense alone, and in fact either part of the multisensory composition can be unremarkable (think of the loss of emotive power most films suffer when their soundtrack is removed). The aesthetic of the work (not just of the individual parts) arises precisely between them, in the experience of viewing, listening, and resolving the relationships between the two. The aesthetic of multimedia work is a relational aesthetic. The concept as popularised by Bourriaud focuses almost solely on human relations, but the idea of an artform whose aesthetic arises from the relations it creates is applicable much more widely (the entirety of Brandon LaBelle's *Background Noise* (2008) concerns the relationship of sound(art) to space). As Bourriaud's aesthetics focus on the "inter-human relations which [the artworks] represent, produce or prompt" (Bourriaud 2002 p. 112) the aesthetics of multimedia work are the inter-sensory impressions, correspondences, contrasts, revelations and surprises which the artworks produce or prompt. Trying to probe, prod, and coax these relationships into revealing themselves – and to recognise them when they arise – has been the major work of this research. The forms they take, and the mechanisms by which they operate, are the essential subject of this project and all the artworks created within it.

Site

Site is often used in modern sound artworks; 'site specificity' and 'responding to a space' are familiar phrases. Sound can be extraordinarily powerful in this type of work. Max Neuhaus' *Times Square* (1992) melds soundart with the ambient noises of the city. Bill Fontana's *Distant Trains* (1984) relayed the sounds from eight live microphones in the Köln Hauptbahnhof station to the site of the former Anhalter Bahnhof station in Berlin, revitalising the derelict site with ephemeral audio reminders emitting from loudspeakers in the ground. Suzanne Phillipsz *Surround Me* (2010) filled locations in the City of London with songs that would have been sung there in medieval times. Christian Boltanski's *The Whispers* (2008), a piece which the author was involved in fabricating, played back readings of letters, sent from soldiers in the first world war trenches, to their families and sweethearts in England. The readings were presented on a clifftop overlooking Folkestone harbour, from which the soldiers had left for France nearly 100 years before. All these works – as well as being inextricably linked with time - involved sound's dislocation in bringing a new reading to a place, an audible semantic layer imposed upon and interacting with the physical fabric of the location.

I will now describe two of my works that deal with site, and which came about through a reappraisal of the 'object' in the sound-object equation during the second year of study. This had previously been considered as something smaller than the viewer placed on a plinth or on the floor (Morris' definition is: "generally small in scale, definitively object-like, potentially handleable, often intimate" (Morris 1993 p.25)), but *Torch Song*, a piece created for OVADA's *Spotlight* exhibition in 2011, invited a reappraisal of this position. The work was designed as a site-specific sonic intervention into a room in Oxford town hall, and through

interacting with the sonic and visual qualities of the structure, the realisation came that the building was materially no different to any of the other objects I had been using previously - it was simply a box that was large enough to contain the viewer. As in the previous smaller works, by sonically emphasizing parts of the infrastructure of the building, *Torch Song* added extra layers of meaning to that box and redefined the visitors' relationship to it. This realisation led to the proposition that the site, or environment, could be treated in the same way as Morris' *Box* or the metal sculpture in *Bleigiessen*. If the room or landscape is considered as the object in our sound/object composition, then the role of sound in shifting the viewer's perception of their environment can be explored.

Case Study: *Torch Song* (p. 169).

Exhibited: *Spotlight* group show, Oxford 02/12/11

Torch Song is an interactive artwork, presented in a dark room, that creates a sonic composition from the infrastructure of a building. It allows visitors to activate and play with sounds streamed from around a building by shining torches onto light sensors in a custom-built control panel. Although very different in its sonic aesthetic and concept, this work owes a debt to Peter Vogel, whose work activates kinetic sound machines and electronic circuits through the use of light sensors and shadows (Vogel 2007). The form of simple interactivity, adding or blocking light to trigger a sound, is simple and elegant. However Vogel's (exceptional) work always uses triggers to control mechanical systems or electrical circuits directly. In Torch Song the sounds are streamed from around a building and the point is not just the compositional interface but the boundary between noise and music and an attempt to reimagine the building in the mind of the

visitor. A piece that allows the public to engage sonically with architecture like *Torch Song* is *Playing the Building* (2005 - 2012) by Talking Heads frontman David Byrne, in which an old organ controls solenoids and vibration motors to allow the public to sonically activate parts of a building by pressing its keys. The piece is interactive and focuses on the sounds of the building, and not (as in many other architectural soundworks) what buildings do to sound. However *Playing the Building* imposes artificial excitation into the structure and is heard acoustically, whereas *Torch Song* uses amplification to reveal sounds that are already present.

At *Spotlight*, the interface presented to the public was a white-painted wooden cabinet with a transparent Perspex top, resembling a display cabinet. It contained 8 photocells, each mapped in the control software to one of the sounds, and with the source of that sound written underneath. Sounds were sourced from a window, a radiator, the air conditioning, a cast iron staircase, a wooden floor, an electrical junction box, a power supply, and a data router. Visitors controlled the live-streamed sounds of the building by shining torches onto the photocells - the brighter the light, the louder that sound. The torches could be set to flash, creating rhythmic effects, and encouraging experimentation with composition. Many people spent time with the work playing and composing with the sounds. Visitors enjoyed the audiovisual link and the quality of the sounds, but were often unaware that the sounds originated in real-time from the building (and were fascinated when they understood this). The control panel was large enough to accommodate multiple players; visitors engaged in collaborative compositions and a lone composer seemed annoyed to find their work interrupted by the arrival of another. The soundscape of disembodied clicks and drones brought a new perception of the room in which the piece was presented; the sounds seemed at certain times soothing, at others mysterious and threatening and

confronted assumptions that buildings are silent, static and dead. The sound extended the room, giving it a sense of architecture as living thing – to paraphrase Goethe, 'unfreezing the music' – a place full of unexplained events, subject to time and decay, and shot through with electrical and hydraulic nervous systems.

Case Study: *SolarWork #2* (p. 173).

Exhibited:

Audiograft, Oxford Brookes University 29/02/12 to 29/03/12

Digital Design Weekend, Victoria and Albert Museum, London 22-23/09/12

SolarWork #2 is a site-specific, outdoor, solar-powered sound artwork that investigates the possibility of extending a visitor's appreciation of a site using sound. Sound and location are very natural partners, especially when intangible audio is used to speak of something departed; the demolished station in Bill Fontana's *Distant Trains* (1984) or a long forgotten London in Susan Philipsz *Surround Me* (2010) (a sense of memory and loss which comes across clearly in Iain Sinclair's short video review of the work for the Tate: https://www.youtube.com/watch?v=ISzXgoE7Dc0). Max Neuhaus' *Times Square* (1977–1992; reinstated in 2002), situated under a grate in New York city, is another example in which imported sounds mix with those of the location to create an enhanced landscape. Neuhaus' work has some aesthetic similarities with *SolarWork #2*. In both pieces, sounds are added to the landscape which are essentially non-referential (it could be argued that the abstract low sounds in Times Square recall trains or the quiet electronic chirps of *SolarWork* recall birdsong but both are abstracted and the reading more a result of location than

the sound itself, unlike the other works mentioned previously). These sounds are carefully chosen and placed to mix with the natural sounds of the landscape and produce a hybrid sonic aesthetic which both results from, and speaks to, the site in which it is placed. They are also both durational works, designed and installed such that they become part of the landscape over time. When *SolarWork* was taken down after a month the sense of change in the landscape – which had after all simply returned to its previous state – was startling.

In *SolarWork #2*, a field of small sounds draws visitors into and through the landscape, encouraging them to explore and reimagine their environment. Solar power is used to allow the work to be sited outdoors for indefinite periods of time with little or no maintenance. *Solarwork #2* consists of seven brass gramophone horns hung in trees, roughly 20m apart, in a line across the landscape. Each horn is connected to an oscillator circuit and solar cell, and emits high-pitched drones, siren sounds and cicada-like chirps in response to the ambient light conditions. The piece uses piezo disc sounders and simple square wave oscillators (Collins 2006 pp. 129-133) and draws very little current; as such it will work even on overcast days, although the sound will be quieter. The volume of the sounds was carefully considered so as not to drown out the sounds of the environment. In bright sunlight it is just possible to discern the sounds from two horns when standing between them. The sonic element of this work uses Rolf Julius' concept of 'small music' – low volume sounds to draw the listener in and force them to listen more acutely - as a way to subtly draw people's attention to their sonic environment. There is an interesting 'inverse' power relationship in the idea, in that the smaller the music is, the more is demanded of the listener, and the more control the piece exerts over them.

A consistent comment about the work is that the listening experience expands, or *unfolds*; from walking under a horn and noticing an unusual sound, the visitor's attention is drawn to the horn above them; their attention is led to birdsong (which is in the same pitch register as the horn sounds), then other environmental sounds, then their visual perception expands to the other horns, which they then explore; and then perhaps noticing the weather, and how the horn sounds change with changing sunlight and shadows. The piece creates a trajectory of attention from an initial focus on the horns, broadening to an extended appreciation of the location; real birdsong, sirens, traffic, insects, people. The dimensions of the work can be considered to expand beyond the material and sonic boundaries of the horns, to the limits of hearing and sight (one visitor commented: “This work is miles wide and miles high, and takes me right into the sound of the world”). The piece is 'undetermined', in that it holds no prescribed viewing order or route. Our freedom in exploring creates new relationships between us, the work and the landscape, and reminds us of our embodiment and ability to roam, and that “sound is not merely information exchange, but is capable of creating relationships between listeners and their environment in a dynamic process of embodied cognition” (Truax 2012).

The sounds for the work are created instantaneously by sunlight, tightly coupling the artwork and location. The sound arises directly from the elements rather than being pre-recorded material imposed on the space. Indeed, the environment is so vital to the work that the piece cannot be considered to exist without it. The chaotic nature of the weather is reflected in the composition, and the chance events and indeterminacy inherent in this process is embraced as part of the nature of the work. The sound of *SolarWork #2* can be considered a durational performance, an open-ended, long-term composition, in that it will continue for

as long as the components last, and each day can be considered a small 'movement' in the overall musical structure.

Exploring the Ontology of Objects

So far this chapter has been concerned with exploiting the properties of sound to bring new readings to objects, but some experiments explored the ontology of physical things – specifically, three-dimensional shape and materiality. These qualities are fundamental to objects, and the first sets this work apart from all visual music and two-dimensional mappings.

Case Study: *Shape Experiments* (p. 127).

Study carried out in year 1 of the research.

Shape experiments involved viewing a static shape from different angles while listening to a range of sounds, with the intention of investigating the process of multisensory perception at a basic level. Although a subjective artistic process, the process is comparable to studies of sound symbolism – the concept that words are not always simply arbitrary sounds but arise from the qualities of the objects they represent, a question most famously posed in Köhler / Ramachandran and Hubbard's 'Bouba/Kiki' study referred to the introduction (Ramachandran and Hubbard 2001, 2003, after Köhler 1992. p224). For example Ohala provides evidence from several languages (and several studies) that "the expression of size utilizes speech sounds whose characteristic acoustic frequencies vary inversely with size of the thing designated" (Ohala 1997) – in other words, the word for

small is often high pitched and uses front vowels, and that for large low pitched with back vowels, as in English. Deroy and Auvary use the phenomena to investigate the Molyneux problem, or "whether the crossmodal matching observed between felt and seen shapes at a very early age is acquired through exposure and associative learning, or whether it pre-exists exposure instead" (Deroy and Auvray 2013). Although the process of the Shape Experiments was not as rigorous as these studies, the intent was similar; an attempt to investigate correspondences between sound and shape at a pre-semantic level.

The shapes were based on Cezanne's basic forms – the sphere, cone, and cylinder - plus a cube. All shapes were roughly 30cm in size and painted white. The sounds were sine, saw, triangle, square and noise waveforms, with adjustable frequency and filter. Each object was viewed while listening to each waveform. The pitch of the waveform was varied, and also the frequency, boost and cut of the filter to give different timbres. Observations were:

Pure sounds (sine) work better with static-feeling forms like the sphere.

Sounds with more than one component (e.g. root tone and overtones, triangle, square) imply a relation to two parts of an object at once, and work best with objects that involve asymmetry or change of shape such as the cone.

There is a strong link between dynamism in form and sound. The cone and white noise worked well together, whereas the noise seemed unbalanced with the sphere, implying a dynamism that the shape does not possess.

Some frequencies draw attention to specific parts or properties of an object: sound with a mid-frequency cut appeared to come from inside the object, and one of the sounds placed with the sphere enhanced the sense of its material.

What is striking about these results is the range of mappings created from such a simple setup – themes of shape, materiality, movement, and meaning are all very obviously present in the results. The *Shape Experiments* indicated that even with very simple shapes, essentially absent of cultural associations or language, sound can be a powerful force in reimagining physical objects. The study was extended in *Double Helix* (p. 105).

Sound's Role in the Ontology of an Object

As previously discussed in the section on time, pairing objects with sounds forces the viewer to consider the life of objects beyond the immediate and the visible, and that an object is made of not just physical matter but also a cloud of memories, associations and multisensory potentialities – as Morris says, "… to oppose the ontology of the art object as a silent, timeless, autonomous thing" (Morris 2000 p. 165). The work *Shower* explores the part sound plays in the ontology of an object. The piece attempts to investigate where the boundaries of the definition of an object lie. *Shower* emerged from a simple question: if the physical matter of an object was removed, and just the sound remained, how much could the presence or experience of the complete object be evoked by its sound alone?

Case Study: *Shower* (p. 144).

Exhibited:

Work in progress show, Oxford Brookes, 29/10/10

Audiograft, Oxford, 14/02/11 - 20/02/11

Kinetica Art Fair 2011, London 04/02/11 - 07/02/11

Pegasus Theatre Oxford 08/05/12 - 10/05/12

A stereo recording of a domestic shower is played back through speakers arranged to spatially mimic a shower; the shower head sound emerges from a single speaker suspended above the visitor, while the sound of water hitting the floor comes from four speakers at the corners of an imaginary shower tray. A button is situated where the controls of the shower would normally be and the audio plays all the time it is held in. When the visitor releases the button, the soundfile switches from playing the main shower recording to the sound of the shower slowly dripping to silence.

There are three concerns of this work which are echoed in wider soundart practice. Firstly spatiality, which is essential to the experience. As noted below the sound of the shower has to surround the user in order for the effect to be believable; the shower head sound has to come from above and the splashing sound from around your feet (and not from just a point source). This use of spatiality recalls the work of Bernhard Leitner, whose speaker constructions, surrounding the listener with speakers mounted on wooden or steel frameworks, produce a "tone-space composition" of sound moving in space (Schulz 2002 p. 126). Leitner's concern was an architecturally-inspired treatment of sound in space, but in both cases the use of spatiality takes listening out of the purely aural and re-frames it as whole-body experience. Secondly *Shower* has obvious domestic references, reimagining familiar day-to-day objects using sound, reminiscent of Haroon Mirza's "dislocated domestic environments assembled from an eclectic inventory of objects" (Bonacina 2010). Thirdly the piece replaces a missing element of a scenario with sound, an idea expressed in Shirley Pegna

and Wajid Yaseen's *Ghost Quartet* (2011), where the music created by a string quartet is played back into four chairs (one for each instrument) using surface transducers to turn the chairs themselves into resonating surfaces. The simultaneous absence and presence of the musicians is emotive and captivating. As with Pegna and Yaseen's work, *Shower* is a very minimal representation of the object. In fact all it consisted of was a sound recording played in the same spatial arrangement as the real thing, activated by a push button. Nevertheless, for most users the effect was startling, as recounted by Kat Austen, writer on the New Scientist blog, reporting on the piece at the Kinetica Art Fair 2011:

"By pressing a button positioned to evoke memories of municipal swimming pools, you activate sound recordings of a shower … the effect is disconcertingly realistic, the disconnect between your auditory and other senses causing a quick succession of anxious double-takes as you fight the urge to leap out of the water that isn't there" (Austen 2011).

Shower has been installed four times. Feedback from the first 'work in progress' showing at Brookes indicated that the piece made people feel disorientated and uncomfortable, from both fear of getting wet and showering in public, and these fears were played on during subsequent installations in a public window and a large exhibition. Most recently the work was installed in a shower room at the Pegasus Theatre in Oxford, and in this installation a pressure mat switch and the switch-off sound were added. All previous installations had been in a lighted, public room, but at Pegasus - in keeping with the methodology followed during the research of experimenting with the presentation of work where possible – the room was dark and people were instructed to enter individually and step on the mat once the door closed. Subjectively the sonic experience was enhanced, both

due to the darkness which tends to focus the attention on the aural, and because the tiled shower room added its own appropriate resonance to the sounds.

It was found that the positioning of the speakers has to mimic a real shower to work, and the brain is not fooled unless the splashing sound surrounds us in a realistic way. Almost all visitors reported feeling some apprehension of getting wet or showering in public when initially using it. It is also interesting that, when exhibited at the hot and busy Kinetica, people would claim they felt refreshed after using the piece - all associations which are bound up with the experience of being in a shower. It is also clear that despite the name and speaker arrangement, it is largely the sound that evokes these associations. Thus the effect of sound goes far beyond a simple transference of information; it is enough to stimulate the imagination or even a physical reaction - many visitors jumped, laughed or screamed in reaction to triggering the sound. This research suggests that the sound an object makes is an important part of its ontology, which appears self-evident, and yet is easy to forget. An object's sound is inextricably linked to its materiality and physical shape – Merleau-Ponty's 'specific nature'. In *Shower* we hear the pressure of the water being forced through the nozzles, we can tell it is a fluid, we hear the material of the bath it falls into and, in some cases, the resonance of the room in which it is presented. Sound can reveal the material or shape of an object, or of two materials coming together. Merleau-Ponty suggests that "one may doubt whether the sense of hearing brings us genuine 'things'" (Merleau-Ponty 1962 p. 267) which I would argue against; standing outside in the rain with our eyes closed, we can tell the difference between the sounds of water falling on a leaf, a plastic bag, or a corrugated steel roof. Sound may be limited in spatial resolution, but it certainly brings us things; and why are things revealed in this way less genuine than those revealed by sight? Juhani Pallasmaa claims that

“All the senses … can be regarded as extensions of the sense of touch – as specialisations of the skin” (Pallasmaa 2005 p. 42) and when hearing brings us such a rich sense of an object's material qualities, evoking the act of touching that material, that claim is easy to believe. The sound artist and binaural field recordist Dallas Simpson explored the idea of objects and locations – pools, bridges, quarries - revealing their ontology through sound in a series of recordings entitled the *Stone Vandal Suite*, where structures and objects were sonically activated by throwing stones. According to Simpson the static object is “silent - in a state of infinite unexpressed sonic potentiality” until struck by a stone, and that “the concept of disturbance or interaction with the environment is a vital process necessary to liberate the 'voice' of the location by eliciting the sounds of silent objects and surfaces present at the location without recourse to verbal description. Thus in a particular way the location can be made to 'speak for itself' by the presence and creative activities of the sound artist” (Simpson 2013). In refusing to ‘speak for’ the location, and utilising the democratic medium of stone throwing to allow it to reveal its own truths, Simpson demonstrates the possibility of sound to bring us genuine things.

Summary

Some objects – such as musical instruments – are largely defined by their sound. If so, should an object's definition include all the sounds it is capable of making, adding multiple layers of understanding, overlapping and concertinaring together into a detailed experiential map of the object? And again, if an object’s definition includes its sounds, should the boundary of the object be the point at which the sounds can no longer be heard, which will vary according to the situation, the

environment, and from person to person? This chapter has shown that sonic material can be used to extend our appreciation of an object, evoking a new or enhanced sensibility of an object's *specific nature*, and has raised questions about the role of sound in an object's ontology. In particular we have seen that:

- The perception of sound can alter our sense of time, space and materiality in objects.
- If shape and sound are to be perceived as one work it helps to match their sense of movement, or dynamism.
- The object in a multimedia work need not be small, opening up the possibility of working with the built or natural environment.
- Sounds can strongly evoke the presence of an object even when that object is absent; they are an indivisible quality of that object resulting from its physical material and shape, and can indeed *bring us things*.

This chapter has considered ways in which existing qualities of objects can be revealed and enhanced through the perception of sound. The next will focus on presenting elements in different media as one work, paving the way for a discussion of more extended multisensory possibilities in the final chapters.

Chapter 2

Crossmodal Reinforcers

In chapter 1 we have examined some of the ways sound and objects interact in a multimedia artwork. This chapter takes a short departure to discuss how multimedia pieces work and can be created – beginning with the psychology of perception and then suggesting how this knowledge helps us ensure that two media are appreciated as part of the same piece. The idea of *crossmodal reinforcers* is introduced, techniques which help sound and object to fuse in the mind of the viewer. A number of reinforcers are identified and illustrated with examples from research and practice.

Multisensory Research in Psychology

Multisensory perception is an active area of psychological and neurological research that investigates the simultaneous stimulation of more than one sense and how the disparate sensory signals are combined to form a single percept (Stein and Meredith 1993). As we have seen, after a long period of unimodal research (the prevailing paradigm of the 20th century), modern neuroimaging techniques have meant scientific interest in synaesthesia has resumed, accompanied by research into the more universal crossmodal correspondences. Psychoacoustics research has explored the mechanisms and relationship between sound and its perception (for a useful overview of the physiology and psychology of sound and its perception in the environment – location, auditory scene

analysis, speech recognition etc., see Wolfe et al. (2009 pp. 218-297)). Audiovisual illusions have indicated that the senses affect each other at a level below conscious control, indicating that senses affect each other at a fundamental level and should not only be studied in isolation.

The renewed interest in multimodal perception seems to reflect a recent trend towards holistic research approaches which consider a system rather than its parts; for example multimodal analysis, which treats communication as the sum of numerous signals including body language, gaze, and quality of voice (Jewitt 2009), the study of complexity and non-linear systems and networks (Heylighen 1989, Ball 1999, Beer 1995), emergent behaviours in robots (Brooks 1991) and swarms of insects (Bonabeau et al. 1999).

The idea of presenting work in two modalities may seem complex compared to artwork designed for a single sense, but is actually a simplification of what we do everyday; assimilating information from all of our senses concurrently to build an understanding of the world at a particular time and place. The idea that sensory impressions should be studied in a holistic rather than reductionist manner informed the Gestalt school of Psychology in the 1020s and '30s. Gestaltists developed a series of laws, which suggested how movement and shape could be extracted from a complex visual scene, of which several are applicable to our discussion. Although largely focussing on the visual sense, audio versions of the laws have been proposed (McLean 2005, and Wolfe et al. (2009 pp. 268-269) carry interesting examples of auditory segregation and grouping). Those most pertinent to this discussion are:

Law of Proximity: objects close to each other are perceived as belonging together.

Law of Similarity: objects similar in some attribute (e.g. size, shape, colour) are perceived as belonging together.

Law of common fate: objects that move in the same direction or change together are grouped.

Law of Closure: objects are perceived as being closed and complete even if their outlines are incomplete or obscured.

The principles in these laws can also be related to multisensory experience, and in fact the crossmodal reinforcers introduced later are essentially readings of the Gestalt laws as applied to multimedia work.

Audiovisual illusions can suggest much about the interaction of the senses. Several notable experiments (along with the well-known ventriloquist effect (Alais and Burr 2004)) indicate that vision, despite having pre-eminence amongst the senses, does not act in isolation. The McGurk effect (McGurk and MacDonald 1976) demonstrates the interdependency of hearing and vision and that what we hear can be directly affected by what we see. The illusion presents a video of an actor saying /ga/ overdubbed with a sound recording of them saying /ba/. The combined percept is often heard as /da/, but on closing the eyes or the ears the percept reverts to the original reading. The illusion is consistent and cognitively inpenetrable (that is, even if we know what is happening we cannot affect the result), and shows that sight affects hearing at a subconscious level – essentially, that we hear not only with our ears, but also with our eyes. This sensory interplay is confirmed by the double flash experiment (Shams et al. 2002). It presents a single flash of light together with either a single or multiple audio beeps. Even

though only one flash is ever present, the number of light flashes perceived corresponds to the number of beeps heard, so if two beeps are heard a double flash is seen. This illusion is notable as unusually, audition overrides vision. The relevance of both these experiments is that they demonstrate empirically that vision and hearing are perceptually linked and lend weight to the argument that multimedia artworks are valid territory for research.

Synchresis

In his book on the audio arts in cinema, 'Audio-Vision: Sound on Screen', Michel Chion introduces the concept of synchresis, the "spontaneous and irresistible weld produced between a particular auditory phenomenon and visual phenomenon when they occur at the same time" (Chion 1994 p. 63). In the context of cinema sound in which Chion writes, synchresis facilitates overdubbing, mixing, editing and presentation (as well as practically defining much visual music). It is also notable that he uses the word 'weld'; Chion talks of the two media creating a single, new, combined perceptual event. Synchresis, in the language of the text that follows, is a temporal crossmodal reinforcer, and can be realised when elements of the object and sound change simultaneously.

Part of the focus of this PhD was to identify techniques that help fuse sound and vision in the mind of the visitor. I have termed these *crossmodal reinforcers*. The rest of this chapter draws on the findings of Gestalt theory and Chion's idea of synchresis to introduce four reinforcers – spatial, temporal, semantic and causal - and demonstrates how they have been explored practically during this project.

The Spatial Reinforcer

Sounds and objects that share an origin in space (e.g. Morris' box with its speaker inside) are perceived as belonging together. Our normal experience is that sounds originate and emanate from things. This is an expression of the Gestalt law of proximity; that objects that are close to each other in space are perceived as grouped together or part of the same object. The spatial proximity reinforcer was explored just prior to the start of the PhD in *Pod*, which informed subsequent PhD research.

Case Study: *Pod* (Collaboration with sound artist Alison Ballard) (p. 124).

Exhibited:
Shunt, London Bridge 05/08/09 - 09/08/09
Constellation, Whitley Arts Festival Reading, 25/10/13

Pod consists of 2 meter inflatable spheres emitting low frequency pulsing sound. The public are invited to touch and hug the spheres, which resonate with the frequencies played inside. Due to its use of inflatables this work has overtones of play, like Jeff Koons' balloon animals (the majority of which were actually steel, e.g. *Balloon Dog* 1994 - 2000) or Florentijn Hofman's giant *Rubber Duck* (2009 - 2013) - and indeed the piece can be seen as sonic playground, multimedia artwork or physics demonstration depending on the context in which it is shown. However, with speakers inside, Pod is also a tactile listening experience; the low-frequency sound and vibrating skin of the spheres encourage the audience to listen to the sound through their bodies as well as their ears. The resonance of the body's internal cavities and the possibilities of corporal listening have been the

focus of Bernhard Leitner's *Sound Chair* (1976) – deriving partly from Leitner's belief that sound affects our physical and mental wellbeing (Licht 2007 p. 42) - and Kaffe Matthews' *Sonic Armchair (1997)* and *Sonic Bed* (2005), both with embedded loudspeakers. *Pod* focuses on the whole-body experience of sound, but in a more visual and playful way than these examples, which tend to be presented as a new way to focus on audio (meditative and restful, and often with the eyes closed). Matthews' work does incorporate the same ideas of a collective sound experience however, with her beds being big enough for several people to lie side by side. *Pod* continues the theme of this thesis in exploring the perceptual relationship between the seen and heard; it has been found through experience that low-frequency drones match the shape and colour of the inflatables better than high-pitched or narrative sounds (confirming observations made in the *Shape Experiments*), and that there is an optimum volume to match the size of the object.

Each sphere contains a pair of 6" speakers facing each other inside a tube, fed with sounds from an MP3 player. The sounds are sine waves of around 75hz which are fed separately to each speaker and mix inside the cardboard tube. They play at very slightly different frequencies, which creates deep throbbing beat frequencies as the two sound waves interact. This provides movement and an ominous quality as well as making the audio sound lower than it really is. The sounds are deliberately lacking in narrative to allow more room for the visitors imagination, and matched to the shape of the balloons. More dynamic sounds (electrical hums and buzzes) didn't suit the object as well as the simple pulsing 'round' sine waves.

By placing sounds inside the balloons, which vibrate through their skins allowing the visitor to touch or hug the sound, the spheres are given a life and mysterious intentionality, and the sound a focus, bodily presence and tactile reality. Pressing your ear on the skin of the balloon changes the sound, and their movement in the wind introduces a subtle vibrato, revealing sonic events as physical phenomena. The sounds seemed to change the reading of the spheres quite significantly, and comments about alien or surveillance technology were common. Several visitors remarked how relaxing the objects were, and others that there was a breathing or womblike quality to them. *Pod* proved that the collision of sound and object, reinforced by physical proximity, could create a new audiovisual object, with greater possibilities for interpretation and interaction than either element of it in isolation.

The Temporal Reinforcer

The second form of proximity is temporal – that is, when object and sound change at the same time we tend to group them, even if they are not spatially close. This can be related to the Gestalt law of proximity and law of common fate (where two objects moving in the same direction are grouped). Change in an object implies movement, and movement creates sound - so experiencing the two simultaneously forms a strong perceptual binding. The sound need not emanate from the same location as the movement, as demonstrated by the ventriloquist effect.

Case Study: *The Fully Sequential Multi-Sensory Reflect-O-Matic* (p. 166).

Exhibited: *Audiograft*, Oxford, 14/02/11 - 20/02/11

This piece, with its spinning LED lights and name consciously aping the advertising hyperbole of 1950s America, exploited temporal proximity to perceptually join sounds and events. It uses the technique of sonifying light patterns using a solar (photovoltaic) cell. These devices produce electricity when light falls on them and are normally used for generating power; but when the output is connected to an audio system the fluctuating voltages produce an instantaneous conversion of light to sound. The technique has been used by David Strang and Vincent Van Uffelen, who send radio music encoded as light from an LED to a solar cell, where it is converted back into sound, and sonify vibrations in a rubber band using an LED on one side and the solar cell on the other (*Transmission and Interference* 2009 - present). The work focuses on the effects of the translation of information across media and the ability to sonify physical movement through variations in shadows. Strang and Van Uffelen's instruments also use a variety of coloured LEDs to achieve different sounds, which is similar to *The Fully Sequential Multi-Sensory Reflect-O-Matic* in that the changing colour patterns of the fans cause shifting tones in the audio. Solar cells don't have to be used with LEDs; Felix Hess made work using solar cells behind candles (*How Light is Changed into Sound* 1995). Rob Mullender (*Amber* 2008) and Stephen Vitello (*World Trade Center Recordings: Open House Bounce* 1999) have both used sound-to-light techniques to sonify the lights in city streets. In Vitello's case the work is presented as audio-only, but Mullender presents his work as video, focusing on the relationship between physical objects and sound mediated by shifting light patterns.

The Fully Sequential Multi-Sensory Reflect-O-Matic comprises two hand-held fans pointing at each other and fixed upright to a baseplate. The fans have coloured LEDs in one blade creating spinning patterns as the fan turns, and are an expression of the consumerist dream alluded to in the title – cheap, gaudy and disposable. The LEDs point at four photovoltaic cells fixed to the baseplate, a result of experiments with the direct light-to-sound possibilities of PV cells (connecting the raw voltage output of the cells to an amplifier, and lighting them from a candle, LEDs, incandescent bulb etc.). The changing light patterns from the fans caused electrical patterns to be generated in the PV cells, and resulted in a sonification of the fans' patterns – a shifting, overlapping composition of multi-pitch drones. Since the speakers were a few feet from the object, the temporal proximity of the changing sound and light patterns was the main cue that they were causally linked. *Reflect-o-matic* started as research exploring the phenomenon of light to sound using photovoltaics, but yielded a useful example of temporal proximity welding audible and visual aspects of a piece.

The Semantic Reinforcer

Here, audio and visual elements are linked by shared meaning. A photo or statue of a dog at one end of a room will likely appear related to a bark played at the other end, even though the elements are spatially and temporally distinct. The viewer's a priori knowledge will tend to suggest that they are part of one work (although it is unlikely that they will be perceived as one sensory event). A strong semantic reinforcer tends to close down possibilities for new readings and interpretations and, as will be seen in the following chapters, the work in this research progressed into exploring the possibilities of increasing the semantic gap

to allow room for imagination. The gradual widening of this gap and lessening of semantic proximity is the basis for the multisensory continuum proposed in chapter 4.

The Interactive Reinforcer

The final reinforcer presented here is that of interaction. When viewers are able to manipulate something in the work themselves (or see it manipulated), and hear the sound change in response, it suggests that the two media are linked. The interactive reinforcer is related to the temporal; in effect, it is a case of temporal proximity that is within the conscious control of the manipulator of the object. For example, in *Subtle Objects: Pickup* the visitor creates their own narrative for the object by selecting and mixing sounds themselves, which are understood as part of the same work because they change as the object is tipped. Another example is the *Dance Theremuino*, a hand-held instrument which reacts to the movements of a dancer onstage. Although the audience do not manipulate the object themselves, the performative nature of the piece means the causal link between the interaction and sound is very apparent.

Case Study: *Dance Theremuino* (p. 176).

Commission for DAP-Lab dance company, 2012

This work, commissioned by the DAP-Lab dance company for their production *For the Time Being*, is an interactive digital theremin, with distance sensors to translate a dancer's movements into sound. Léon Theremin invented his

eponymous instrument in the 1920s, using analog electronics and capacitive sensing to translate the player's movement into sound (Smirnov 2008 pp. 134-136). Although the theremuino differs significantly from the original – it has totally different technology and sound – it requires a similar playing technique. Theremin himself made an instrument to be played by a dancers' movements, the *Terpsitone*, although anecdotal evidence would suggest that only renowned thereminist Clara Rockmore and Theremin himself ever managed to play it successfully (ibid. pp. 137-139). The concept of an instrument to be played 'in the air' by gesture was extended by Michel Waisvisz' *The Hands* (1984), a self-made device that Waisvisz played with only minor modifications for fourteen years. Creating novel instruments and especially interfaces which forego the usual limitations of knobs and sliders is the focus of John Richards and his project Dirty Electronics, the mission of which he describes as being "an increasing focus in electronic music on shared experiences face-to-face, ritual, gesture, touch, social interaction and the exploration of devised instruments" (Richards 2008). The *Dodecaudion* (2011) by panGenerator uses the same technology as the *Dance Theremuino* to create a dodecahedral 12-channel music and video controller, although in this case the unit is always presented hung in space on wires. This is a major difference to the *Dance Theremuino* as it immediately positions the device as an instrument, defining where the player has to stand and holding them to one spot, rather than a unit translating the free movement of a dancer into sound.

The *Dance Theremuino* consists of an arduino microcontroller running a granular synthesizer in a spherical Perspex ball with five infrared distance sensors spaced out around the shell. The theremuino is programmed with code modified from the open-source Auduino project (http://code.google.com/p/tinkerit/wiki/Auduino), which turns it into a

synthesizer with two voices and five variable parameters. The project replaced all the control potentiometers of the original Auduino with distance sensors and added a guitar radio transmitter system, as well as modifications to the software. Several simpler thereminos were built prior to the dance version, investigating interaction design in musical instruments (http://evolutionaryart.co.uk/theremuino.php). The *Dance Theremino* is a good example of the interactive reinforcer. The dancer performs movements with the object, twisting and turning, holding it up, throwing and catching it and cradling it close to the body. The distance sensors, which have a range of about 80cm, translate these movements into changes in the synthesizer parameters, modifying the sound and inspiring further extemporisation from the dancer. The instrument and the performer become partners in a sound and movement feedback loop, and even though the ball has no onboard speakers and its sounds emit from either side of the stage, the correlation between the movements of the ball and the changing sounds reinforce the sense of their common origin and perceptually weld the sounds to the ball.

Dominance and the Balance of Media

The reinforcers described above can help multimedia work appear coherent, but another important factor is balancing the elements. When either part is dominant, a situation occurs which upsets the audiovisual equation. Sound files must be carefully balanced in terms of their volumes and content, and the sounds must be balanced with the visuals – which might include colour, shape and volume (i.e. size in both the audio and physical senses), to ensure that no element of the work dominates. One of the audio files auditioned for *Subtle Objects:*

Superabled included a melody, and on trying the piece it quickly became clear that, despite being only heard occasionally, the melody totally dominated all the other audio and visual elements of the work. It lodged in the mind distractingly, and soon completely unbalanced the composition of elements. Similarly the pitch and volume of *SolarWork #2* was developed to balance environmental sounds without drowning them out, and the loudness of *Volume* is adjusted to match the size of the shell.

In one sense this is a multimodal reading of the art of composition, or "arranging in a decorative manner the diverse elements at the painter's command to express his feelings." (Matisse 1908). However it holds doubly true for work in two media, for not only must audio and visual elements balance within themselves, but they must also balance each other. There must be a composition of elements allowing each one to be appreciated individually and as part of the whole, and to work together to create new readings, and in ontologically quite different media. The skill of a multimedia artist lies in encouraging disparate elements to speak together to create the desired response.

Summary

This chapter has discussed the issues involved in presenting a multimedia composition and introduced the concept of crossmodal reinforcers. By referencing the Gestalt laws of perception and extending Michel Chion's synchresis into interactive domains, this chapter suggested four types of reinforcer (spatial, temporal, semantic and interactive) derived from a synthesis of existing research with observations from practice, which can be used to bind the sonic and visual aspects of a multimedia piece. When the reinforcers are

successful, the balance of the elements is correct, and the work is received as a holistic, audiovisual artwork, the two media can perceptually interact in a number of ways, which are explored in the next chapter.

Chapter 3

The Perception of Multimedia Work

Having looked at techniques to balance and mesh two media into one work, we now consider their perception and what control we have over the effects. This chapter aims to explore and categorise the relationships set up between seen and heard, to gain an understanding of the mechanisms at play. Using a behavioural model from research in communication studies, we consider a range of responses that result from the interaction of two senses and how to apply them in an arts context. The behavioural model is expanded to include the new category of distraction, where it is impossible to focus on both media simultaneously.

Lessons from Communication Studies

A useful place to start is by extending Connor's (2011) reading of Partan and Marler's (1999) research on multimodal communication in animals (fig. 1). The table describes cases where stimulation in either sense alone result in the same behaviour, and others where either stimulus alone results in different behaviours, and then considers what happens when both stimuli are experienced concurrently. A range of behavioural effects are described which we will use as a basis for discussion.

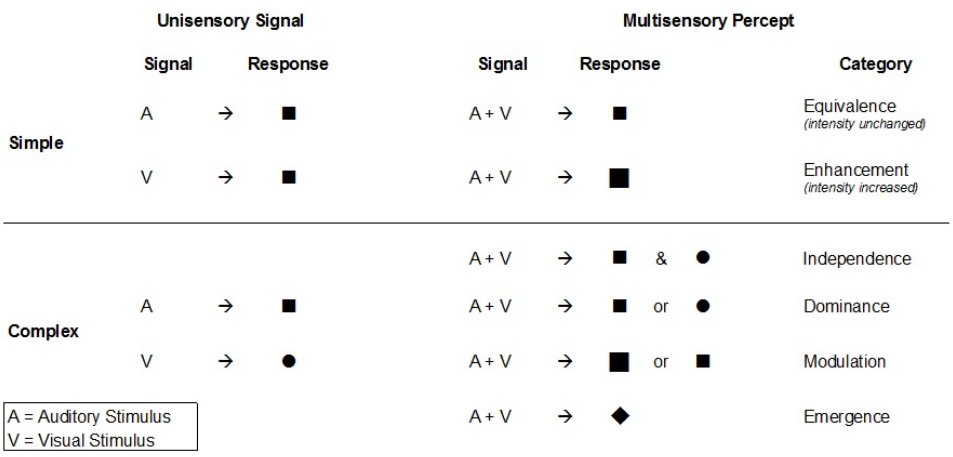

Fig. 1. Multimodal responses in animals (after Partan and Marler (1999)).

Applying each category in the table in a different context – humans in an art gallery – yields some useful insights into the way we understand and create meaning from multimedia art. Some care must be taken as the objective, repeatable observational methodology of the studies referenced by Partan and Marler does not always transfer to the subjective, individual responses to an art piece - where personal experience and knowledge play a part - but the comparison is still valuable.

Equivalence: In this situation neither stimulus affects the other or changes the resulting percept. Both sound and vision alone produce the same response, and the combination evokes no more response than either on their own.

Enhancement: Enhancement is a common effect of multimedia practice. In the table enhancement refers to the increase in amplitude of a response common to

both audio and visual stimuli when they are received simultaneously. In arts practice this can be expressed as a quality that both elements possess being enhanced by their co-perception. An example is the recent work *Arpeggi* which was created in the final year of study to tour the UK as part of the 'Audible Forces' group show.

Example: *Arpeggi* (p. 184).

Exhibited:

Audible Forces Brighton Festival, 03-05/05/13

Audible Forces Norfolk and Norwich Festival, 17-19/05/13

Audible Forces Salisbury Festival, 25-26/05/13

Audible Forces Greenwich and Docklands Festival, 21-23/06/13

Audible Forces Stockton Festival, 02-04/08/13

Audible Forces Lakes Alive Festival, 09-11/08/13

The *Arpeggi* are kinetic sculptures modelled on anemometers. Each sculpture consists of a two-meter high central pole with a hub at the top, on which are mounted three aluminium arms and dishes which revolve in the wind. Each arm has a loudspeaker mounted on it pointing into the dish, the sonic focussing effect of which causes the sounds from the speakers to be highly directional. As the *Arpeggi* spin the sounds from the speakers project sequentially as the piece turns. The Arpeggi exist in the lineage of kinetic and wind-driven sound sculptures, which includes the work of Max Eastley (who over a long career has made a series of ingenious sculptures that continue and expand on methods used in the aeolian harps popular in Victorian times) and Peter Appleton (both featured in Davies

1985), *Chorus* (2013) by Ray Lee, and the *Singing Ringing Tree* (2006) by Tonkin Liu. The work was created for *Audible Forces*, a show featuring instruments powered by, or responding to the wind. Clive Bell, reviewing *Audible Forces* in the Wire, referred to *Arpeggi* as having "sci-fi overtones" and being "an image of surveillance overkill in a posh English garden" (Bell 2013), and it is true that the visual and audible associations recall some kind of state data-gathering machinery. It is not a piece of surveillance art, but it shares some territory with work such as James Bridle's *Drone Shadows* (2012 - 2014) or Paulo Cirio's *Face to Facebook* (2011) which raise questions about the use and legality of data collection in modern society.

The movement of the *Arpeggi* is driven by the wind, but to create the sounds solar-powered oscillator circuits mounted on the arms are used, which yield a complex soundscape of electronic pulses changing in pitch and rhythm depending on the amount of sunlight hitting the solar cell. On each arm two pairs of oscillators are summed together, fed into an amplifier and out to the speaker. Visitors were able to walk between the two sculptures and hear the sounds changing with the sun and wind as the arms rotated; they also hear different phasing patterns between the sounds as the windspeed changes and the sculptures speed up and slow down.

The demonstration of enhancement relates to the shared characteristics of the work; the revolving aluminium domes with their air of rocketry or radar, and the 'sci-fi' electronic sounds. These create a combined effect of some alien communications device or covert surveillance equipment. Importantly, both the sound and look of the sculptures have these associations to some degree, but the combination makes a much stronger sensory impression than either on their own.

To achieve enhancement there must be some semantic dialog between the two media; there must be a situation set up in which a quality of the audio speaks to a quality of the visual, and vice versa, and the result of perceiving the two concurrently is that this quality is amplified.

Independence

This category, in the diagram, refers to a situation in which a visual stimulus produces one response and the audio another, and there is no change when the two are played simultaneously. The two media have no perceptual qualities in common to the observer. In an art context this means an object and sound that seem to have no resonance (some examples of these were observed in the *Shape Experiments*). However, the response to a multimedia artwork is personal and contingent upon the visitor's existing knowledge. In the behavioural studies the results are observable and repeatable, but in an art context what holds little resonance for one may evoke a response in another.

Modulation

In this category the audio and visual senses interact to affect the amplitude of the response. The response is different quantitatively, but not qualitatively, from what would have been experienced in the presence of a single sensory input, being greater than or less than the original (single sense) response.

Emergence

In emergence two elements interact to produce something entirely new. Emergence in art requires imagination and co-operation on the part of the audience, who are active participants in co-creating the work and whose agency can be invoked by carefully controlling the distance in meaning between the seen and heard. In this semantic gap a space of potential is opened up in which the viewer's imagination can be stimulated to create new objects inspired by, but distinct from, the original ones perceived. Discussion of the mechanism by which the audience co-creates a work is hardly new; in 1862 Kazuko Okakura writes in The Book of Tea "in leaving something unsaid the beholder is given a chance to complete the idea and thus a great masterpiece rivets your attention until you seem to become actually part of it" (Okakura 2001 p. 37) and in 1959, focussing on the audience's performative agency, Marcel Duchamp writes: "All in all, the creative act is not performed by the artist alone; the spectator brings the work in contact with the external world by deciphering and interpreting its inner qualification and thus adds his contribution to the creative act" (Lebel 1959 pp. 77-78). Umberto Eco expands on the subject in 'The Open Work': "The search for *suggestiveness* is a deliberate move to "open" the work to the free response of the addressee. An artistic work that suggests is also one that can be performed with the full emotional and imaginative resources of the interpreter." (Eco 1989 p. 9)

The difference in a multimedia artwork is that we are considering work that has not only an external relationship between artwork and viewer, but also an internal relationship between the different media. Controlling the internal

relationship allows wider possibilities for the external relationship: wider possibilities for suggestiveness and the performative input of the spectator.

Case Study: *Volume* (p. 139).

Exhibited:

Work in progress show, Oxford Brookes, 29/10/10

Unfoldings solo show, Watermans Gallery London, 20/09/13 – 19/10/13

Volume is a work that investigates emergence from sounds, visuals and imagination. It consists of a single, slightly open oyster shell with a small speaker inside. A hole is drilled in the underside of the shell for the speaker wire, which is connected to an MP3 player and amplifier. The speaker plays the sound of occasional water drips, to which was added a very large reverb, making it sound as if the drips were recorded in a cave or cathedral. The sound is intentionally quiet, both to match the size of the shell and to draw the viewer in and force them to listen more acutely. The work is probably the closest in this project to the aesthetic of Rolf Julius – small and unassuming objects and sounds, designed to be shown in a gallery, and demanding attention and engagement from the visitor. As discussed elsewhere, Julius often attempted to match the properties of the sounds and objects he used, and in this respect Volume differs as the two are deliberately mismatched to create the effect of an 'impossible object'. It also differs in that the speaker is hidden inside the object (this is something that Julius wanted to do with the rocks he used, but was practically unable to and subsequently discovered that a small speaker placed on top had the same

proximity effect). The work of Miki Yui shares an aesthetic and a philosophical position with that of Julius; “an extremely evocative displacement of aural perspective, as we first struggle to hear the sounds and then struggle to determine what is ‘music’ and what is incidental” (Hanssen 2012). Yui’s work continues Julius’ practice of ‘small sounds’ and displays a restrained minimal presentation using assemblages of objects. Her work has overtones of lightness, absence and memory; her materials include dust, broken mirrors, Japanese paper, crockery, seeds and water. These works do not come to us; they require a sustained attention, and force us into a state of acute listening, demanding engagement on their own, barely audible terms.

With the speaker inside the shell, *Volume* uses the proximity reinforcer discussed previously to bond object and sound. There is also some semantic similarity in the shell and sound of water, but also perceptual mismatch - although vision shows the shell is small, the echoing drips imply the space inside it is enormous, and audio and visual cues are contrasted with each other to create an engagement with the concept of space and our audiovisual perception of it. The visitor's intended experience is that of emergence brought about through sensory dislocation. The piece encourages the imaginary creation of an object that is bigger on the inside than on the outside, a new object emerging from what physically exists, but which itself can only exist in the imagination. The three dimensions of sound, visuals and imagination here open the spectator up to suggestions that would be impossible using either the physical or sonic elements of the work on their own.

Distraction

An extension to the behavioural model is the category of distraction. Here, the semantic gap between the media is so great that not only do they do not work as a gestalt, but perceived together one media distracts the viewer so much that it is impossible to concentrate on either. In a visiting lecture at Oxford Brookes University, sound artist Steve Roden described *Above the Sand, Flown and Undone (Levitation)* (2006), one of his process-based multimedia works. The work was presented as sculpture and audio, both originating from the same piece of classical music but transformed by different processes. Roden claimed that when he presented the two results together it was difficult to concentrate on either, and the best way to appreciate the work was to close the eyes and listen, or turn the sound off to look. When held up to the ideas informing this thesis Roden's work seems to fail, but when questioned he stated that his focus is on process and as long as the transformations of the original material stay true to the premeditated concepts, he accepts the end result as the correct and true outcome for the work.

Expanding the Space of Possibilities

In earlier discussions of balance and composition we have seen that multimedia works require appreciation of the internal relationships between the media as well as those between the piece and the audience. I now wish to use an example from evolutionary computing to illustrate the idea of expanded possibilities in multimedia work.

This computer science field contains the concepts of genetic algorithms (GAs) and multi-dimensional search spaces (Mitchell 1999 pp. 6-7). In a GA – a computer model of the process of natural selection - an object (which might be a robot control algorithm, a share price predictor or an aeroplane wing being evolved for optimum efficiency) is represented by a number of variables. Each is counted as one parameter - or dimension - of the object that can be varied, and the finished object exists at the point where all the dimensions' values intersect. It can be seen that quickly the dimensions in a problem can surpass the three we are used to in the physical world (for example, a sound might have dimensions for pitch, duration, timbre, rhythmic complexity, dynamism and mood), and this is why GAs are used - searching a multi-dimensional space of possibilities for an optimal result is something they are very adept at. A large number of objects are created with random values for the dimensions and tested to see how well they perform; the best are saved and bred to produce a new generation which are re-tested; iterating towards individuals which fulfil all the requirements.

I wish to use this example to illustrate the idea that in multimedia works, the dimensionality and suggestiveness of the piece is expanded. I do not mean the work's physical dimensionality (i.e. the 2D of paintings or 3D of sculptures) but, as in a GA, the number of variables that are involved in creating a finished version of the piece. A unisensory work might be considered to be two-dimensional in this regard; in broad terms, and incorporating the performative agency of the audience as part of the equation, the variables involved in creating a reading of the work are the artwork itself and the spectator's imagination, and the reading of the work exists somewhere in the space of possibilities bounded by these parameters. Multimedia artworks add another sensory input – another variable - and expand the potential for interpretation exponentially, into three dimensions.

With the viewer's reading existing at the convergence of both elements of the work itself and their imagination, multimedia works can expand the space of possibilities and the number of potential readings available to the artist. The shift from a two-dimensional (fig. 2) to three-dimensional (fig. 3) space results in a hugely increased area of possibilities.

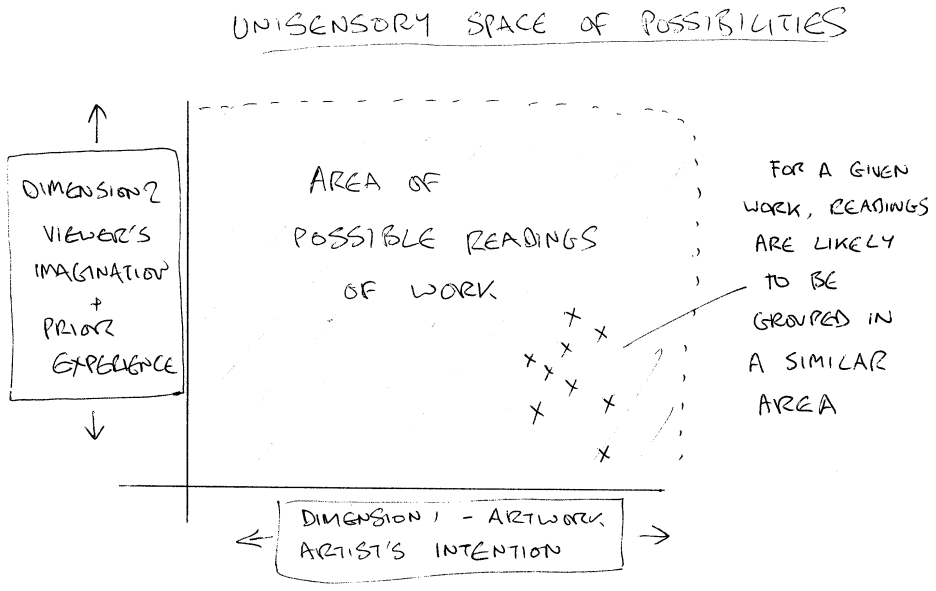

Fig. 2. A two-dimension (unisensory) space of interpretation possibilities

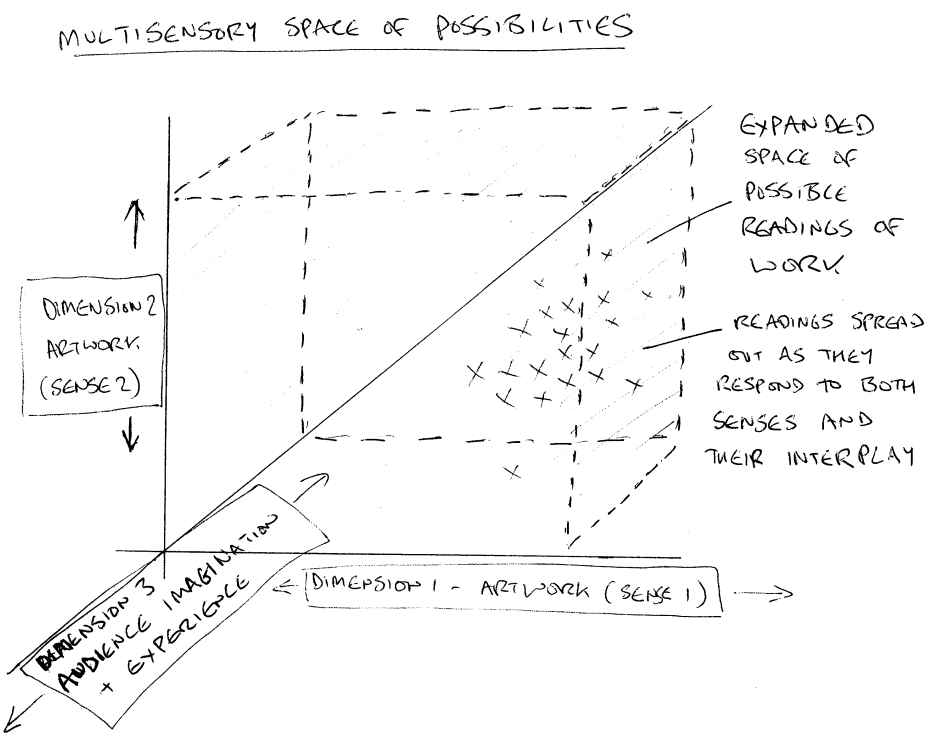

Fig. 3. The increase in potential readings arising from a shift to multimedia work.

Association

Moving on from the behavioural table we now discuss the techniques of association and dislocation. Association is a valuable multisensory strategy, which occurs when the two elements share easily recognisable qualities and mutually make those qualities apparent. The brain, when confronted by multiple sense impressions, attempts to associate the seen and heard and integrate them into a meaningful whole, and associated elements are held in a tension which needs little cognitive interrogation to resolve. Association relies on finding semantic similarities between the two elements, and these similarities reinforcing each other, often leading to *enhancement* (as in the radar-like sounds and appearance of *Arpeggi*).

Dislocation

The opposite mechanism – dislocation - can be equally effective. Association works by pairing elements to enhance their shared qualities; the technique of dislocation is to *widen the semantic gap* between the seen and heard, so that similarities between them are not immediately apparent. The audience is then forced to engage with the work in order to understand the link between the two media, which gives rise to these effects:

- Engagement: by enlarging the semantic gap interest is generated and the viewer is drawn into the work, becoming active co-creator rather than passive receiver.

- Unease: if sensory messages do not concur, feelings of apprehension may result, and shifts in the relationship between the seen and heard play with the viewer's perception of reality.

- Extension: An object can be extended semantically by pairing it with sounds that are tangentially, rather than directly, related. It is possible to extend an object further and in more directions using dislocation; pairing the training shoe in *Pickup* with sounds of boats, cows and sewing machines creates a multilayered object that simple associative sounds (e.g. basketball) could never achieve.

- Emergence, or creation of a 'third form': in attempting to reconcile the two forms of the seen and heard, the imagination can create a new, third form, related to but distinct from either of the original elements.

In Janet Cardiff and George Bures Miller's *The Muriel Lake Incident* (1999), the visitor stands beside a model theatre, looking past rows of miniature seat backs to a small screen showing a film, and listening to a binaural sound recording in headphones. The audio comprises the sound of the film and a woman who

appears to be sitting next to you and talking to you. However Cardiff and Bures Miller recorded the binaural soundtrack in a real theatre, and the soundtrack implies a large ambient space totally at odds with the size of the model, in what Cardiff calls a 'dislocation of the senses' (Christov-Bakargiev 2001 p. 122).

Dislocation, to varying degrees, underpins the multisensory continuum – a scale of increasing semantic separation upon which multimedia works can be situated and evaluated, and which will be fully introduced and discussed in the next chapter.

Summary

Using behavioural science research as a starting point, this chapter explores the ways in which sound and vision can interact perceptually, and illustrates the more important ones with practical examples. The main effects discussed are:

- Enhancement, which emphasises certain pre-existing qualities of the media.
- Emergence, which creates a new imaginary object from the interplay of the sensory elements.
- Distraction, which occurs when either element attracts the attention to such a degree it is impossible to focus on both.
- Association, the welding of sound and object – and possible enhancement of one or both - arising from a similarity in qualities (phenomenological or semantic) across both media.
- Dislocation, a mindshift caused by the deliberate, partial mismatching of the two media.

Additionally, the example of a search space in genetic algorithms is used to show that by adding an extra sense, the space of possibilities that the final artwork can occupy is increased, implying enhanced creative opportunities for the multimedia artist.

Chapter 4

The Multisensory Continuum

During the second year of research, a key issue emerged; how to arrange the works produced in order to clarify and examine relationships between them. It was apparent that all the pieces explored proximity between the seen and heard, in time, location or meaning; and one, in particular, proved pivotal. *Ceremony* is a work using cymatics, the technique of activating a physical medium (typically water or a granulated solid like sand or sugar) using sound. Under the right conditions the material instantaneously forms into patterns following the nodes and antinodes (points of maximum and minimum vibration) in the sound. *Ceremony* is a piece where sound and object are causally and physically linked with no semantic, physical or temporal gap between them. Reflecting on this work brought the realisation that all the pieces made had differing amounts of semantic separation between objects and sounds, and this could be the major axis upon which the works were arranged. *Ceremony* directly links sound and pattern to occupy one end of the scale, and at the other extreme acousmatic music aims to split the sound and referent object entirely (R. Murray Schafer's *schizophonia*) to appreciate sounds as entities in themselves (the idea central to Pierre Schaeffer's 'reduced listening' (Chion 1994 p. 29)). Between these end points lies a continuum of increasing semantic separation of sound and object within which each work can be framed. Furthermore, and drawing on the multisensory effects discussed previously, the continuum can be split into distinct

categories, each of which provides its own possibilities for multimedia art practice (fig. 4).

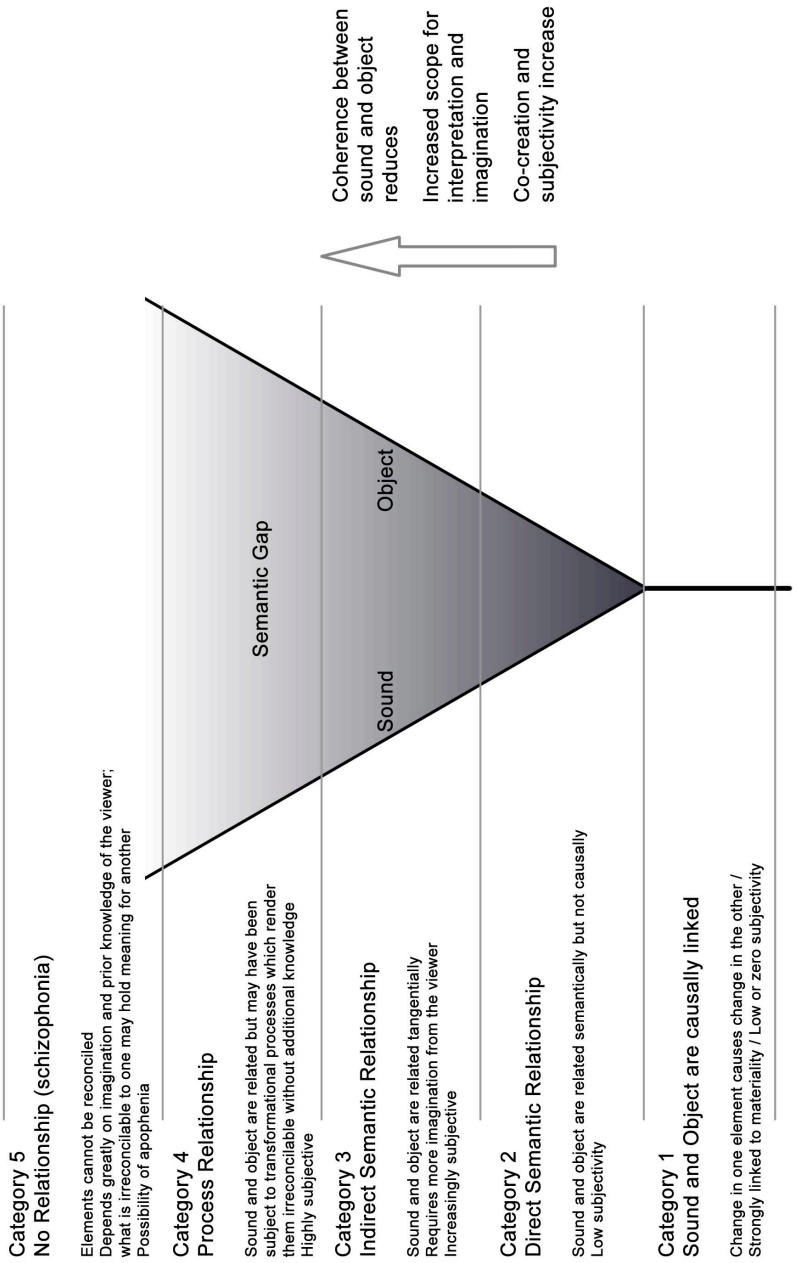

Fig. 4. The multisensory continuum and categories.

Category 1: Direct Physical Relationship

At one end of the continuum lie works in which sound and object are physically related. The object or pattern may directly result from the sound, as in the technique of Cymatics or the use of a Ruben's Tube. Conversely, the sound may be dictated by (and directly originate from) the shape and material of the object – for instance, sound sculptures that are struck, bowed or otherwise activated to produce sound. In both cases the two media are mutually and inseparably related. Creating sounds by setting an object in motion, or finding its points of resonance, can reveal the structure and materiality of that object - although the laws of physics act identically on fleshly or artificial materials and spaces, a point brought home to the author upon visiting a performance of Tudor's Rainforest IV (1973) and hearing jungle sounds emerging from old radiators and sheets of broken glass.

Case Study: *Ceremony* (p. 141).

Exhibited:
Work in progress show, Oxford Brookes, 29/10/10
Audiograft, Oxford, 14/02/11 - 20/02/11
Kinetica Art Fair 2011, London 04/02/11 - 07/02/11
Unfoldings solo show, Watermans Gallery London, 20/09/13 – 19/10/13 (as *Ritual*)

Ceremony is an artwork utilising cymatics, the technique of directly visualising sound through the vibration of physical material, and illustrates the directly-linked sound and object category. It was exhibited at Brookes and the Kinetica Art Fair 2011, and re-made in larger form as *Ritual* for the final show at Waterman's

Gallery in London. In *Ceremony* eight loudspeakers are filled with vibrating water, but (unlike most cymatics artworks) the emphasis here is not primarily on the patterns formed in the liquid. Because the sounds rise and fall in volume, the water only vibrates some of the time, and an emphasis is created on the contrast between the rippled and still water, the transitions between the two forms, and the rhythms in which the water moves. The work is intended, not as a demonstration of physics, but rather as a phenomenological exploration of water and sound, and references work which uses water for its symbolic and humanistic resonances such as text and installation pieces by Yoko Ono (Iles 1997 p. 44-51, Rothbart 2006) or Rolf Julius (Schulz 2002 p.116). The piece was inspired in part by Akseli Gallen-Kallela's painting Lake Keitele (1905) which depicts a mirror-calm lake surface broken by bands of ripples. The still water is reflective, shiny and inviting; the bands of ripples are opaque, matt and mysterious. *Ceremony* aims to explore these two aspects of the nature of water captured in the painting, using sound as a driving force, and provides a tightly-coupled audiovisual experience created by the pulsing sound being obviously linked to the changing patterns in the water. Cymatics has an obvious attraction for artists working with sound and visuals; the process allows an objective rendering of sound as form, albeit one determined in part by the shape and qualities of the materials used to do so. As such it has informed artworks including Alvin Lucier's Queen of the South (Lucier et al. 2005), Suguru Goto's Cymatics (Imperica 2012) and the photography of Alexander Lauterwasser (Lauterwasser 2007), and Jenny's related invention to visualise the human voice, the Tonoscope, is currently being re-imagined in digital media by Lewis Sykes (Sykes 2011). The danger with cymatics works is that they appear as simply a physics demonstration, and cannot move beyond an impressive but limited illustration of the action of sound upon a medium. Lucier's

piece is of note as it incorporates the cymatics into a feedback loop with musicians; the music they play is turned into a pattern which the musicians respond to, creating new patterns, and so on. The cymatics becomes part of a bigger scheme and transcends its role as physics demonstration by becoming a new form of visual feedback. Ceremony attempts to avoid the problem by using multiple speakers and focusing on the visual and sonic patterns formed between the group as the water shifts from still and transparent to rippled and opaque. A notable work which takes the 'seeing sound' aspect to its logical conclusion is *Untitled* (2004) by Douglas Henderson. This piece consists of four loudspeakers painted blue and playing very low frequency sound, meaning the audio can be seen but not heard. By removing the audible sound from the equation the piece sidesteps the problems with literal mappings, opening a window into realms of experience which are normally out of sensorial reach: "it is precisely from the close interrelation between the sonic and the non-sonic that his works take shape. In his Untitled, for instance, the visual aspect dominates: we see the changing patterns created on four water surfaces excited by sub-woofers, while the 55-minute four-channel composition that creates these patterns remains acoustically inaudible – being pitched below our threshold of hearing." (Glandien 2012).

Ceremony consists of eight small waterproof loudspeakers arranged equidistantly in a circle on a 40x40cm square wooden base and connected to an amplifier. The amplifier connects to the audio output of a computer running a Max/MSP patch. The speakers are filled with water. The Max program fades sound in and out of the speakers, which creates periods of patterning on the water's surface, and times when it is totally still. Once made and exhibited, it became apparent that the causal audiovisual relationship in *Ceremony* establishes a baseline situation of

no gap between sound and object, illustrating one end of the multisensory continuum and a reference point for the assessment of other work. In contrast to the acousmatic concept of removing sounds from their original referent, *Ceremony* can be thought of as the opposite extreme; the object (the water) is not just 'attached' to the sound, it – or at least the pattern formed on its surface – *is* the sound, instantaneously rendered in three dimensions through displacement of the material. Cymatics is as close as we can get to seeing audio phenomena with the naked eye, and allows us some appreciation of the agitation of the environment required to create and sustain sound. We cannot visually perceive the chaotic air pressure fluctuations of sound all around us; but as the water is transformed by the audio, it helps us appreciate sound as a series of interacting waves. The ontological shift from the water's 'solid' form – agitated, opaque, present - to the 'fluid' form - flat, calm, transparent, absent – informing both our understanding of sound and water, is a primary focus of the piece.

Category 2: Direct Semantic Relationship

The next category of the continuum concerns works which possess a clear semantic relationship between seen and heard, but where the media may not share a common origin, introducing some separation between the sound and object. The break away from the physical causality of the previous category which starts here will enable more esoteric sound/object relationships to be explored in subsequent stages.

Case Study: *Stereo Rain Paintings* (p. 159).

Exhibited:

Time Machines solo show, Oxford 13/09/11 - 16/09/11

Out of Office, Abingdon 27.11.12 – 02.12.12

Stereo Rain Paintings was exhibited as part of Time Machines solo show at Oxford Brookes University in September 2011. The piece is constructed of two sheets of mild steel, upon which abstract patterns have been splashed in clear varnish. The sheets are placed outside and the unvarnished areas allowed to rust for several months. The plates are exhibited hung on a wall adjacent to each other. The visual tension between the rusted and protected areas of steel speaks of decay and the nature and properties of the materials. The audio component of the work is a five minute recording of rain hitting the sheets during the period they were left to rust. Both the audio and the varnish splashes echo the process of decay caused by the water. The rusted mild steel in this work bears a resemblance in process and material to the monumental pieces of Richard Serra, but diverge in purpose; Serra's work being concerned with form and scale and the Rain Paintings focusing on a sense of time and process of decay brought into the static material by the sound. In this respect the piece is the antithesis of Morris' *Box with the Sound of Its Own Making* (1961); it shares the technique of using sound to render imaginable processes that have happened in the object's past, but in this case that process is decay, not creation. It is *Plate with the Sound of Its Unmaking*. The steel exists, in a dry gallery, in a state of suspended decay with only the recording of rain and splashes of varnish to indicate how it came to be in its rusty condition.

In *Stereo Rain Paintings* the sound and object are directly related, but the nature of the relationship requires some imagination on the part of the viewer to understand. Reconciling the gap expands the viewer's attention to elements and processes beyond what is immediately present. Film sound designer Walter Murch writes that film "should strive to create a purposeful and fruitful tension between what is on the screen and what is kindled in the mind of the audience […] the filmmaker can open up a perceptual vacuum into which the mind of the audience must inevitably rush" (Murch 2000). The same is true of sound and object works, and indeed of any multimedia composition. The judging of this "purposeful and fruitful tension" is key to the success of the work.

Stage 3: Indirect Semantic Relationship

The third stage further widens the gap between the seen and heard. In this case, the two media bear a tenuous, indirect or incomplete relationship to each other. The attempted resolution of this dislocation engages the viewer's interest and imagination, and enables the artist to explore a wide range of possible readings. The creation of a multimedia work in this category becomes a composition of elements that must be balanced to create an overall sensory impression, and ensure that no one element predominates.

Case Study: *Subtle Objects: Pickup* (p. 132).

Exhibited:

Stadium, University of Brighton Grand Parade Gallery, Brighton 13/07/10 - 31/07/10

Subtle Objects: Pickup, Jubilee Library, Brighton 22/05/10 - 30/05/10

Subtle Objects: Pickup exploits semantic dislocation to engage the visitor in creating their own narrative between a sports shoe and six soundfiles. The work bears similarities to Janet Cardiff's work, for example *Whispering Room* (1991), in that the narratives built up by the participant are dependent on their personal journey through the material and are by necessity non-linear. A picture of the object, or story, or location builds up over time piece by piece as more information is revealed. Cardiff plays with this explicitly in her audio and video walks, abruptly switching the city scene you are looking at on your screen – and standing in front of – to a forest for a few seconds to signify daydreaming, or from day to the same scene at night, suddenly jumping 12 hours or so (*Alter Bahnhof Video Walk*, 2012). The user is caught off guard trying to reconcile the composed narrative on the device with the ongoing narrative of the real world and the dislocation is confusing and fascinating in equal measure. Technically *Pickup* uses an accelerometer to measures tilt, which has rapidly become an accepted method of interaction with technology. Atau Tanaka and Adam Parkinson used accelerometers as a musical interface in *4 Hands iPhone* (2010), a performance work controlling sample playback using tilt on four phones. Pickup is an installation work but through its interactive nature has overtones of performance (one of the audience at a work in progress event moved the shoe rapidly which relegated the object to being merely a sound controller, but did create sonically interesting 'scratching' sounds).

Pickup consists of a Nike Air Jordan basketball shoe, placed on a plinth. A sign instructs visitors to put on headphones, pick up the shoe and tilt it. The shoe is

fitted with an accelerometer, and controls the volume in the headphones of six sound files. The sounds relate to its manufacture and status as a consumer object and the mix between them is determined by the attitude of the shoe in space. They are: a sewing machine, some Chinese speech, a cow, a spoken description of the rubber tapping process over a rainforest ambience, the sound of docks and a ship's horn, and the soundtrack of a youtube video in which a US-based Air Jordan collector unwraps and describes a pair of Nikes identical to the ones used in the piece (these were his latest 'pickup' – the term used by collectors denoting the acquisition of a new pair of shoes, and which inspired the name of the work). The Nike shoe was chosen for several reasons; mainly it is pre-loaded with pre-conceptions, allowing multiple routes to the creation of new narratives that challenge or extend our understanding of the immediate physical object. Using this shoe allows engagement with the ideas of manufacture, globalisation, capitalism, and commodity fetishism.

The sounds were selected to interact with the nature of the object and the user's preconceptions, but their tangential nature leaves a semantic gap to encourage the participant's interpretation. They are deliberately not overly political or prescriptive, to allow the visitor's imagination to play a part in constructing a personal understanding of the piece. The sounds deconstruct the shoe, highlighting specific parts of it in the viewer's attention - for instance the description of rubber-tapping that is heard when the user is viewing the sole. When the shoe is held at an angle, the sounds are mixed in some proportion. This creates a unique narrative and cloud of associations that surround and interpret the object (and add the 'subtle' layer alluded to in the title), echoing Jeff Koons' comments on commodity-related work:

"...through this procession of contingencies, discourses are being pulled together into the object itself, promoting an awareness of the fact that all meanings are contingent upon some other meaning, where meanings are appropriated for their relationship to external forces, the larger social schema in which they're involved." (Koons 1986)

The aim of the work is that the experience of the piece will be unique for each participant, being created at the intersection of the physical object which is held, the audible object which is heard, and any *a priori* ideas or memories that the visitor has which are triggered by association.

Pickup was exhibited alongside a second version of the piece (*Subtle Objects: Superabled*), which worked in an identical fashion, made using an Ossur 'Cheetah Foot' prosthetic leg. Picking up and tilting the leg controlled six soundfiles referring to advances in prosthetic technology and the gradual shift in public perception of para-atheletes from 'disabled' to 'superabled' (prosthetics approaching or exceeding natural capabilities or allowing miraculous changes in appearance or height – such as Aimee Mullins' appearances in Matthew Barney's film *Cremaster 3* (2002)).

The intention in pairing what might at first seem unrelated sounds with the shoe was to encourage participants' imaginations to create a personal experience out of what they saw, heard and knew already. For instance, one of the comments at a work-in-progress showing of the piece concerned hearing a sweatshop. In fact, nowhere in any of the sounds does a sweatshop appear, but the perceptual proximity of a trainer, the sounds of sewing and Chinese speech – along with the well-publicised accusations of sweatshop labour by the Nike brand - are enough to create a suggestion to that effect in the imagination of the user. In *Pickup*,

engagement lies in dislocating sound and vision enough to create a semantic gap in which the imagination can play.

Stage 4: Process Relationship

Continuing the separation of sound and object, process relationships are those that create audio and visual elements by transformative processes on some original material. Although the gap between the elements does depend somewhat on the processes involved, there is a high likelihood it will be large as transformative processes may include accretion or removal, re-ordering, inversion or randomisation controlled by some unrelated command, and the end result will depend a great deal on the ontologies of the materials involved. It is possible that the final components of the work share a common ancestry but the semantic gap is widened past the point at which the viewer can reconcile them. Nevertheless this is distinct from stage 5 (no relationship) in that the two objects are still linked by origin and transformative process. Steve Roden's *Above the Sand, Flown and Undone (Levitation)* (2006) discussed previously is an example of this kind of work, and another of my own is *Sound with a Box of its Own Making*.

Case Study: *Sound with a Box of its Own Making* (p. 187).

Exhibited: *Unfoldings* solo show, Watermans Gallery London, 20/09/13 – 19/10/13

The work *Sound with a Box of its Own Making* directly references Robert Morris' *Box with the Sound of its own Making* (1961). Both pieces are investigations into process and transformation; the original work records the construction of the box and replays it with the finished object; this work uses software to encode an image of Morris' work into sound. The encoding process renders the x and y co-ordinates of an image of Morris' work as frequency and volume changes in a sound over time. The sound then contains the image of the box encoded within it, which can be recreated by anyone with the appropriate software. A frequency – time plot (or spectrogram) appeared in the 1999 Aphex Twin track *ΔMi−1 = −αΣn=1NDi[n][Σj□C[i]Fji[n − 1] + Fexti[[n−1]]* (otherwise known as *Equation*) as a hidden face that looms at the end of the track if the music is played back through spectrogram software. However, without the software it is impossible to tell that the sound contains the image, as they bear no semantic similarity at all. The work is an example of steganography, or "hiding information in other information, thus hiding the existence of the communicated information" (Morkel et al. 2005). This also means that the seen and heard are linked, but the gap between them is not reconcilable without additional knowledge. As discussed previously, transformative processes form the basis of Steve Roden's practice. He creates "intuitive translations" (Cascella 2012 p. 86) between written, sonic and visual media, discovering through these translations new aesthetics deriving from patterns and relationships buried within the original material that would otherwise have remained hidden: "he used the vowel structure in the poem as the score to strike five small chimes. The result is an ancient-sounding texture, woven by the voice and its recurring waves [...] his creative process is more akin to a transformation that includes unpredictable decisions, and the rigour of the system never gets in the way of eyes and ears" (ibid. p. 87).

Sound with a Box of its Own Making arose from a period of research into the manipulation of sound using modern software tools. In addition to the program *Paulstretch* used in *Bleigiessen*, the research also turned up the technique of encoding images into sound. By mapping time on the horizontal axis of the image, and frequency on the vertical, the process converts the brightness and position of the image pixels into corresponding frequencies. It is relatively simple to encode an image as sound, and then recreate the image by viewing the sound in frequency-analysis spectrogram software. Recreating the box in this way turns the original piece on its head; the box-containing-sound of the original work becomes a sound-containing-box. Readers may quite rightly object that it is not a box but merely a picture; but by mapping another audio parameter to the z-axis it is theoretically possible to physically recreate Morris' box using a 3D printer. The work was presented on two monitors side by side. One showed the sound being repeatedly rendered back into the image of the box. The other, referencing the focus on process in Morris' work, was presented as an instructional video showing the viewer how to encode the picture of the box into sound and decode it again back into an image.

Stage 5: No Relationship

Finally we arrive at the point at which the sound and object cannot be understood as belonging together or being part of the same work. Even in these cases it is impossible to be definitive; some combinations may hold meaning for some viewers, arising from imagination or a priori knowledge, or meaning may arise by apophenia (patterns or connections perceived in random information), and this is something over which the artist has little control. In all multimedia pieces the

artist must, through intuition, skill and an understanding of material, take the two media to the point at which they speak to each other, and then leave the work for the viewer's imagination to complete.

Chapter 5

Discussion and Conclusion

This thesis has investigated, through research, practice and reflection, the mechanisms and artistic possibilities of combining objects with sound. The work in this thesis demonstrates that they can be successfully combined in multimedia artworks despite being media with very different properties. Revisiting the original research questions gives an opportunity to review the scope and results of this research.

Question 1: To what extent and in what ways can physical objects be perceptually activated by audible objects?

Activation is defined in the Oxford English Dictionary as to 'make (something) active or operative', and the research has shown that sound has the potential, when paired with an object, to do exactly this. Drawing on practice, Chapter 1 explored how sound can bring objects to life, giving them a voice and history, and turning their mute passivity into something active, multi-layered and enhanced. Chapters 3 and 4, through the concept of perceptual dislocation and the multisensory continuum, have described how sound can go beyond merely enhancing the existing qualities of the object to create new, transformative sense impressions. The sound activates the object, and the combination of sound and object activates the imagination. As Andrei Tarkovsky says, "used in this way, music does more than intensify the impression of the visual image by providing a

parallel illustration of the same idea; it opens up the possibility of a new, transfigured impression of the same material: something different in kind" (Tarkovsky, 1989 pp. 155-163).

Is it possible to measure the extent of this activation? The response to an artwork relies on both the qualities of the work and the imagination and existing knowledge of the viewer, and is difficult to quantify. But what this research has shown is that there can be a transformational quality of multimedia work which holds true for the majority of people. Further, it suggests that this activation can range from simply illuminating in the attention existing elements of an object, through bringing to mind unseen and imaginary narratives about it, to creating a new 'third form' from the combination of the two sense impressions. These categories, in a broad sense, measure increasing activation of the object in the mind of the viewer, and increasing engagement of their creative faculties.

Question 2: What are the parameters controlling the interplay of audible and physical objects, and how is meaning created through their interaction?

Chapter 2 explored mechanisms by which the interplay of sound and object can be controlled. Proximity of the elements in space, time, meaning or causality have been identified as parameters which help weld audition and vision together and reinforce the impression of them belonging to the same work. The small speaker inside the shell of *Volume*, spatial arrangement of the speakers in *Shower*, sound changing with the dancer's movements when using the *Dance Theremuino*, and direct translation of shifting sunlight patterns into sound in *SolarWork#2* are all forms of proximity being used to enhance audiovisual ties. A related finding is

that technology that isolates the sound from the object, such as headphones, should be used with care.

Major differences in the ontology of audio and physical objects have pointed to strategies for making their combination appear cohesive, such as matching the narrative qualities of the elements; *POD* showed that constant drones suit static objects and the *Reflect-O-Matic* presented shifting light patterns with shifting sounds. Shape also plays a part. *POD*, and the *Shape Experiments*, both indicate that certain shapes and sounds seem to fit together and reinforce each other whereas other combinations have no significant perceptual resonance. The common quality appears to be the dynamism of the elements. The *Shape Experiments* showed that even simple shapes and sounds vary in the amount of apparent movement they imply. Interestingly the dynamic qualities of either element were not so apparent before their co-presentation, and the act of perceiving them together brought this quality to the fore and permanently changed the subsequent perception of them whether together or apart. A low, single frequency hum appears to suit a sphere, and a sound with many or moving frequencies suits the dynamism of a cone. These are very subjective observations but the prevalence in language of sound-related adjectives based on shape would seem to support the idea.

In addition to parameters of proximity, narrative and shape, some pieces have shown that balance is an important factor in the success of an audiovisual work. Physical volume and audible volume both equate to a filling of space, and it is important that they match. When using multiple sound files, as in *Superabled* and *Pickup*, it is necessary to balance the individual audio elements in the piece as well as their relationship to the object itself. Differences in volume or feel, or

situations like that during the development of *Superabled* where one of the six audiofiles unbalanced the overall composition, run the risk of focussing the user's attention on the media rather than the message.

The question of creation of meaning follows on naturally from the discussion of parameters. Once the sensory elements are perceived as belonging to the same work, the way in which they interact to form meaning can be addressed. This research has identified a number of ways in which this happens, relating to the perceptual gap between the two media. Chapters 3 outlined some mechanisms by which the media perceptually interact, such as:

Enhancement – the increase in perceived information presented by one medium due to its correspondences with the other,

Emergence – the interaction of both media to produce a new and distinct percept,

Association – a repetition of information or perceived coherence across the two media leading to a strengthening of that meaning, and

Dislocation – a difference in the perceived meaning of the two media, the reconciliation of which engages the audience in creating their own meaning.

Chapter 4 extends the idea of dislocation to introduce the Multisensory Continuum. This considers the consequences and possibilities of increasing amounts of dislocation between the media. Starting with the idea of a direct causal relationship between the two media the continuum proceeds through five stages. As the coherence of message between the two elements decreases, and the semantic gap widens, the role of the viewer's imagination in creating meaning increases and the work becomes more subjective:

Direct causal relationship:	Change in one element causes change in the other Strongly linked to materiality Low or zero subjectivity
Direct semantic relationship:	Sound and object are related semantically but not causally Low subjectivity
Indirect semantic relationship:	Sound and object are related tangentially Requires more imagination from the viewer Increasingly subjective
Process relationship:	Sound and object are related but may have been subject to transformational processes which render them irreconcilable without additional knowledge Highly subjective
No relationship:	Elements cannot be reconciled Depends greatly on imagination and prior knowledge of the viewer; what is irreconcilable to one may hold meaning for another; possibility of apophenia.

Question 3: How does interactivity affect the experience of the viewer?

Interactivity is a special case of the causal crossmodal reinforcer. In this situation direct actions cause a change in the sound and it is the simultaneity of change which ties them together. Interactivity allows the artist to engage their audience in co-creation of the work and there is potential for rich experience in the feedback loops created between the object, sound and interactor. Sometimes expressive actions are an outcome of the work, and sometimes the actions are simply a way to control visual or sonic elements. Both have been seen in *Pickup*; the intention was that users gently tilt the shoe to mix sounds, in pursuit of a personal meaning about the shoe, but some used expressive energetic actions to achieve sonic 'scratching' effects in a more experiential exploration of the possibilities of the technology.

Methodologies

A focus on methodology and examination of the creative process were key to the development of this research. The project is situated in the field of 'art as a mode of enquiry' (Brown et al. 2001 p. 25), borrowing both empirical, goal-focussed and intuitive, process-focussed investigative approaches from science and art respectively. Over the three years of practical work – each of which included at least one public exhibition – a number of strategies were developed to create, evaluate and document work:

Thinking by Making

Working with materials was an important element of the research, and the possibilities and limitations afforded by sounds, locations, physical objects or software tools existed in a continuous dialog with the development of the concepts explored in this thesis. Practical work was planned and executed with the goal of manifesting or exploring an idea pertinent to the current research, on the instigation of anything from a hunch (*Ceremony*, which originated from a personal interest in cymatics, where it was only upon making and reflecting about the work that the relevant issues it embodied became apparent (Blow, 2012. pp. 33-43)) to a fully-determined investigation akin to a science experiment (for example, the *Shape Experiments*). Similarly, *Volume* started by experimenting with different sounds from inside the shell, and it was by a serendipitous moment of trying a sound with reverb that the concept of a small object that sounded large came about. Opening up to intuition, chance and experimentation of this kind – and developing a mind receptive to the results – has been one of the most important personal lessons from this research.

Documentation

All work was documented using audio and video recording and photography. The making / development phases and exhibitions were recorded and represented with a mixture of raw footage (video note-taking), edited videos for public viewing online, numerous photographs, written notes and sketches, and audio recordings. Documentation was vital to the development process. It allowed personal reflection and for the research to be presented in conferences, and facilitated discussion in work-in-progress meetings both with supervisory team and peers.

Reflective Practice (see Appendix 3)

Reflective practice was a core component of the methodology used in this research. Periods of reflection, learning, and mentally examining new ideas complimented and consolidated the discoveries arising from making and exhibiting. To give this 'thinking time' a physical expression, a strategy was developed for encapsulating a mixture of technical notes, feedback, observations and feelings about each piece of work in one place. A photograph of each piece of work on A4 paper was used as a visual notepad, with observations written directly on the paper. Using a photograph of the work as a starting point for notemaking was found more inspirational than a blank page, and often allowed an evaluation of the work in a wider context. Observations concerned elements of the work that were successful and those that could be improved, colours, shapes, moods and feelings, inspirations, similar works and reference points, and so on – the idea being to create a cloud of observations and associations around the work that might cross-pollinate into further insights.

In an attempt to understand the relationships within the work a mapping exercise was undertaken using a long roll of paper. The names of all the pieces were written along the top edge of the roll, and the concepts that had arisen during the research (such as proximity, enhancement, dislocation etc) along the bottom edge. By drawing lines joining each piece of work with the ideas it embodied, it was possible to gain an emergent idea of the concepts that were important, those which were only tangential, and those which were promising but needed more investigation.

Visitor Feedback

Visitor feedback to shows was assessed in three ways. Direct conversations allowed a useful insight into people's immediate reactions to the work. Question and answer sessions after a showing of the work (regular work-in-progress presentations at the University and a 'scratch' night at the Basement venue in Brighton), chaired by a third party, were instrumental in understanding how people approached, used and responded to the work, and wherever possible this would be the method of choice for evaluating work in future. Discussion was key and found to be the most effective way to help evaluate the work. Discussions took place throughout the research, with the supervisory team, with peers in work-in-progress presentations, with other students and academics as part of lectures about the work at *Sight Sound Space and Play* conference 2010 and 2011, with visiting artists, and with the public. Insights arising from discussion, and specifically from another person's personal understanding (or misunderstanding) of the work, were always useful and occasionally profoundly affected the direction of the research. Written feedback sheets were handed out to visitors to the *Time Machines* exhibition which, due to the time they required to complete, furnished deeper insights into the work but somewhat compromised the visitor experience. Finally comments books, which although allowing feedback to be collected when the artist was not present, were usually found to be of little use in gaining any real insight into the work.

Recent Explorations

The most recent artwork created for this project is *Aeolus*.

Case Study: Aeolus (p. 191).

Exhibited: *Unfoldings* solo show, Watermans Gallery London, 20/09/13 – 19/10/13

Aeolus, named after the keeper of the winds in Greek mythology, is a cabinet containing the sounds of the wind. Visually, *Aeolus* is a mid-20th century oak index-card cabinet of the kind that used to be found in libraries. It has a sloping front with 12 small drawers. Each drawer has a handle and small brass nameholder on the front. Each drawer is empty but when opened plays a looped recording of a wind – for example, the Mistral or the Chinook. Multiple drawers can be opened to create a composition of the aeolian sounds, and the drawers themselves have an effect on the sound, changing its volume and timbre depending on how far they are opened.

With its library cabinet of 12 small drawers this work has associations of archiving, memory, collection and control. In this respect and visually it bears a resemblance to some of Christian Boltanski's work, notably *Reserve of the Dead Swiss* (1990), although it lacks its political gravitas; in spirit it is closer to Joseph Cornell's cabinets, a collection of found objects brought together and preserved for the delight of the collector – a sort of aeolian *wunderkammer*. As with *Volume* there is an element of playfulness and surrealism to *Aeolus* due to the incongruity of the sound and object. The most similar existing work in looks and operation is Janet Cardiff and George Bures Miller's *The Cabinet of Curiousness* (2010), which similarly uses an oak cabinet with drawers containing speakers. However Cardiff and Miller's work makes no attempt to hide the speakers or the fact that it requires external wires. It also has a very different sonic aesthetic, the sounds

being a collection of music, film sound and Cardiff talking which appear as a random collection or non-linear narrative. According to Cardiff and Bures Miller's website it concerns "obsolete system of cataloguing single pieces of data and our current tendency to inundate ourselves with excessive information" (Cardiff and Bures Miller 2010), but arguably lacks some of the theatrical and surreal overtones of Aeolus with its sounds of the wind locked up inside seemingly empty drawers.

Each drawer in *Aeolus* has the name of its wind and a pair of geographical coordinates in typewriter script on the front, as if it is a specimen that has been captured and imprisoned within the cabinet for the collector's pleasure. All the technology is hidden behind false backs in each drawer, and to the audience the sounds appear to come from nowhere; one visitor remarked that 'there is something very Harry Potter about it'. But the visitor can also approach the piece for its sonic qualities, a sort of Aeolian instrument with an interface resembling the pull-stops on an organ. A subjective evaluation of interaction with the cabinet (though observation and conversation) was that most visitors found it easy to use and the majority understood the sounds, were interested by the combination and tended to stay with the work for some time. It seemed to appeal equally to both adults and children and was robust enough to survive a month in a London artspace. Comments included "Lovely, lovely idea! Irresistible. How does it work? Amazing", "Gorgeous. Would have liked some human voices", "Good, hard to work out what all the noises are", "Brilliant idea…love it". The comments point to further explorations, checking that the sounds are intelligible enough, and trying the cabinet with other recordings.

Aeolus continues many themes that have arisen during the course of this research. It uses spatial and interactive crossmodal reinforcers to bond the sound and the object. It presents the audience with a sensory dislocation, in the concept of winds being locked up in a cabinet, and exploits the perceptual gap between the seen and heard to invite the audience to imagine their own narrative for the work. It deals with natural forces, which (although there has not been space to explore in this document) is a recurring theme - *Volume*, *Ceremony*, *Shower*, *Ritual*, *Arpeggi*, *SolarWork#2*, *Sundial*, the *Rain Paintings* and *Memory Triptych* all deal with water, wind, rain or sun.

Conclusion

This project has investigated the relationship between sound and physical objects, using multimedia artworks as a research tool. From an initial observation that most 'sound sculptures' are either sculptural musical instruments or physical manifestations of pure audio came the idea to examine the relationship between objects combined with non-causal sounds. Crossmodal correspondences find much precedent in attempts to relate colour or timbre to pitch, but it seems that few have worked in, and even fewer have studied, the specific case of sound and three-dimensional objects. It is this gap that the work set out to address. By creating a series of multimedia artworks and using a combination of visitor feedback and reflective practice, the research questions were addressed and the mechanisms by which multimedia art is made and received were investigated. The main outcomes of the work are as follows:

Foremostly, a new framework within which to understand multimedia artworks is proposed. A continuum based on increasing semantic separation between the

physical and audible elements of the work, which maps five distinct relationships between the two media, allows the process of creation of meaning in multimedia works to be explored (Chapter 4).

Secondly, compared to a single-media work, it is proposed that the space defining a viewer's reading of a multimedia work is expanded from two to three dimensions; that is, the possible interpretations now depend on the interplay between the two media, as well as between the artwork and the viewer's imagination. These interactions are explored referring to existing research into multimodal communication and evolutionary modelling (Chapter 3).

Thirdly, the concept of Crossmodal Reinforcers is introduced. Crossmodal Reinforcers describe mechanisms by which two media can be presented as one work, originating from Gestalt theory and Michel Chion's synchresis, and comprising proximity in space, time, meaning and causality (Chapter 2).

Fourthly, a series of original artworks (Appendix 1), exhibited across the UK (Appendix 2), which both arise from and inform the ideas presented in this thesis.

Finally papers in Leonardo Music Journal LMJ23: Sound Art (Blow 2013), Reflections on Process in Sound Issue 1: autumn 2012 (Blow 2012), and 2 conference papers presented at Sight, Sound, Space and Play conference, Leicester deMontfort University, June 2010 and 2011 (Appendix 4).

It is hoped that this research will be useful to practitioners and theorists working in the area of multimedia artworks. It is the result of practical experimentation, personal research and reflection, and much discussion, and although far from complete, is put forward as a starting point for further research and an inspiration

for new work and collaborations. The project has opened up several avenues for further investigation; a continuation of the work into sound and shape, synchronicities between broken/unbroken objects and sounds, texture's effect on the perception of pitch or timbre, and more work exploring the semantic reinforcer are all possibilities. The idea that both sound and objects perceptually 'unfold' in time (sound due to its temporality, and objects since – as Morris discusses in *Notes on Sculpture, Part 1* (Morris 1993 pp. 6-7) - you can take time examining them from all sides) also holds promise.

In exploring mechanisms by which work in two senses can be understood, this thesis aims to be of use to any multimedia artist - whether they are working with sounds and objects, visual music, sculpture, painting, video, in fact any sensory combinations. The concepts explored in this thesis are widely applicable outside the sphere of sounds and objects, and the ideas of association, dislocation, the perceptual gap and the multisensory continuum put forward herein exist as a conceptual framework to be assessed, used, amended and extended in any multimedia work as each sees fit.

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Appendix 1

Artworks Created During this Project

Appendix 1 presents all the works made during this project in chronological order (along with *POD* (2009), developed prior this PhD but relevant to the concerns of this thesis). Full documentation including images, sketches, video and sound recordings, software code and press appearances can be found in the accompanying media files.

List of works in chronological order — Page

POD (2009) (Collaboration with Alison Ballard)

Inflatables, electronics, sound

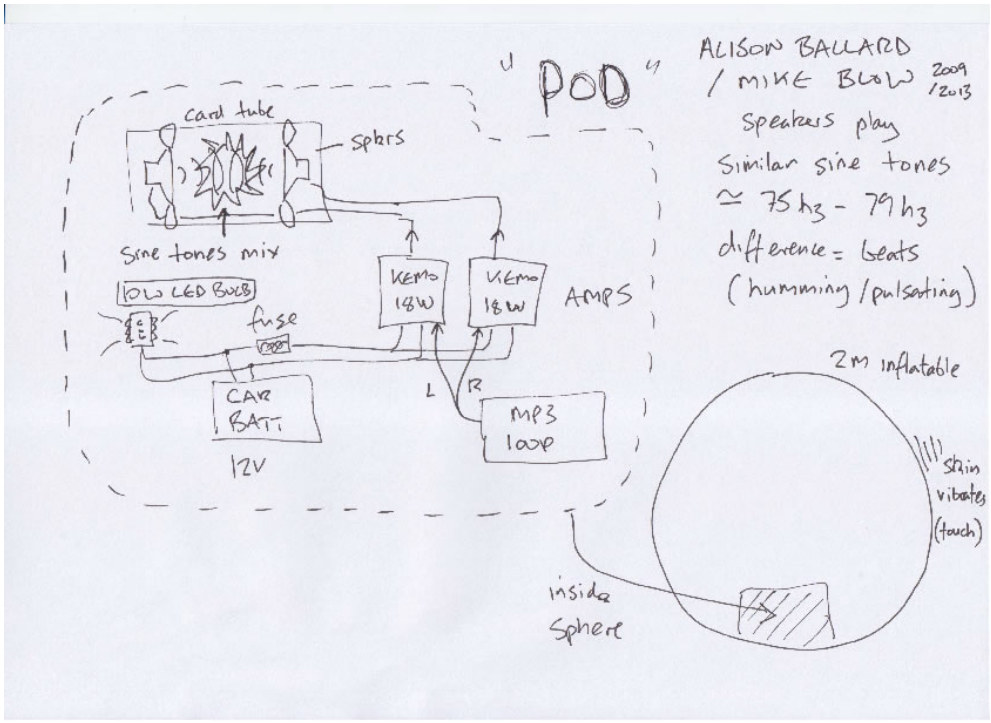
Each POD approx. 2m diameter

An installation of large blue inflatable spheres which hum with a low-frequency pulsing sound. Recent installations have also included a light inside. The audience is encouraged to touch the spheres and feel the sound pulsing through them.

Technical

Each pod consists of audio electronics inside a custom-made tough PVC inflatable sphere. Inside each is a car battery running two KEMO 18W amp modules attached to 6" speakers facing each other about 30cm apart inside a cardboard tube. An mp3 player supplies the speakers with two slightly different frequencies around 75Hz. The microtonal mismatch in frequencies results in beats (audible pulsing) as the two soundwaves interfere inside the tube. The equipment is placed inside the sphere which is then inflated using an electric pump. The sound is transmitted through the skin of the inflatable and can be felt as well as heard.


GREGGS
SONY


"POD"
ALISON BALLARD
/ MIKE BLOW 2009 /2013
Speakers play
similar sine tones
≃ 75 hz - 79 hz
difference = beats
(humming / pulsating)
card tube
spkrs
sine tones mix
LOW LED BULBS
fuse
KEMO 18W
KEMO 18W
AMPS
CAR BATT
12V
L
R
MP3 loop
2m inflatable
skin vibrates (touch)
inside Sphere


HAPPY 25

Shape Experiments (2010)

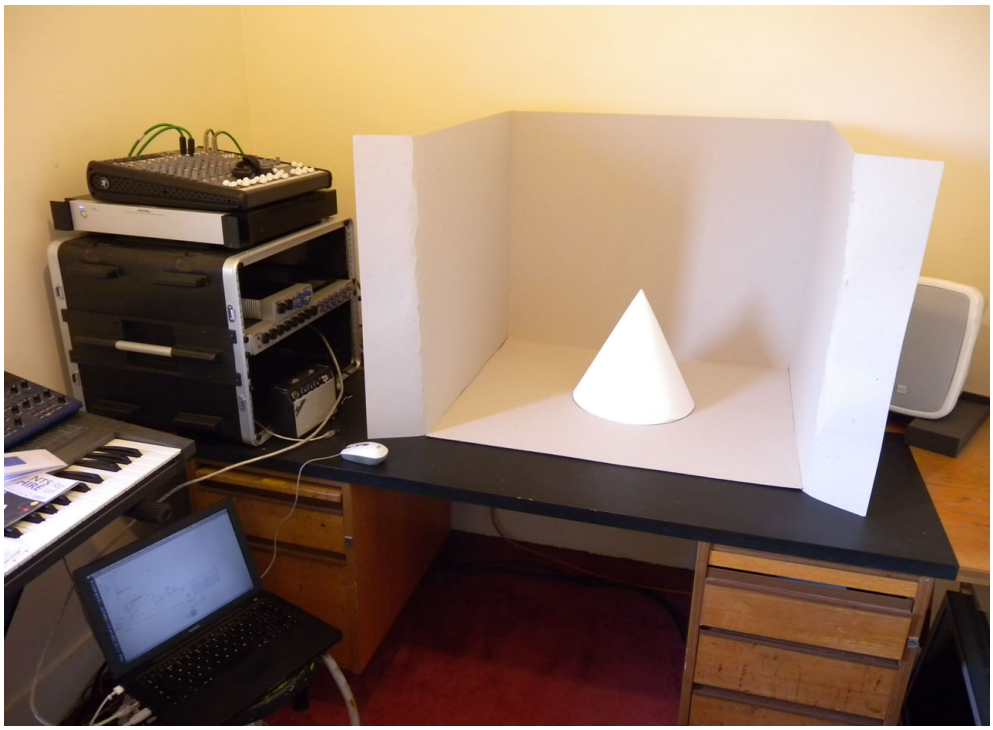
Card, sound

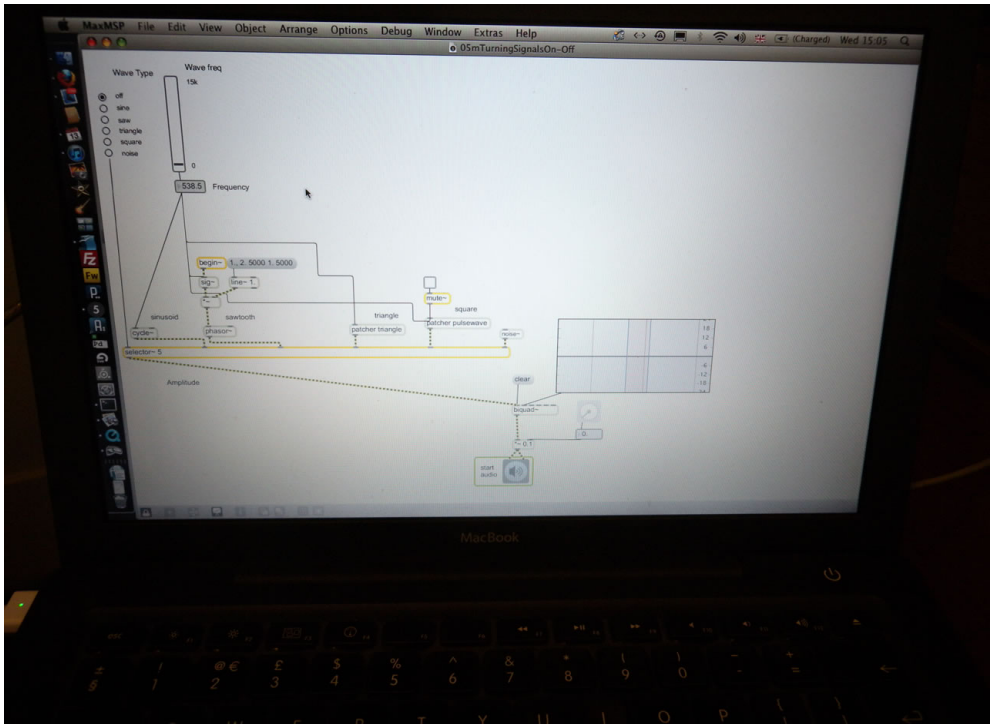
Each shape approx. 30x30cm

Four basic shapes (cylinder, cube, sphere and cone) of about 30cm height were viewed while listening to constant tones – sine, square, triangle, saw and noise waveforms with an adjustable frequency and filter to change the tone. Each object was viewed while listening to the tones and varying their frequency and tone. Subjective impressions of the combinations were noted and compared in an attempt to categorise fundamental crossmodal correlations.

Technical

The shapes were made from cardboard and plastic and painted white. A viewing booth was made from card to reduce visual distractions. The audio was created with a MAX/MSP sketch which allowed mouse control over the waveform and filter.




MaxMSP File Edit View Object Arrange Options Debug Window Extras Help
05mTurningSignalsOn-Off
Wave Type
Wave freq
15k
off
sine
saw
triangle
square
noise
0
538.5 Frequency
begin~ 1. 2. 5000 1. 5000
sig~
line~ 1
mute~
square
sinusoid
sawtooth
triangle
patcher triangle
patcher pulsewave
cycle~
phasor~
noise~
selector~ 5
Amplitude
clear
line~
0.1
start audio
MacBook

Double Helix (2010)

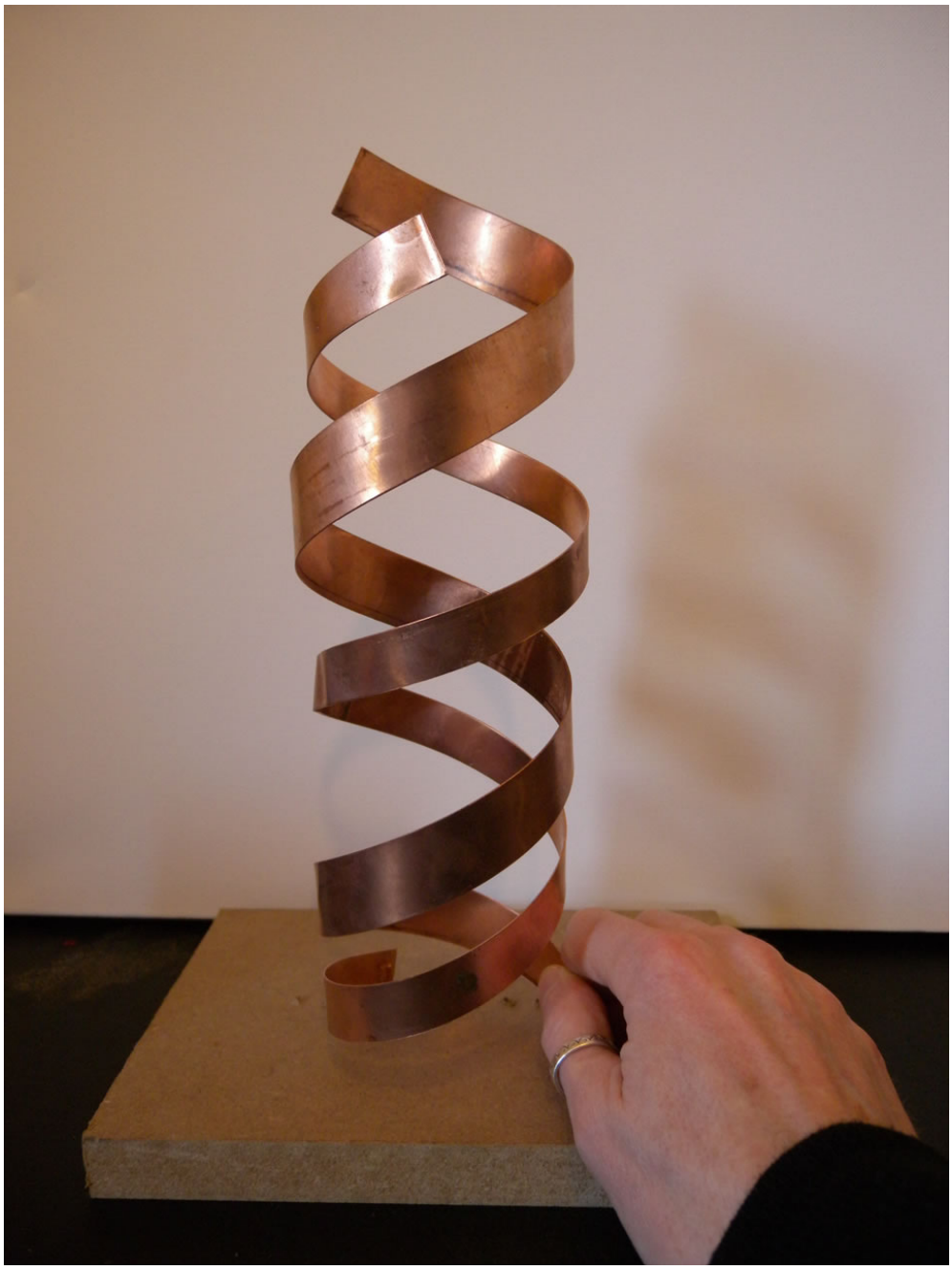
Copper, wood, photograph, sound

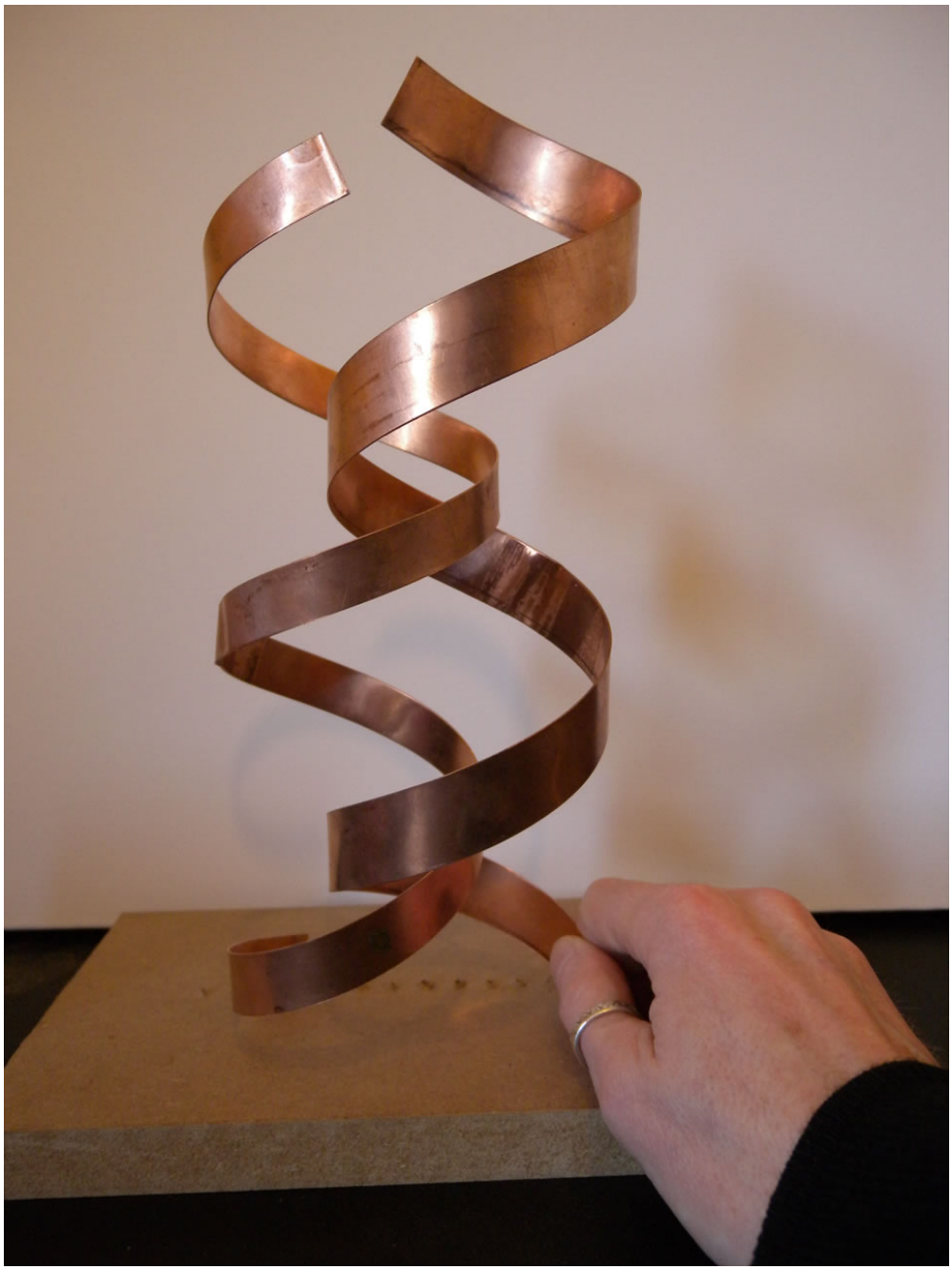
Sculpture height 30cm

A photograph of a double helix sculpture made of copper strip was presented with a collection of sounds, all of which subjectively shared some qualities (form, dynamism, semantic metaphor) with the helix. The photograph was used as a work-in-progress to allow the presentation of the work more easily to an audience, although presenting the real sculpture would in retrospect have been more relevant to this thesis. The sounds comprised in sequence; a rising shepherd tone (an aural illusion in which a tone appears to endlessly rise or fall), a falling shepherd tone, two shepherd tones one rising one falling, the sound of a jet aeroplane; a thunderstorm; a pulsing electronic sound; an excerpt from a Chopin piano concerto; and a recording of William Borroughs reading an excerpt of his novel *Cities of the Red Night* concerned with viruses. As in the *Shape Experiments*, the photograph and sound were presented together in an attempt to reveal correlations between the seen and heard.

Technical

The helix was made of 2 pieces of 10mm wide copper strip bent around a tube. One was mounted in a block of wood and the other held to enable different forms to be created. The sounds were synthesized or sourced online and edited together in Ableton to make a single audio file.





Subtle Objects: Pickup (2010)
Subtle Objects: Superabled (2010)

Found object, electronics, sound

Pickup: Approx. 30cm l x 15cm h x 8cm w

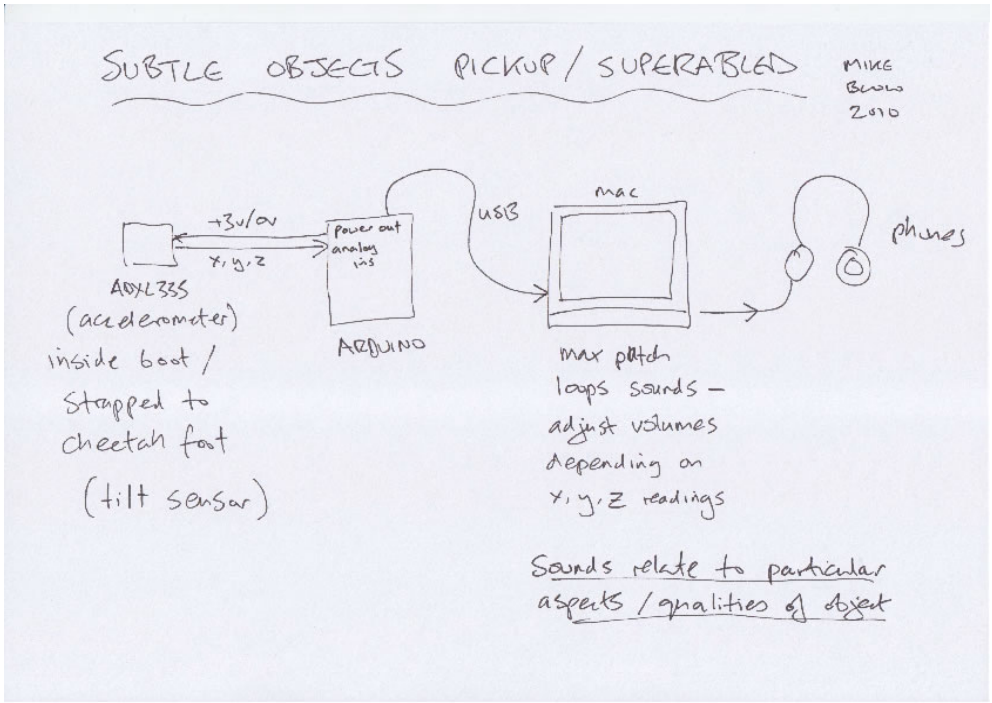
Superabled: Approx. 60cm l x 25cm h x 5cm w

These two works shared the same concept and technology. An object (in *Pickup* a Nike Air Jordan basketball shoe, and in *Superabled* an Ossur Cheetah Foot prosthetic leg) are fitted with a sensor which allows them to be used as sound controllers. The visitor puts on some headphones and picks up the object. Initially one soundloop will be heard but on tilting the object the sound will fade into a different loop, and another on turning it upside down, etc. In all there are six soundfiles for each object which have some tangential relation to that object and which can be heard by tilting it in different directions.

The soundfiles for *Pickup* concerned its origins, manufacture, shipping, collectability and commodity status. They were a cow, rubber tapping, a sewing machine, docks, some Chinese speech (asking about prices in dollars) and an audio track by a US Air Jordan collector who bought a pair of the same shoes and made an 'unwrapping' video of them. The sounds for *Superabled* concerned the ongoing debate surrounding the fairness of prosthetics in competitive athletics.

Technical

Each object was fitted with an ADXL335 three-axis accelerometer. This device measures tilt in 3 dimensions and its readings were sent via an arduino to a mac running a MAX/MSP patch. The patch looped six soundfiles, the volumes of which were mapped to the six extreme positions of the object (upright, upside down, laying on left side, laying on right side, tilted towards you, tilted away from you – the six sides of an invisible cube). The measurements of the amount of tilt were scaled and used to control the sound clip volumes which faded from one to the other due to the analog nature of the accelerometer signals. The resulting sound mix was sent out of the mac to headphones.


SUBTLE OBJECTS PICKUP / SUPERABLED
MIKE BLOW 2010
+3v/0v
x, y, z
Power out
analog ins
ADXL335
(accelerometer)
inside boot /
strapped to
cheetah foot
(tilt sensor)
ARDUINO
USB
mac
phones
max patch
loops sounds –
adjust volumes
depending on
x, y, z readings
Sounds relate to particular
aspects / qualities of object

A27 Zen Garden (2010)

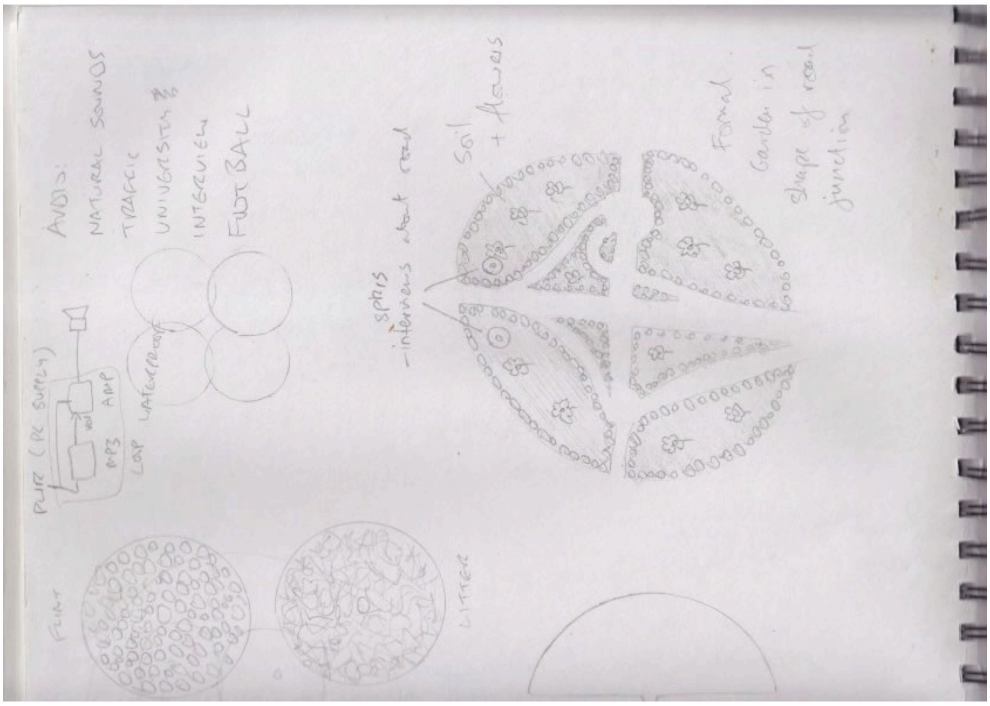
Stone, wood chips, electronics, sound

Circle, 5m diameter

The plan view of a road junction near the exhibition site was mapped out in a stone and wood chip circle on the lawn of a country house. Four speakers around the edge of the circle played processed field recordings of the junction. The work was designed to reimagine the busy and transitory road junction as a space for relaxation and lingering.

Technical

The four speakers were arranged in two parallel loops with two speakers in series in each loop; this gives an arrangement that preserves the original impedance of the speakers. The audio file was recorded on a Zoom H4n, and made using multiple tracks with resonator and tremolo effects in Ableton Live, exported as an MP3 and played on a stick MP3 player through a hifi amp at the exhibition.


AUDIO:
NATURAL SOUNDS
TRAFFIC
INTERVIEW
FOOTBALL
LITTER

Volume (2010)

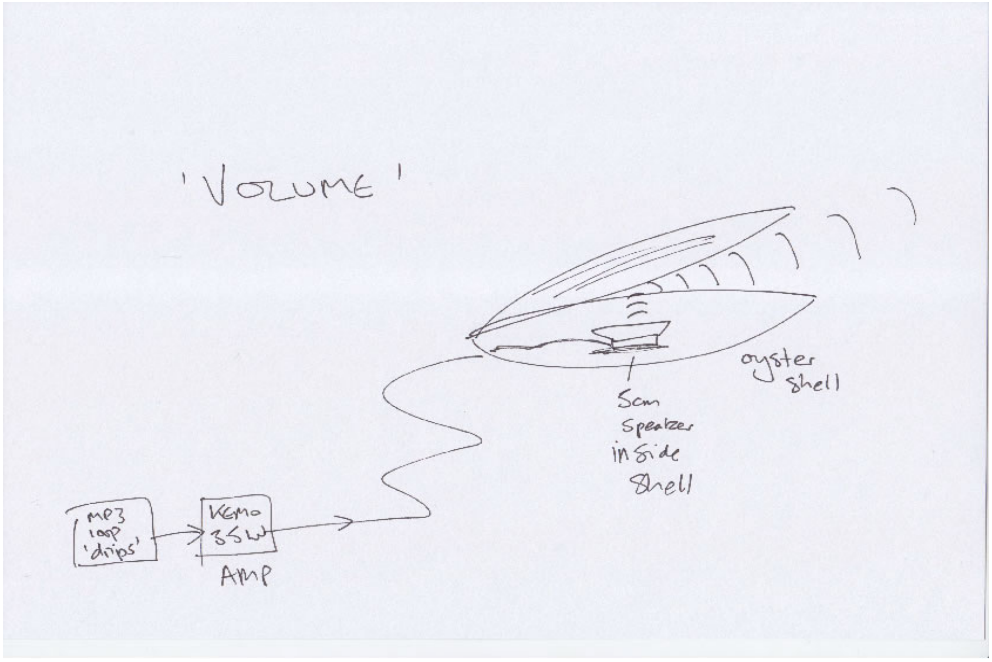
Oyster shell, electronics, sound

13cm d x 8cm w x 5cm h

A slightly-open oyster shell with a loudspeaker inside plays the sound of water drops with a large echo added, as if in a cavern.

Technical

The water drips soundfile, recorded on a zoom h4n and treated with a long reverb in Ableton Live, is played from a computer or mp3 player through an amp connected to the small speaker in the shell.



Ceremony (2010)

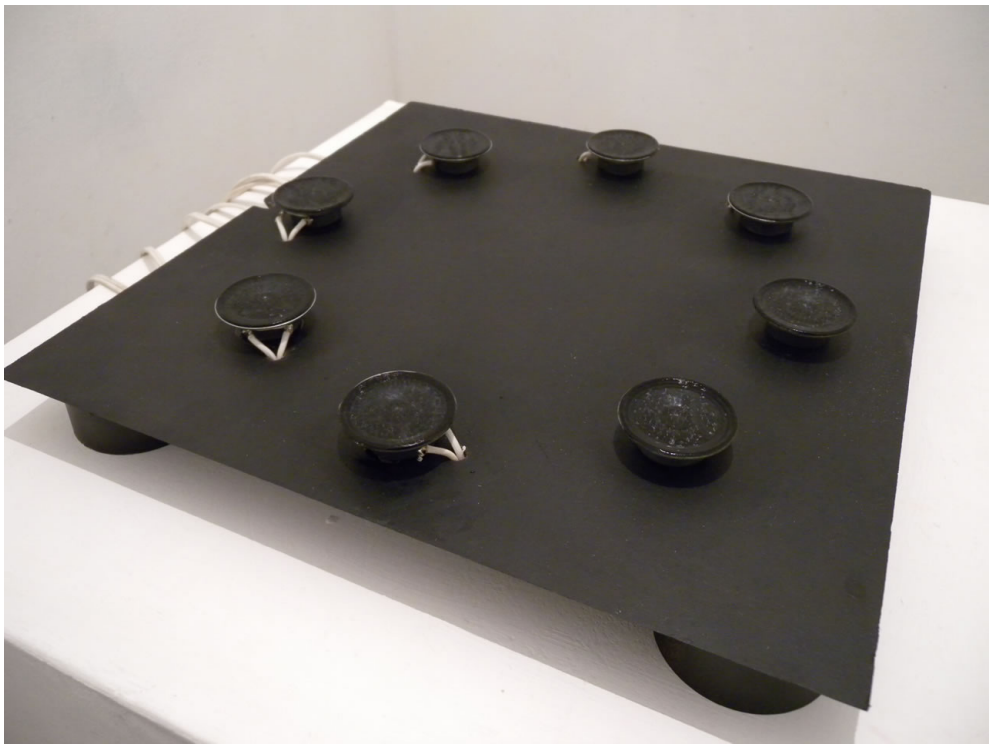
Loudspeakers, water, wood, electronics, sound

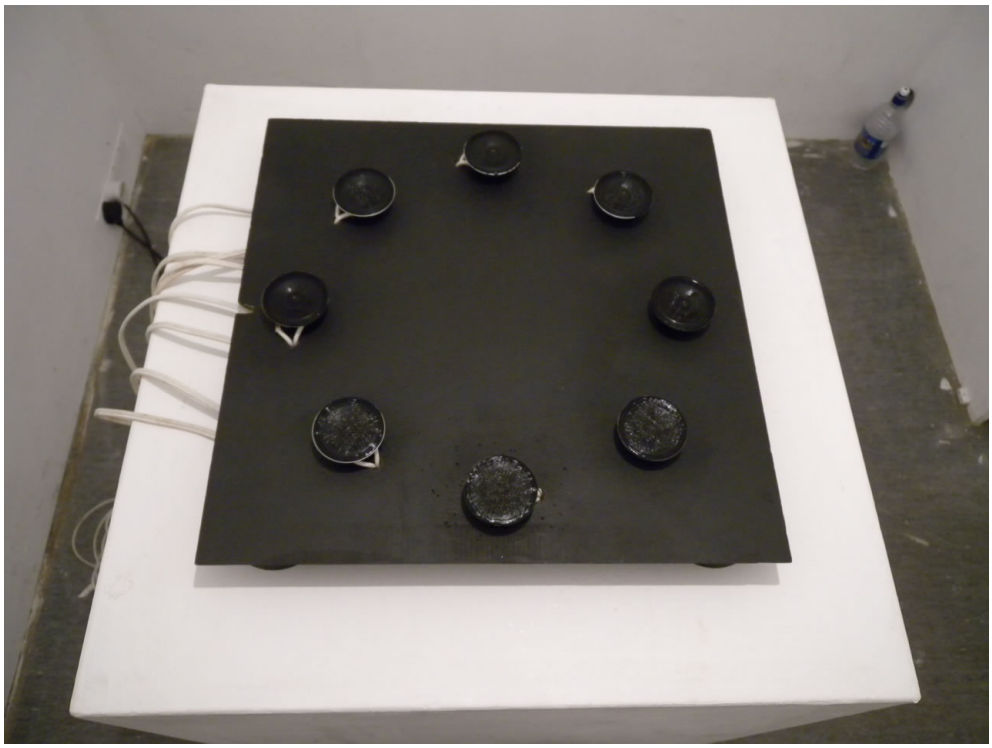
6cm high x 40cm wide x 40cm deep

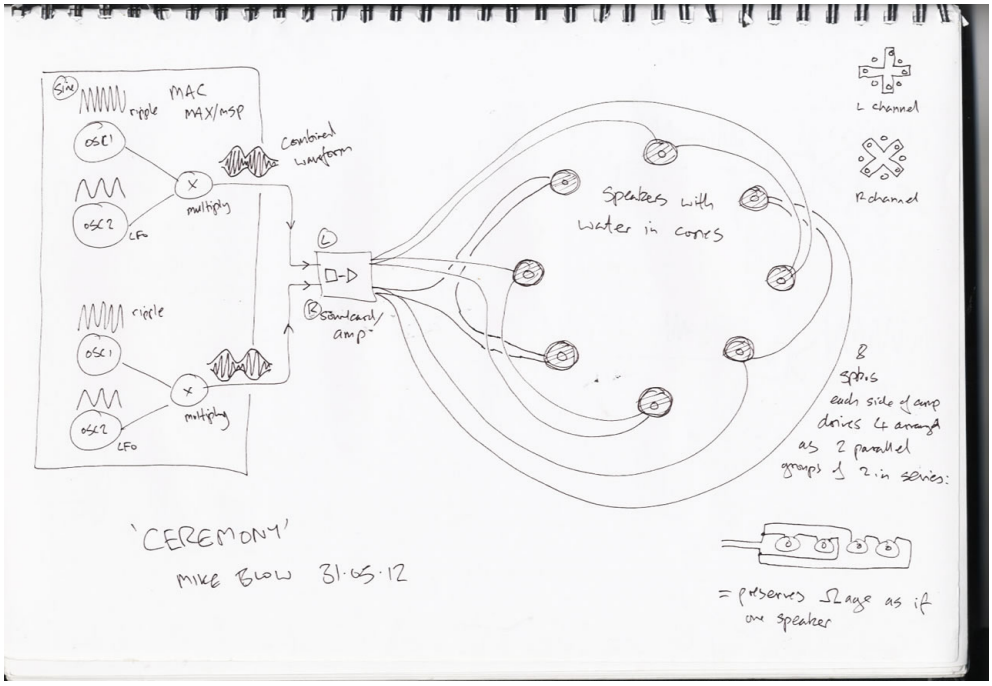
A circle of 8 small loudspeakers mounted on a board. The speakers hold water and pulse with low-frequency sound, causing the water to ripple and then become still in repetitive patterns.

Technical

Each output of a hifi amp powers four of the speakers, wired in two parallel loops of two speakers each. A MAX/MSP sketch on a computer generates two sine waves, each of which is modulated by another low-frequency sine wave so the output fades up and down in volume. One sine wave is fed to each input of the amp and the corresponding output to four of the speakers. The speakers are 5cm diameter and made from waterproof plastic.






MAC
MAX/MSP
ripple
osc1
osc2
LFo
multiply
combined waveform
circle
osc1
osc2
LFo
multiply
L
R
standard amp
speakers with water in cones
L channel
R channel
8 spkrs each side of amp drives 4 arrays as 2 parallel groups of 2 in series:
= preserves Stage as if on speaker
'CEREMONY'
MIKE BLOW 31.05.12

Shower (2010)

Loudspeakers, electronics, sound

Approx. 2m high x 50cm wide x 50cm deep

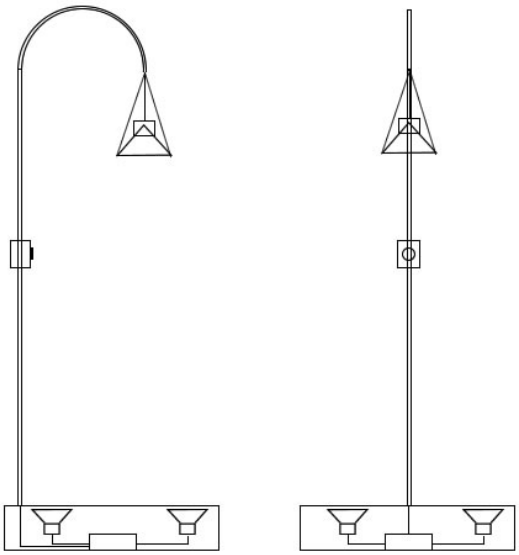
Speakers above and below the user play a recording of a domestic shower, activated by a button or footswitch. The recording is arranged so that it spatially mimics a real shower, with the sound of the showerhead coming from a speaker above and the sound of the water hitting the floor from four speakers around the user's feet. When the button is released the audio seamlessly switches to a clip of the shower switching off and dripping to silence.

Technical

Shower's soundfile was recorded using a Zoom H4n and two external condenser mics on stands. The file was played back from a MAX/MSP sketch running on a mac, which was triggered by an arcade button or a footswitch interfaced to the mac using an arduino microcontroller. The audio was output using a Presonus Firebox audio interface and a hifi amp to drive the speakers.

Installed at Kinetica, button operated

Installed at Pegasus theatre Oxford with a footswitch



Piano Arrangement (Low-High) (2010)

Piano

Variable; as exhibited, app. 1.5m deep x 0.5m wide x 1.5m high

An upright piano is tipped on its end so the pitch of the notes mirrors their arrangement in space, i.e. the low (bass) notes are closest to the floor.

Willow Line (2010)

Photograph with sound

A photograph is displayed with a sound recording of its subject. The recording is the ambient sound at the location of the image, starting one minute before and finishing one minute after the instant the photograph was taken. This moment can be heard as the click of the camera shutter. The piece was never exhibited due to the physical part being two-dimensional.

Technical

The Zoom H4n recorder was set up recording with ambient mics and simultaneous inputs from contact mics attached to the camera body to record the click of the shutter.

Bleigiessen (Bending Time) (2011)

Metal sculpture with sound

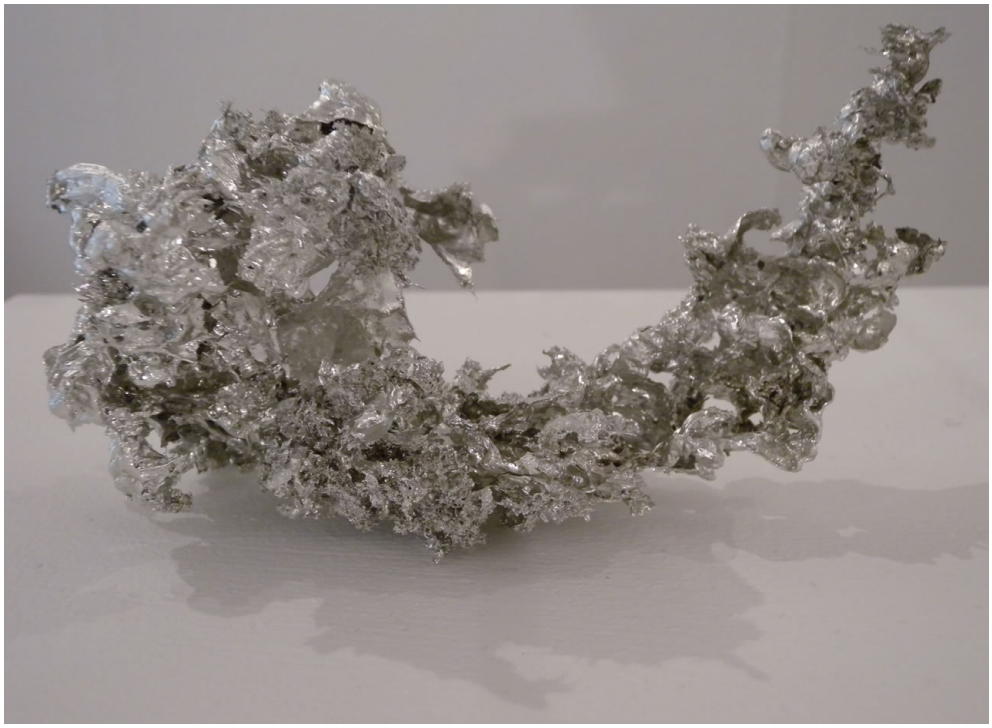
Approx. 25cm w x 5cm d x 10cm h

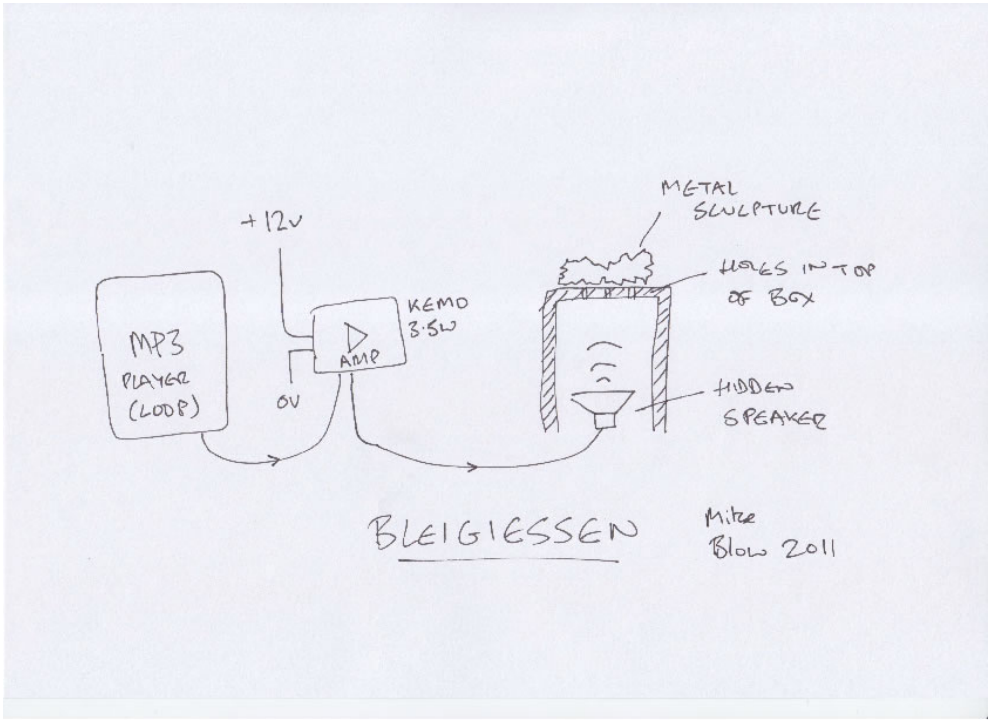
A sculpture created by casting hot metal into water is accompanied by the sound of its creation slowed down 100 times.

Technical

The bleigiessen sculptures were created by melting casting metal in a steel pot over a camp stove and throwing the metal into a bin of cold water. It was found that the speed and nature of the throwing action resulted in different shapes. The sound of the process was recorded using two homemade hydrophones (piezo discs dipped in plasti-dip rubber paint) and a Zoom H4n recorder. In exhibition one sculpture was presented on a plinth with the sound of its creation, slowed down 100 times using the software *Paulstretch,* played on a loop in headphones.


beyerdynamic





Bleigiessen version as presented at Unfoldings, with concealed speaker inside box.

For a Limited Period Only (2011)

Lamp, electronics, headphones, sound

Dimensions variable

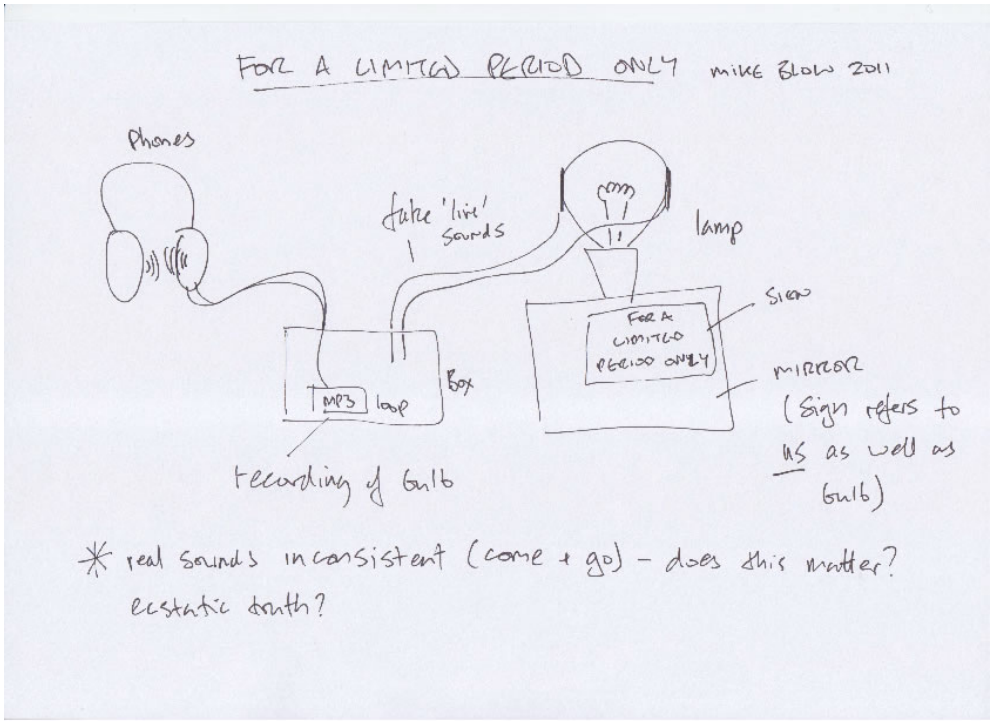
Two piezo contact mics amplify the decay of a light bulb's filament. The visitor is presented with a domestic lamp with a mirrored base and no shade. The bare bulb has two contact microphone discs glued to it. Wires lead from the discs into a small box and another wire leads out of the box to headphones. The name of the piece – *For a Limited Period Only* – is written on the base of the lamp in self-adhesive plastic punch strips.

The piece concerned decay and was designed to work on a number of levels. Firstly that you can listen to the highly-amplified sputtering of the filament as it burns away. This actually happened some of the time, but not constantly, so for the work's appearance in *Time Machines* the sound came from a pre-recorded mp3 file; but a live version (or a mix of live and pre-recorded) would be preferable. Secondly the title refers to the incandescent bulb, which are now an endangered species. Thirdly, in order to read the text the visitor has to see themself reflected in the mirrored base of the lamp and be reminded of their own limited lifespan.

Technical

The sputtering of the filament was recorded with a Zoom H4n recorder and two piezo disc contact mics. As mentioned, in *Time Machines* the recording was

played from an MP3 player hidden inside a plastic box. However if a live or part-live version was developed an amplifier could be incorporated into the system to amplify the mics.



Memory Triptych (2011)

Steel sheet, varnish, wood, electronics, sound

3 plates each 60cm x 50cm, hung on 5cm standoffs

Three steel plates, wall mounted. Upon each is written in varnish a haiku, which has been revealed by leaving the plate outside to rust in the unprotected areas. Two of the plates have a speaker attached to the back of them with sounds referencing the subject of the haiku, played on loop from MP3 players. One is left purposefully silent. *Memory Triptych* is an experiment in coincidences between sound, language and memory. The three haiku are:

Recall if you can / The feeling of having just / Arrived in Venice

(Sound: field recording of Venice)

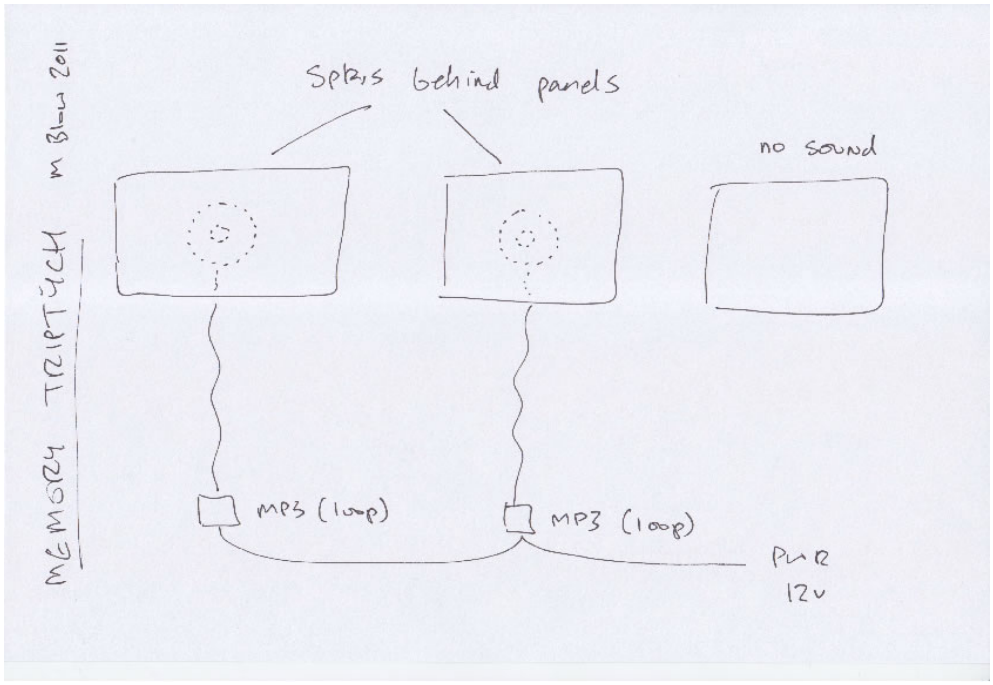
Confused butterfly / Looks for flowers in the lawn / I mowed yesterday

(Sound: field recording of a summer's day)

Bright summer churchyard / Darkened by a small grave / Covered in toy cars

(No sound)


recall if you can.
the feeling of having just
returned to venice


MEMORY TRIPTYCH M Blow 2011
Spkrs behind panels
no sound
MP3 (loop)
MP3 (loop)
PWR
12v


recall, if you can
the feeling of having just
arrived in venice
bright summer churchyard
confused butterfly
looks for flowers in the lawn
i mowed yesterday

Stereo Rain Paintings (2011)

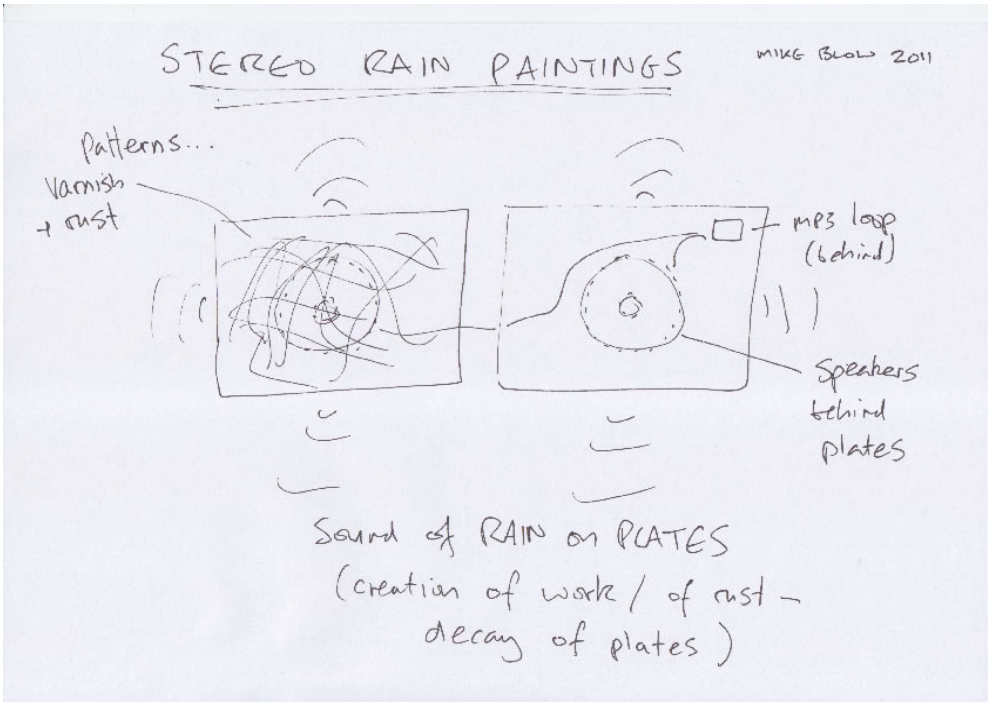
Steel sheet, varnish, wood, electronics, sound

Two plates, each 50 x 60 x 5cm

The steel plates are splashed with varnish and left outside to rust in the unprotected areas. The plates are presented side-by-side with the sound of rain in stereo, played from a speaker behind each plate.

Technical

The sound of rain falling on the plates was recorded using a Zoom H4n and two piezo-disc contact microphones. The sound was edited into a loop on Ableton Live and then played from an MP3 player, via two mono KEMO 3.5W amplifiers to two speakers which were held in place on the back of each plate by tape. The speakers faced the wall and the plates were fitted with 5cm standoffs to allow the sound to escape from behind them.


STEREO RAIN PAINTINGS
MIKE BLOW 2011
Patterns...
Varnish
+ rust
mp3 loop
(behind)
Speakers
behind
plates
Sound of RAIN on PLATES
(creation of work / of rust -
decay of plates)

Sundial (Solar Drums) (2011)

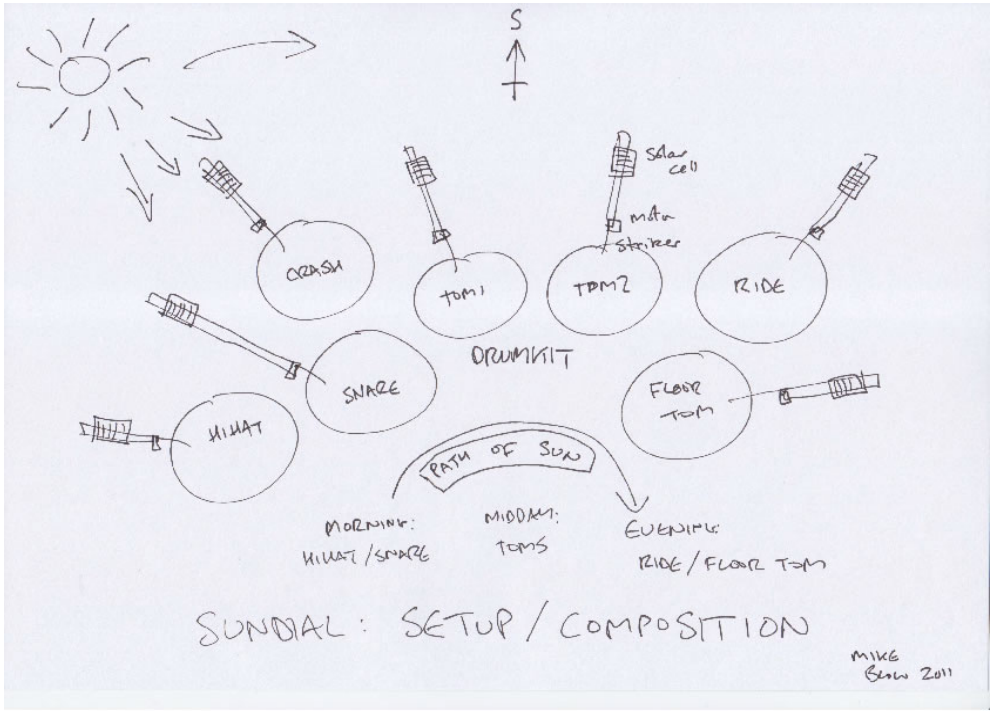
Drumkit, electronics, sound

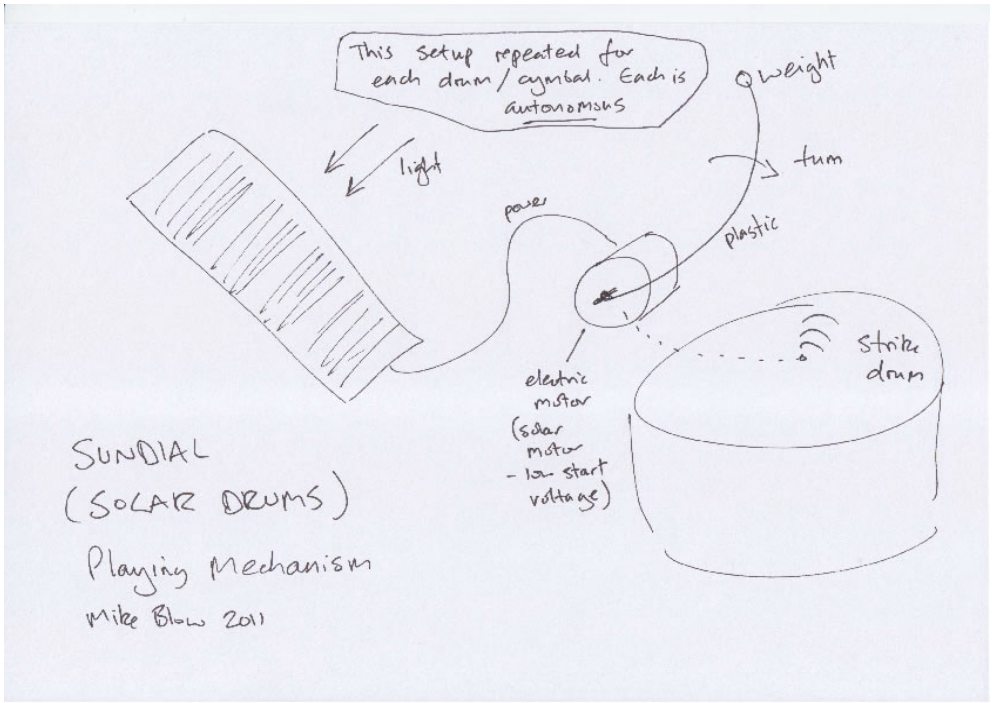
App. 2m x 1m x 1m

Description: A drumkit is set up outside and played by solar-powered motors. The solar panels face outwards from the kit in a semi-circle meaning different drums sound as the sun moves across the sky. The drumkit becomes an automatic, sonic sundial, changing its rhythm and composition depending on the amount of sunlight and the time of day. In *Time Machines*, due to invigilation issues, the static drums and solar motors were presented indoors, accompanied by a video of the piece working outside.

Technical

The motors used were 3v solar types which require little energy to get started. Each motor was connected directly to an 8.2V 0.9W photovoltaic cell. The motors and cells were mounted on microphone stands and arranged around the drumkit so that plastic armatures fitted to the motors would spin and hit the drums (the plastic armatures were long cable ties which had the necessary flexibility and 'spring' to hit the drum with some force and then bend and clear the drum as the motor continued).


S
solar cell
motor
striker
CRASH
TOM1
TOM2
RIDE
DRUMKIT
SNARE
FLOOR TOM
HIHAT
PATH OF SUN
MORNING:
HIHAT / SNARE
MIDDAY:
TOMS
EVENING:
RIDE / FLOOR TOM
SUNDIAL: SETUP / COMPOSITION
MIKE BLOW 2011


This setup repeated for each drum / cymbal. Each is autonomous
weight
light
turn
power
plastic
strike drum
electric motor
(solar motor - low start voltage)
SUNDIAL
(SOLAR DRUMS)
Playing Mechanism
Mike Blow 2011

The Fully Sequential Multisensory Reflect-O-Matic (2011)

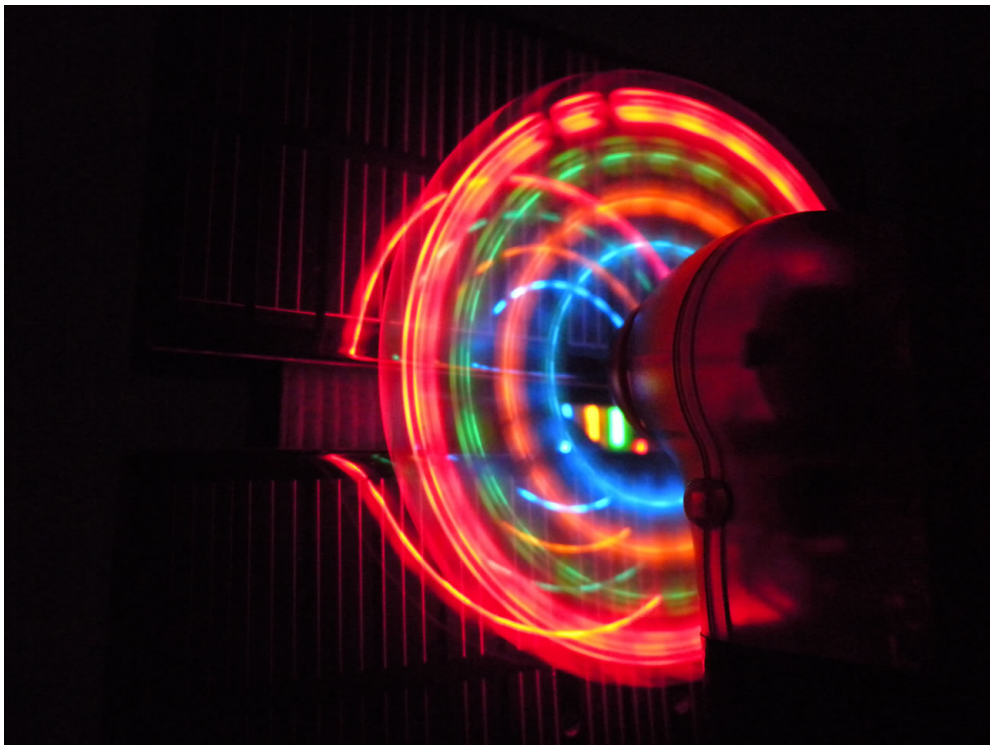
Wood, electronics, sound

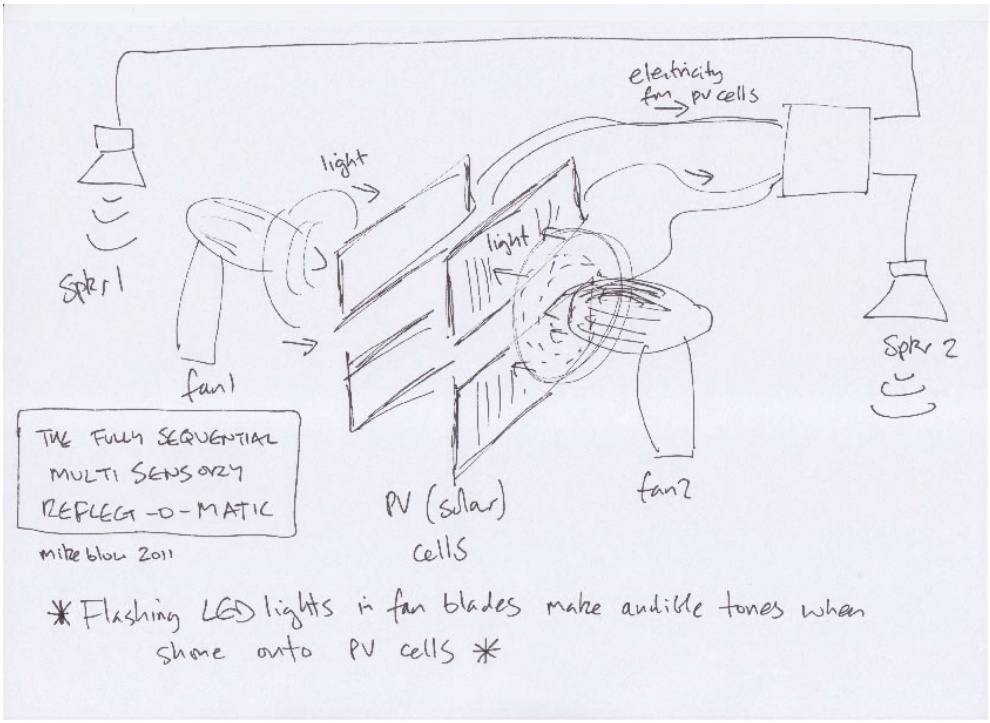
40cm x 20cm x 30cm

Two hand-held motorised fans with flashing LED lights in the blades are installed to run constantly opposite photovoltaic cells. As the fans spin in a dark room and flash in pre-programmed patterns the light causes electric current to be generated in the cells, which is then converted to sound using an amplifier and speakers.

Technical

The fans are mounted opposite each other on a wooden baseplate and shine directly on the cells. Two cells are used in parallel each side to increase the output and catch light from the whole of the blades' trajectory. The output of the cells is connected directly to an audio amplifier and then out to speakers. Each speaker plays the sound derived from one of the fans.




electricity from PV cells
light
light
Spkr 1
Spkr 2
fan1
fan2
THE FULLY SEQUENTIAL MULTI SENSORY REFLEGT-O-MATIC
mike blow 2011
PV (solar) cells
* Flashing LED lights in fan blades make audible tones when shone onto PV cells *

Torch Song (2011)

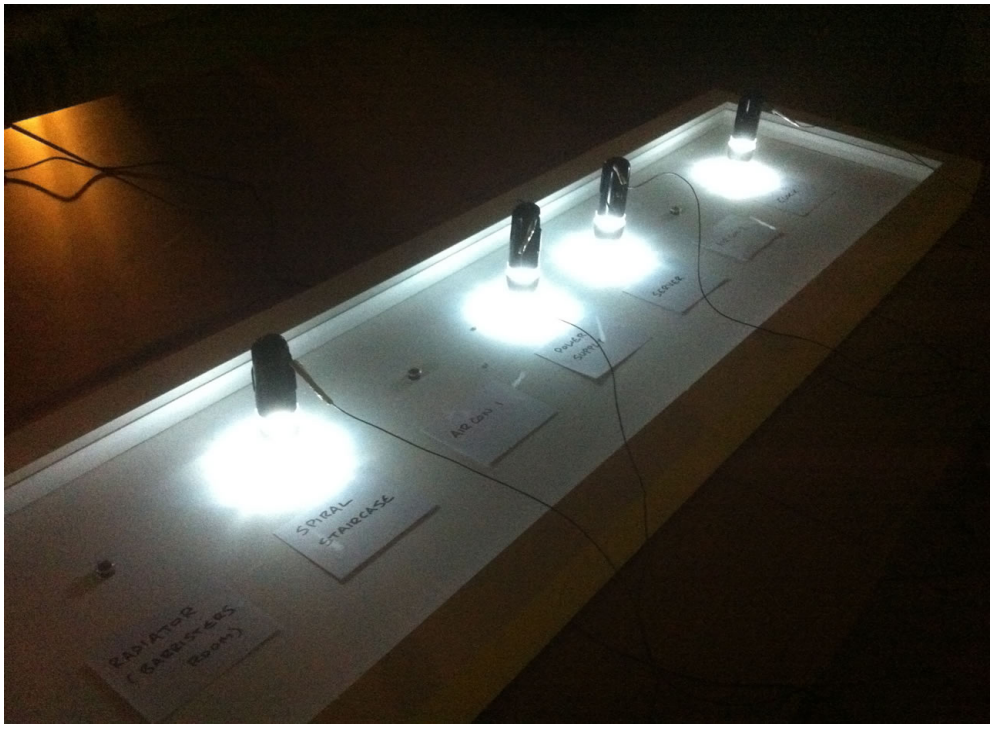
Wood, torches, electronics, sound

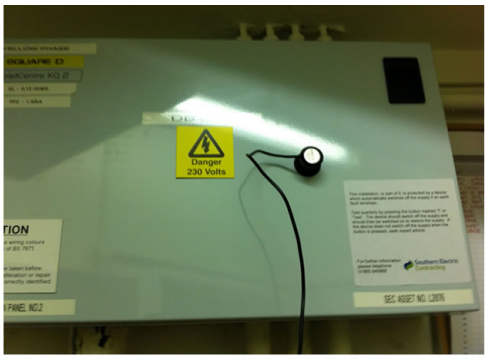
Control panel 1.8m x 40cm x 5 cm

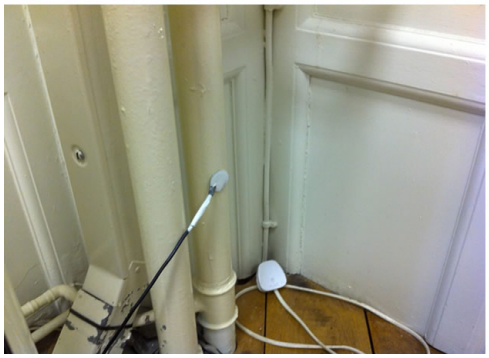
A white wooden control panel with a clear Perspex top allows the audience to interactively create a composition out of the sounds of the building they are in. The control panel is fitted with a row of photocells and by shining torches on them, the visitor can control the relative volumes of eight live audio feeds from infrastructure (air con, electric boxes, structural elements) around the building. Presented in a dark room.

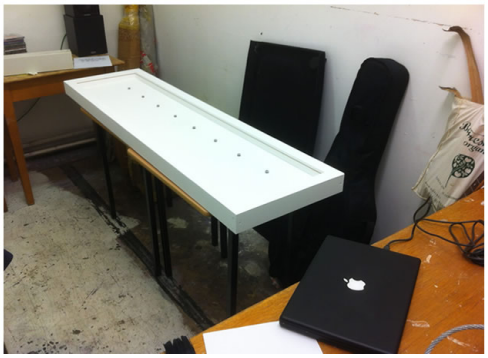
Technical

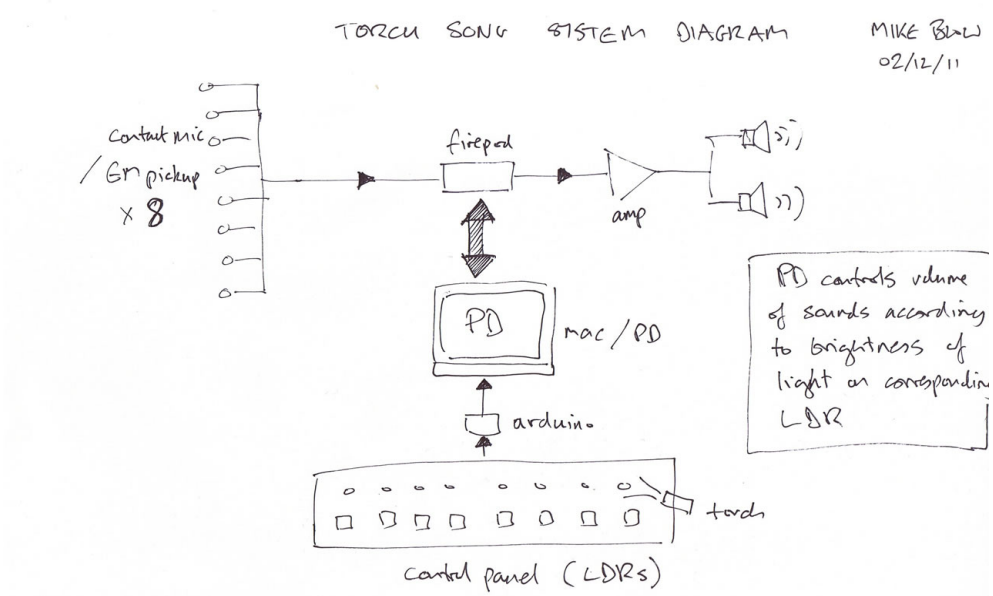
The photocells are wired as potential dividers to 8 analog inputs of an arduino clone board. The numerical outputs from the photocells are read by a Pure Data software patch, and are used to control the volumes of the 8 audio feeds, collected from around the building by a collection of piezo disc contact mics, electromagnetic telephone coils and guitar pickups and interfaced to the computer using an eight-channel soundcard.


SPIRAL
STAIRCASE
RADIATOR
(BARRISTERS
ROOM)


Danger
230 Volts






TORCH SONG SYSTEM DIAGRAM
MIKE BLOW
02/12/11
contact mic / GR pickup x 8
firepod
amp
PD
mac / PD
arduino
control panel (LDRs)
torch
PD controls volume of sounds according to brightness of light on corresponding LDR

SolarWork #2 (2012)

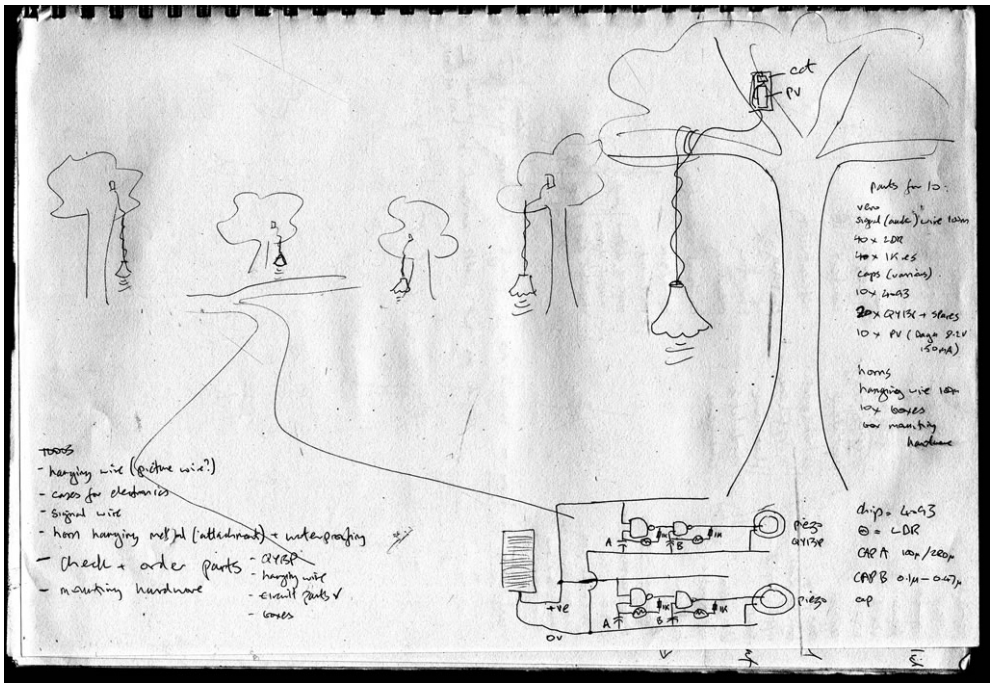
Brass, wood, plastic, electronics, sound

Dimensions variable

A line of seven brass gramophone horns hung in trees play high-pitched chirping sounds in response to the sun. As the climatic conditions change so do the horns' songs, drawing attention to the changing weather conditions and the natural environment.

Technical

Each device for this piece consists of a brass horn fitted with two piezo disc sounders in the neck of the horn, glued either side of a balsa wood resonator. The discs amplify the sound of a square wave oscillator circuit based on one in *Handmade Electronic Music* (Collins 2009), which is housed inside a transparent plastic jar mounted separately in the tree some way from the horn (partly for waterproofing, and partly so that the solar panel can be positioned to most effectively catch the sun).


cct
PV
Parts for 10:
vero
signal (audio) wire 10m
40 x LDR
40 x 1K ers
caps (various)
10 x LM393
20 x CD4151 + stands
10 x PV (Output 2:1V @ 150mA)
horns
hanging wire 10m
10 x boxes
wire mounting hardware
TODOS
- hanging wire (guitar wire?)
- cases for electronics
- signal wire
- horn hanging method (attachment) + waterproofing
- Check + order parts
- mounting hardware
- CD4151
- hanging wire
- circuit parts ✓
- cases
dip. LM393
⊖ = LDR
CAP A 10p / 220p
CAP B 0.1μ – 0.47μ
op
piezo
piezo
+ve
0v

Dance Theremuino (2012)

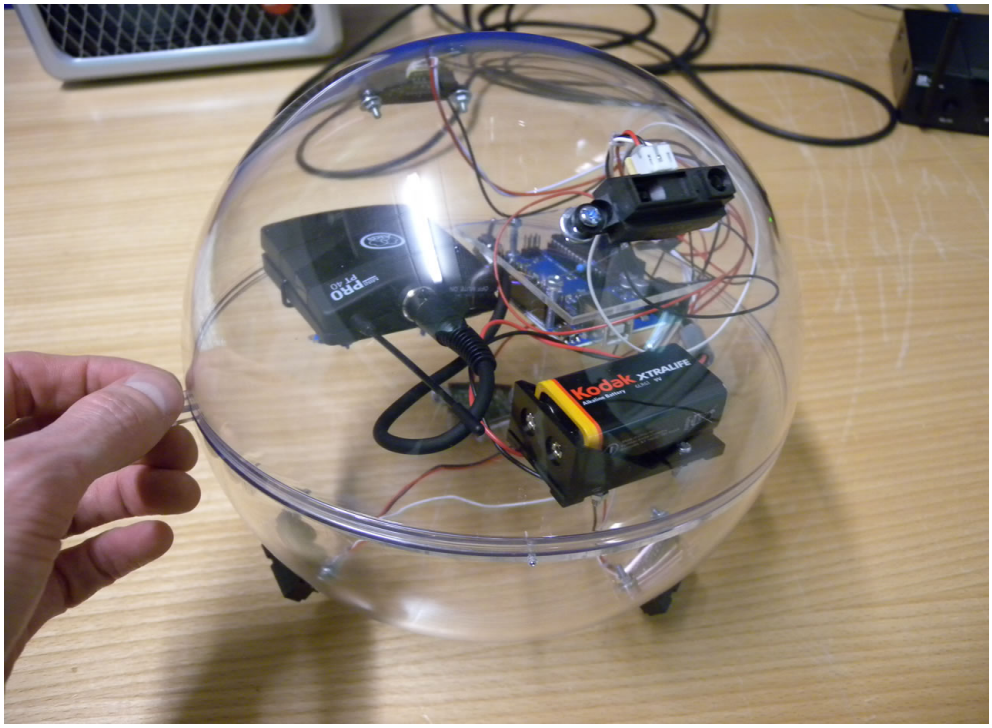
Acrylic, electronics, sound.

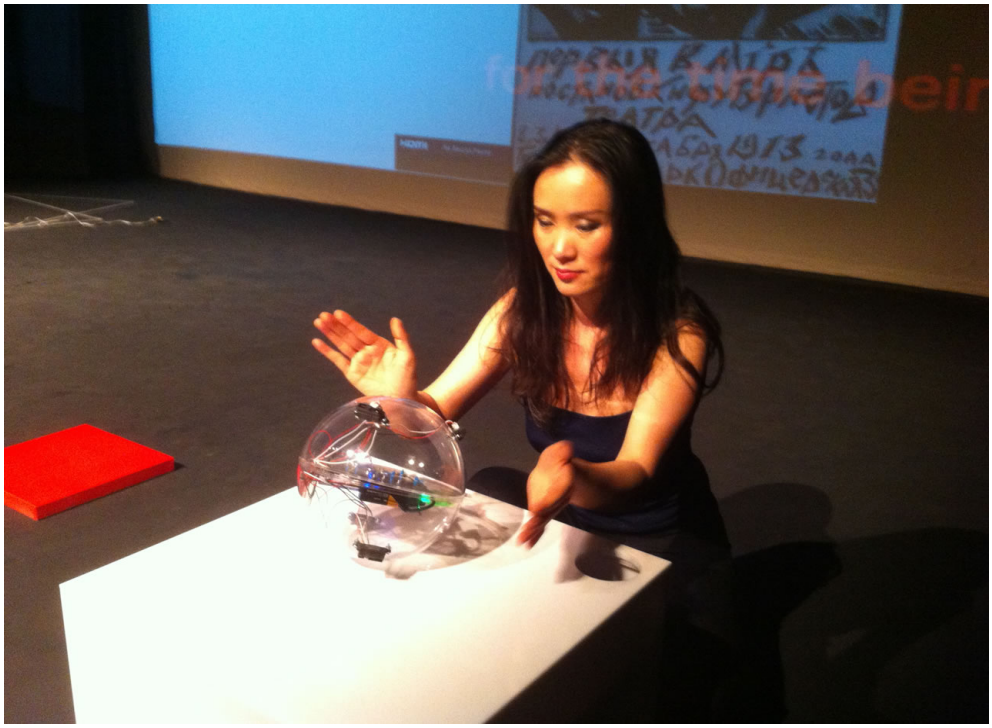
20cm sphere.

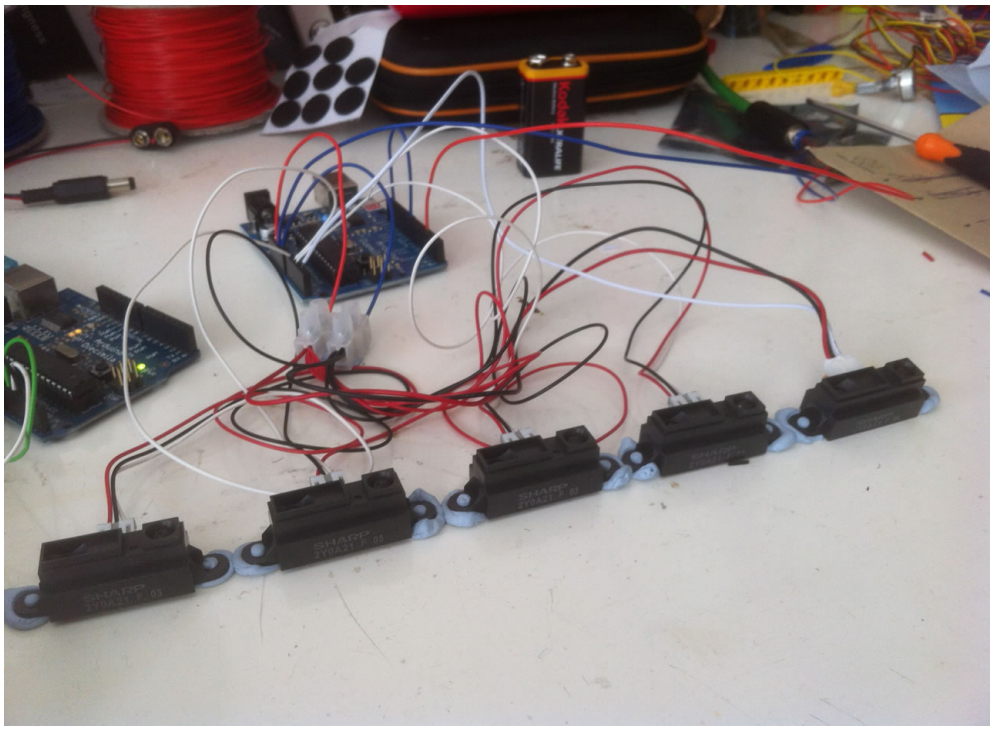
A performance synthesizer based around an arduino microcontroller. The *Dance Theremuino* is a 20cm transparent acrylic sphere with 5 distance sensors on the outside. As a dancer performs with the sphere, the changes in the readings from the sensors measuring the distance to her body are translated into variations in the sound emanating from the device.

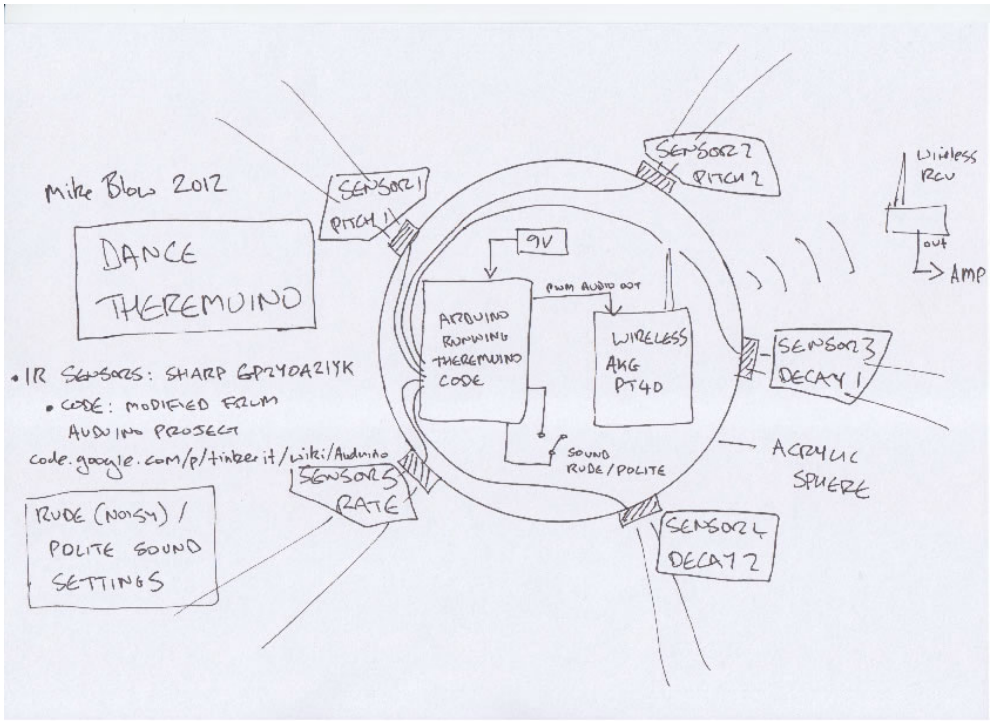
Technical

Dance Theremuino is a modified version of the open-source Auduino synthesizer, in which an arduino microcontroller board is programmed to create a 2-voice grain synthesizer with 5 parameters (pitch and grain size for each voice, and an overall rate control). The original uses potentiometers for each parameter; *Dance Theremuino* replaces these with Sharp GP2Y0A21YK infrared distance sensors. The code is modified to suit the output of the sensors and to create a more glitchy electronic sound. The output from the arduino is transmitted to the PA using an AudioTechnica wireless guitar unit.


Kodak XTRALIFE






Mike Blow 2012
DANCE THEREMUINO
• IR SENSORS: SHARP GP2Y0A21YK
• CODE: MODIFIED FROM AUDUINO PROJECT
code.google.com/p/tinkerit/wiki/Audiuno
RUDE (NOISY) / POLITE SOUND SETTINGS
SENSOR1 PITCH 1
SENSOR2 PITCH 2
SENSOR3 DECAY 1
SENSOR4 DECAY 2
SENSOR5 RATE
9V
PWM AUDIO OUT
ARDUINO RUNNING THEREMUINO CODE
WIRELESS AKG PT40
SOUND RUDE/POLITE
ACRYLIC SPHERE
Wireless RCV
out
AMP

Deep Listening (2012)

Neoprene, plastic (raft), hydrophone, electronics, sound

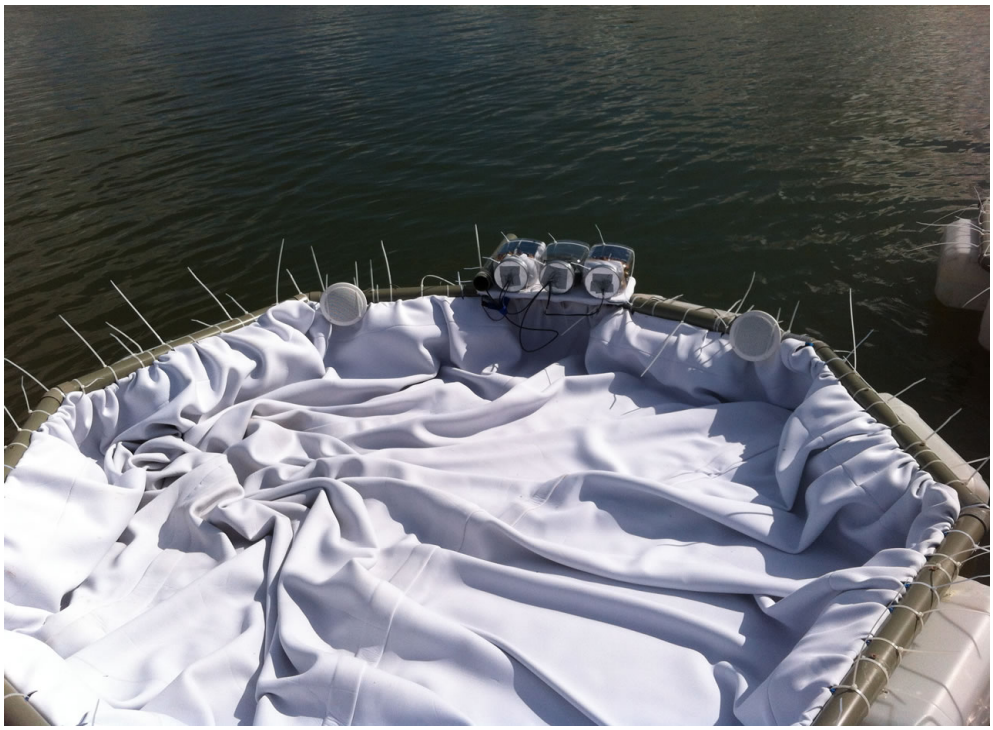
Raft approx. 2m diameter

An aquanaut floats on the surface of a river in a hand-made plastic and neoprene raft resembling a large lilypad. They can hear the underwater sounds of the river, captured by a hydrophone, amplified using solar-powered electronics and presented using two speakers mounted on the edge the raft. The sounds redefine and reveal the river object.

Technical

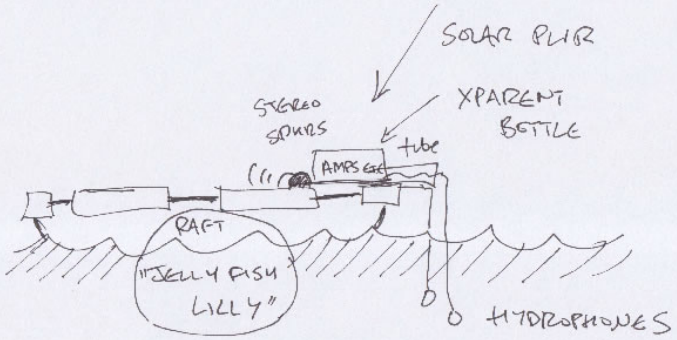
The raft in this project was one of several built, along with a floating dock, for the *River Runs* collaborative project between Tracey Warr of Oxford Brookes University and Gediminas and Nomeda Urbonas of MIT, Cambridge MA. To add a sonic component to one raft I used an Aquarian Audio hydrophone, hung over the side of the craft. The hydrophone signal went to my Zoom H4n (for preamplification and recording) and then to two amplifiers each consisting of a KEMO 3.5W amp module powered by three 8.2V 0.9W solar cells wired in parallel. The amps powered waterproof speakers attached to the inside of the raft.


N285 PNH

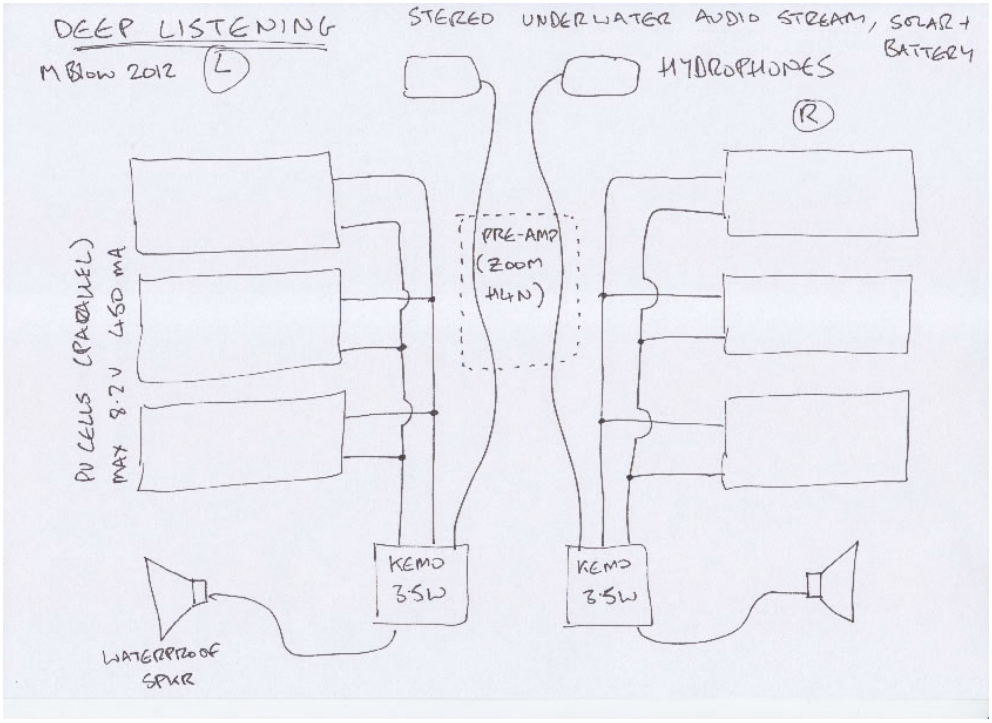


DEEP LISTENING: Attaching to raft

Mike Blow 2012



Listen to under + over water sounds as you drift downstream


DEEP LISTENING
M Blow 2012
L
STEREO UNDERWATER AUDIO STREAM, SOLAR + BATTERY
HYDROPHONES
R
PRE-AMP (ZOOM H4N)
PV CELLS (PARALLEL) MAX 8.2 V 450 mA
KEMO 3.5W
KEMO 3.5W
WATERPROOF SPKR

Arpeggi (2013)

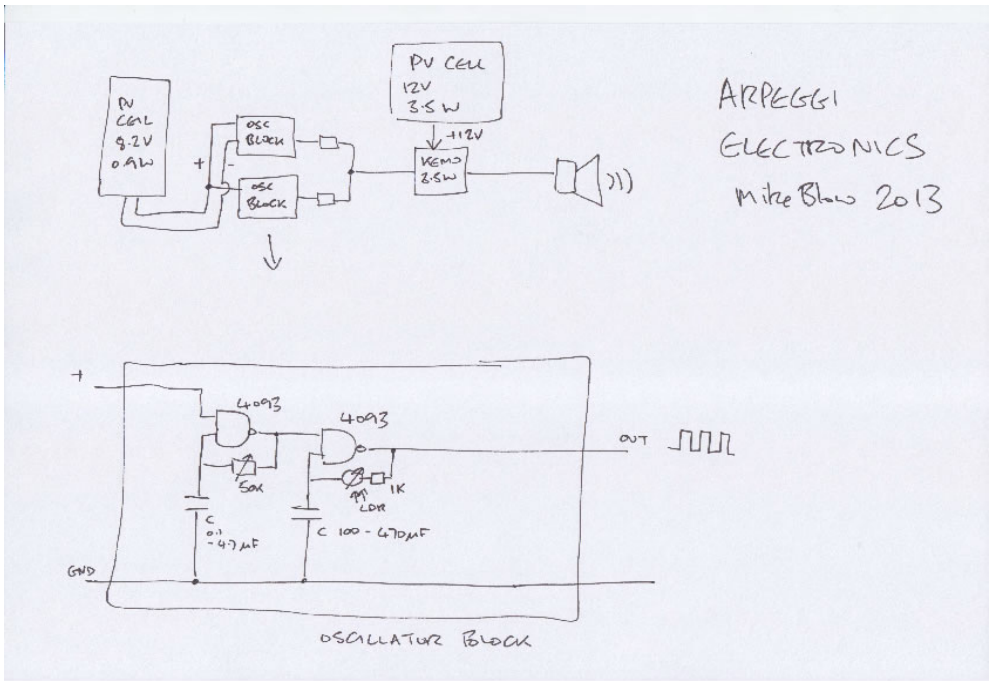
Aluminium, electronics, rope, sound

Each sculpture approx. 1.9m high x 2.7m diameter

Two sculptures resembling large windspeed instruments (anemometers) revolve in the wind. Each has three solar-powered oscillator circuits (one on each arm) feeding speakers pointing into the dishes. The audience hears a composition which reflects the amount of sun and wind as the sculptures spin and the sounds emanating from the dishes interact.

Technical

Each *Arpeggi* sculpture is constructed with a custom-built top section grafted onto an existing PA stand base. The dishes are spun aluminium, held by aluminium spars connected to a large hub bearing on the stand. The sound circuits are those used in SolarWork#2, but modified so that the pitch can be set with a trim pot. Each soundboard has two trimmable oscillators, modulated by two more oscillators with photovoltiac cells – so that, although the basic pitch stays fairly constant, the modulation changes with the amount of sunlight. The audio output from the circuits are sent via KEMO 3.5W amplifier modules to 40W full-range speakers mounted on the spars and pointing into the dishes. Each sound circuit is powered by a 8.2V 0.9W solar panel, and each amp by a separate 12V 3W solar panel.


PV CELL
12V
3.5W
+12V
KEMO
3.5W
PV
CELL
8.2V
0.9W
OSC
BLOCK
OSC
BLOCK
ARPEGGI
ELECTRONICS
Mike Blow 2013
+
4093
4093
OUT
50K
1K
LDR
C
0.1
-47µF
C 100 - 470µF
GND
OSCILLATOR BLOCK

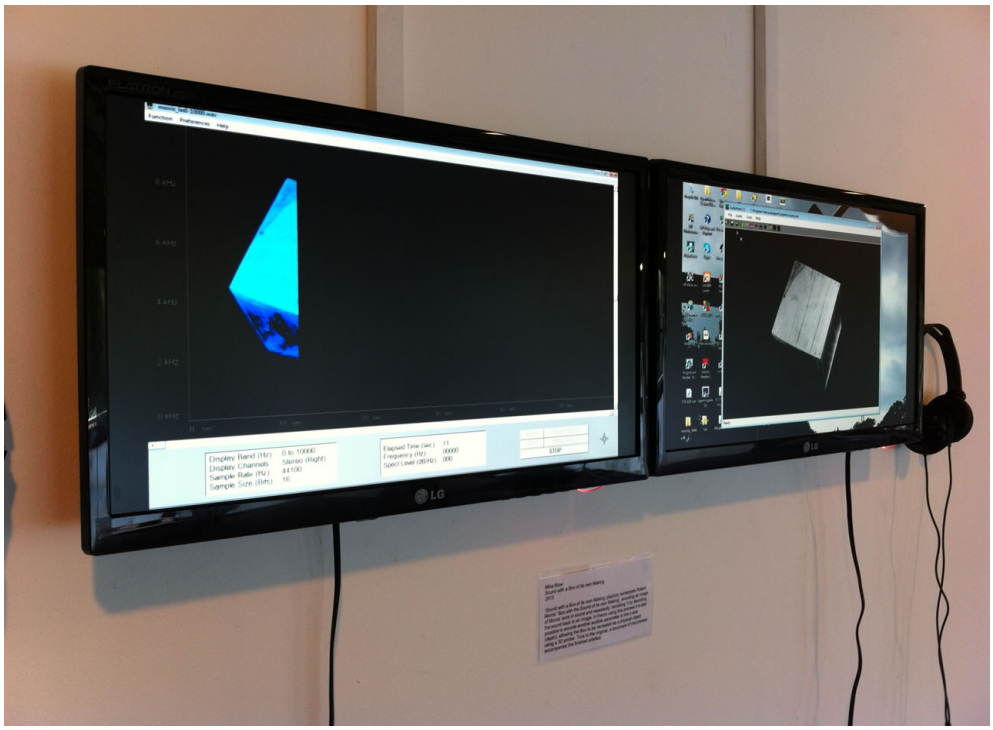
Sound with a Box of its Own Making (2013)

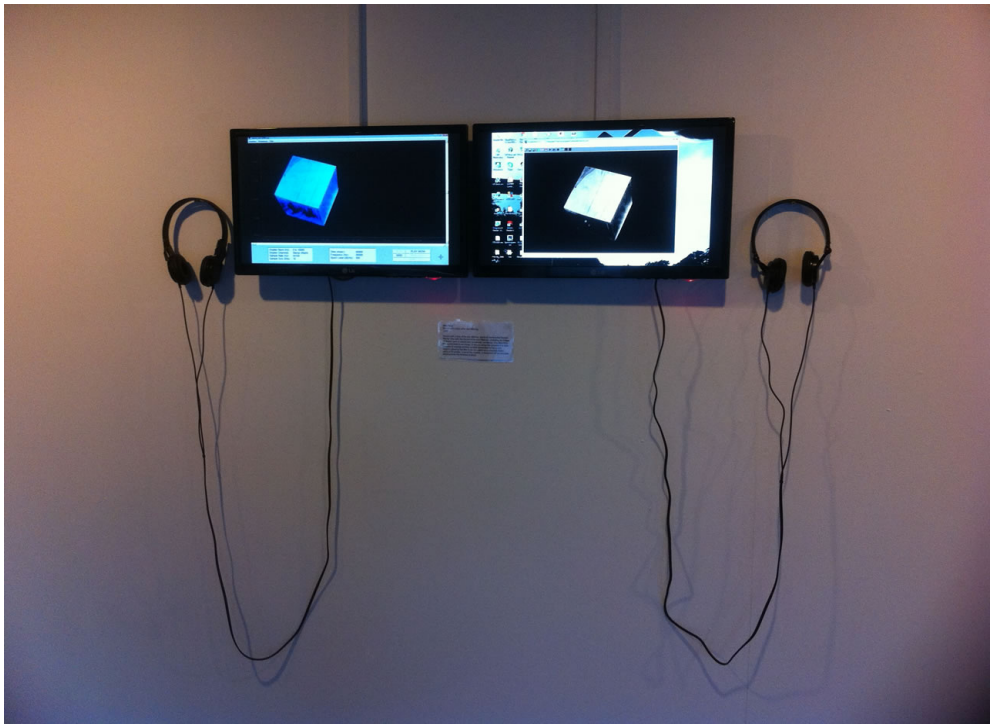
Two videos with sound, 5'11" and 0'44"

Two videos are presented side by side. One is of the image of a Robert Morris' *Box with the Sound of its Own Making* being rendered from left to right on a loop; the render is in fact the image of the box being retrieved from a sound file which holds the image information encoded as audio, and which can be heard concurrently. The piece uses a process of encoding the image as frequencies and then decoding the sound back into the image, creating a sound with a box of its own making. The second video shows the process of making and retrieving the image as an instructional video, in a reference to the emphasis on process in Morris' work.

Technical

The image of the box was found online and converted into sound using Audiopaint software (http://www.nicolasfournel.com/audiopaint.htm). The sound is re-converted back to an image using Spectrogram (http://www.electronics-lab.com/downloads/pc/003/). Both programs are freeware. The settings for the encoding and decoding processes need careful matching if the image is to be retrieved correctly.





Ritual (2013)

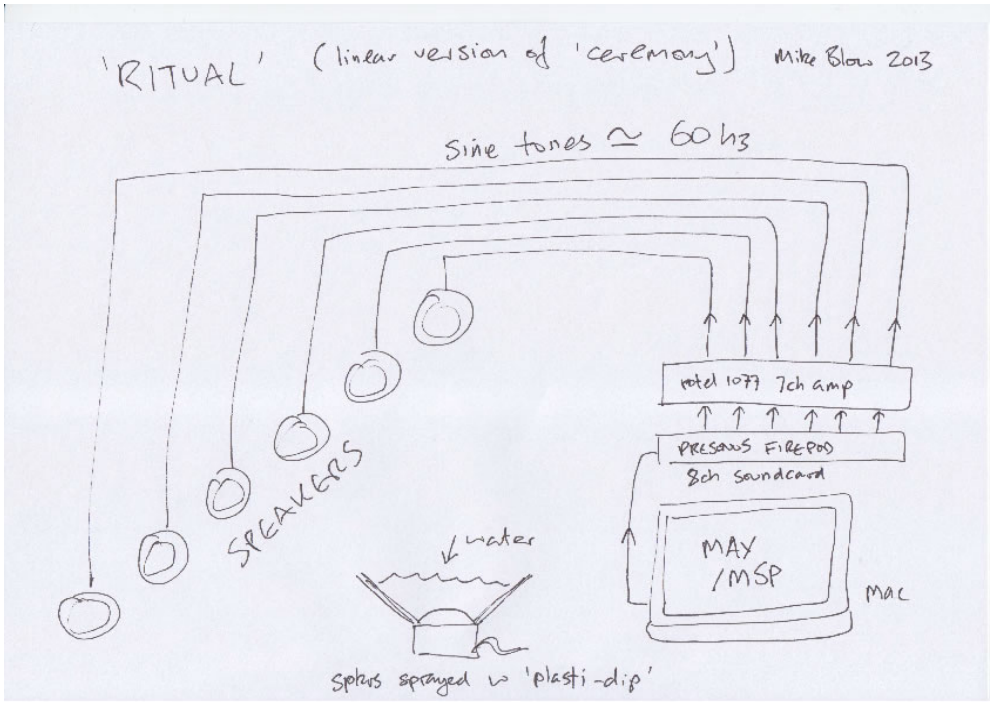
Speakers, water, electronics, sound

Dimensions variable

Ritual is a development of *Ceremony*. The main visual difference was six larger speakers arranged in a line diagonally across a plinth. It also differed in having six independent audio channels feeding one speaker each, which pulsed at different rates.

Technical

The basic setup was similar to *Ceremony* with sine waves pulsing through the speakers to make cymatics patterns, but using a multi-channel soundcard *Ritual* was able to have 6 outputs pulsing at rates between 0.01Hz and 0.5Hz. The speakers were waterproofed with multiple coats of plasti-dip rubber paint.


'RITUAL' (linear version of 'ceremony') Mike Blow 2013
sine tones ≃ 60 hz
SPEAKERS
water
splats sprayed w 'plasti-dip'
rotel 1077 7ch amp
PRESONUS FIREPOD
8ch soundcard
MAX
/MSP
mac

Aeolus (2013)

Wood, metal, electronics, paper, sound

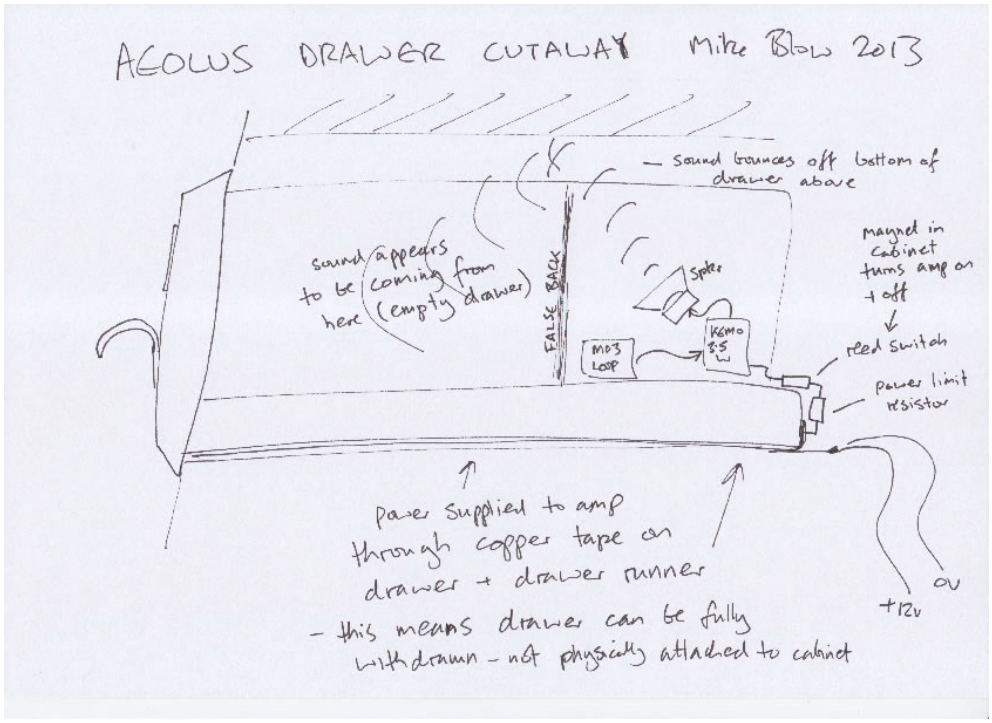
120cm h x 90cm w x 60cm d

An index-card cabinet, with twelve drawers, stands in the gallery. Each drawer contains the sound of a wind, which plays when the drawer is opened. The drawer is labelled with the name of the wind and its approximate location in latitude and longitude. Apart from this unusual functionality, the cabinet appears completely standard, and the drawers, when opened, are empty.

Technical

Aeolus was the largest technical challenge undertaken during this research. Each drawer had to appear empty, be autonomous in terms of sound (so that all 12 could play simultaneously, if desired), ideally be removable for easy maintenance and to switch reliably when in use. To achieve this each drawer - originally being just a front and base - were fitted with sides and a false back about two-thirds of the way down its length, behind which the electronics was installed. Each drawer had an mp3 player looping the soundfile, a KEMO 3.5W amp, and a speaker mounted on angled brackets, pointing up at about 30 degrees. The sound bounced off the bottom of the drawer above and back down into the empty space in the drawer, thus appearing to come from inside the drawer. The drawers had metal stops to prevent their complete withdrawal. The switching was accomplished using reed switches mounted on the inside ends of the drawers, activated by rare earth magnets on the cabinet frame, and worked by switching the power to the amp when the drawer was opened. This had the advantage of

only running the amps when necessary, thus prolonging battery life. However switching the power like this was too much for the first batch of reed switches which soon malfunctioned; the issue was solved with high-power reed switches and current limiting resistors. Once these were fitted the piece ran faultlessly for a month in *Unfoldings*. Battery power came from a single 12v 7Ah unit suspended underneath the cabinet. Each drawer was fitted with copper runners underneath that made contact with more strips on the cabinet body that were connected to the battery; in this way power was passed to the drawers without the need for wires, and the drawers could be withdrawn if required.


AEOLUS DRAWER CUTAWAY Mike Blow 2013
— Sound bounces off bottom of drawer above
sound appears to be coming from here (empty drawer)
FALSE BACK
speaker
MOS LOOP
KEMO S.S W
magnet in cabinet turns amp on + off
reed switch
power limit resistor
Power supplied to amp through copper tape on drawer + drawer runner
- this means drawer can be fully withdrawn - not physically attached to cabinet
0V
+12v

Appendix 2

Exhibition of Works Appearing in this Thesis

Barbican Weekender, London, 1-2/03/14.

Work Presented:

POD (2009)

(Post PhD-submission but relevant to the work presented in this thesis)

***Unfoldings* final PhD show, Watermans London, 20/09/13 – 19/10/13.**

Works Presented:

Volume (2010)

Bleigiessen (2011)

Arpeggi (2013)

Ritual (2013)

Sound with a Box of its Own Making (2013)

Aeolus (2013)

Stereo Rain Paintings (2011)

Unfoldings was scheduled to run for a week but was extended to a month in response to audience feedback.

***Audible Forces* Lakes Alive Festival, 09-11/08/13.**

Work Presented:

Arpeggi (2013)

Audible Forces **Stockton Festival, 02-04/08/13.**

Work Presented:

Arpeggi (2013)

Audible Forces **Greenwich and Docklands Festival, 21-23/06/13.**

Work Presented:

Arpeggi (2013)

Audible Forces **Salisbury Festival, 25-26/05/13.**

Work Presented:

Arpeggi (2013)

Audible Forces **Norfolk and Norwich Festival, 17-19/05/13.**

Work Presented:

Arpeggi (2013)

Audible Forces **Brighton Festival, 03-05/05/13.**

Work Presented:

Arpeggi (2013)

Out of Office **group show, Kemp and Kemp Solicitors Abingdon, 27/11/12 – 02/12/12.**

Work Presented:

Presence Room (2012)

(Indoor version of SolarWork #2)

Stereo Rain Paintings (2011)

***BEAM festival*, Brunel University London, 22-24/06/12.**

Work Presented:

Presence Room (2012)

(Indoor version of SolarWork #2)

DAP Lab, *For the Time Being*, International Festival of Digital Art, Watermans London, 26/05/12.

Work Presented:

Dance Theremuino (2012)

Pegasus Theatre Oxford 8-10/05/12.

Work Presented:

Shower (2010)

***Audiograft 2012* group sound show, Oxford, 28/02/12 - 04/03/12.**

Work Presented:

SolarWork #2 (2012)

***Spotlight* group show, Oxford, 02/12/11.**

Work Presented:

Torch Song (2011)

***Time Machines* solo show, Oxford 13/09/11 - 16/09/11.**

Work Presented:

Bleigiessen (2011)

Memory Triptych (2011)

Sundial (Solar Drums) (2011)

For a Limited Period Only (2011)

Stereo Rain Paintings (2011)

The Fully Sequential Multi-Sensory Reflect-O-Matic (2011)

***Kinetica Art Fair 2011*, London 04/02/11 - 07/02/11.**

Work Presented:

Ceremony (2010)

Shower (2010)

***Audiograft 2011* group sound show, Oxford, 14/02/11 - 20/02/11.**

Work Presented:

Ceremony (2010)

Shower (2010)

Piano Arrangement (High-Low) (2010)

Work in progress show, Oxford Brookes University, 29/10/10.

Work Presented:

A27 Zen Garden (2010) (documentation)

Ceremony (2010)

Shower (2010)

Volume (2010)

***What the Fxxx is Happening Now? 2010*, Falmer Sussex, 14/08/10.**

Work Presented:

A27 Zen Garden (2010)

***Stadium*, University of Brighton Grand Parade Gallery, Brighton, 13/07/10 - 31/07/10.**

Work Presented:

Subtle Objects: Pickup (2010)

Subtle Objects: Superabled (2010)

***Subtle Objects: Pickup*, Jubilee Library, Brighton, 22/05/10 - 30/05/10.**

Work Presented:

Subtle Objects: Pickup (2010)

***POD*, Shunt, London, 5-8/08/2009.**

Work Presented:

POD (2009)

(Prior to starting PhD)

Appendix 3

Reflective Practice

The following pages contain examples of visual tools used to facilitate reflective practice. The first section contains examples of images of work, printed with space for adding observations, questions and references. The second section is images of a large roll of paper on which all existing works (at that time) and all the ideas that being raised by the research were written. Lines were drawn between the corresponding elements, to visually explore which ideas were embodied by each piece, the ideas that occurred most often and those which needed more research.

A27 ZEN GARDEN

Self contained - restful

Mix of art + gardening language

pots?? not sure

Creating a 'displaced environment' (both geographically + in feel)

Sounds very soothing - round form + flowing shape reinforce this (as well as natural materials)

Could be better executed but its a beautiful shape, nice contrast in materials - an object you can walk on

experiential contemplative

time consuming + expensive

Is link to road junction clear enough?

Bleigiessen

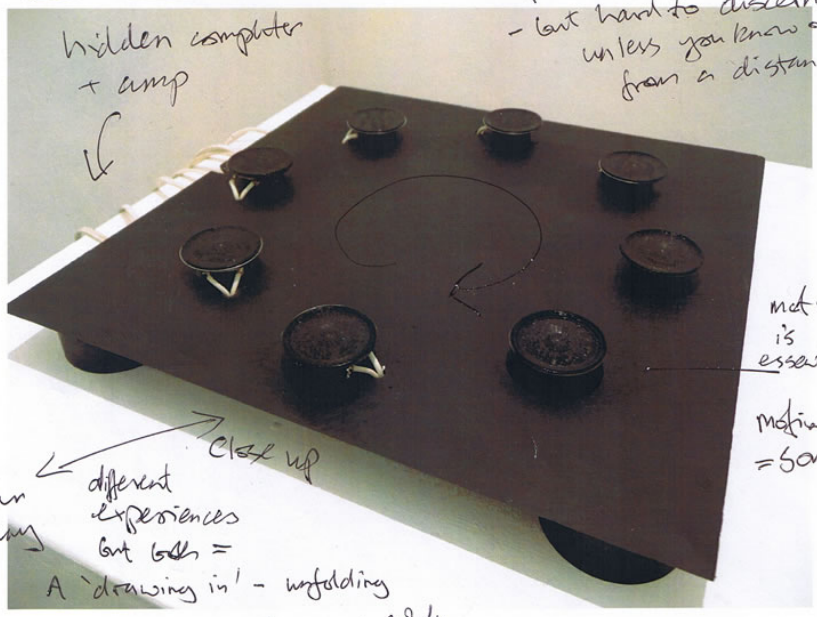
Headphones too isolating

Sound + image don't really fit (PROCESS RELATIONSHIP)

Metal formation fragile + difficult (bigger? more robust?)

Slowing down time by slowing soundtrack - sound is malleable, material also - but by different processes. Both can be melted, stretched, deformed, reformed

CEREMONY



cymatics but not focusing solely on individual water patterns - whole effect (in all 8 spkrs) just as important

Hans Jenny + other cymatics pieces? Julius water + cows full of dust

lewis tanosaki 'seeing sound' - fischinger chladni

Viewers not sure what liquid is - some touch it black = mysterious

is it a maquette for a bigger one? or is it the perfect size?

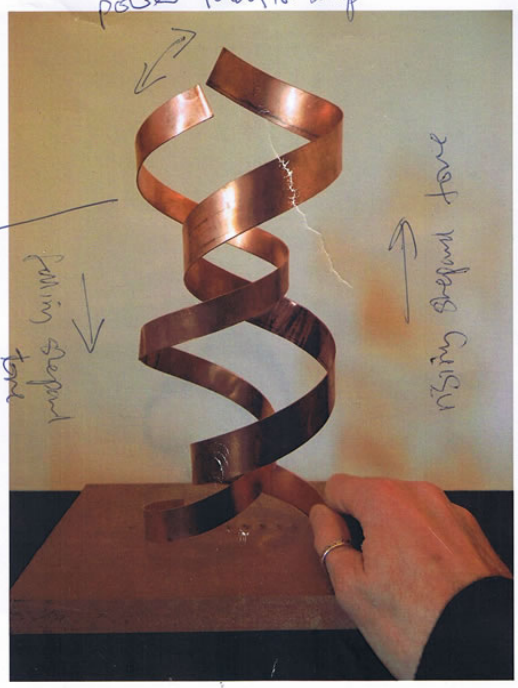
Small speakers force you to come close + listen - & reverse power relationship

layout + position of wires imply a sort of 'procession'/revolving

moments + Greek throughs - that visitors didn't know what the liquid was / dual nature of water / waterproof small spkrs / lack of bit to do 8ch version / 'engagement of people'

Further practice: bigger / more channels? / grid / other liquids

Double Helix



Try with 3D object

Simple shapes can bind to sounds in multiple ways - shape itself, dynamism, flow, semantic metaphor, material

Shape - dynamic, flowing, restless, endless, figurative, sexy

this version has a much more 'intertwined' feel than equally spaced i.e.

For a limited Period

attempts to work on several levels - ambitious

Bulb only makes sound some of the time

fake - but appears live
needs to be live or a better fake!

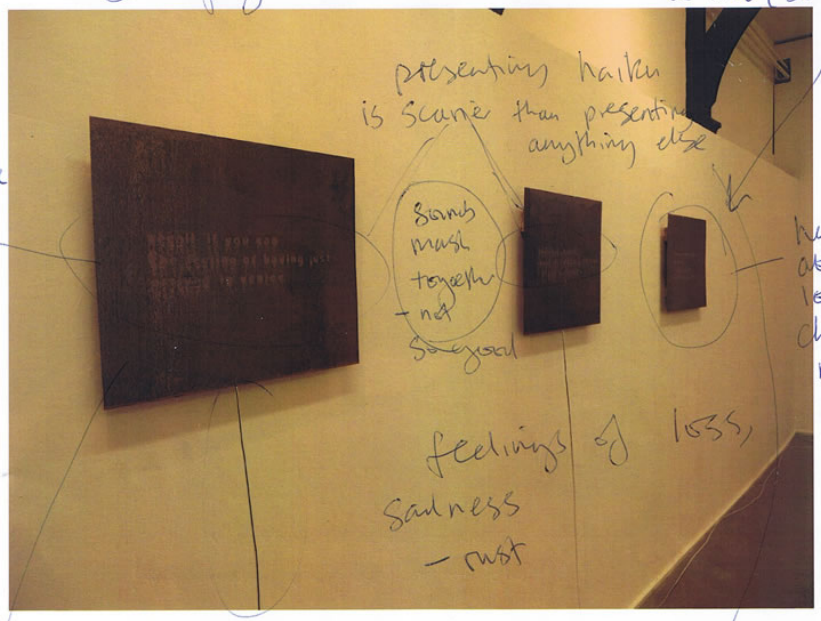
Measurement

Strange, 'Science experiment' look - I like it.

~~pros~~ - engaging, doesn't explain everything
Minimal, minimal appearance.

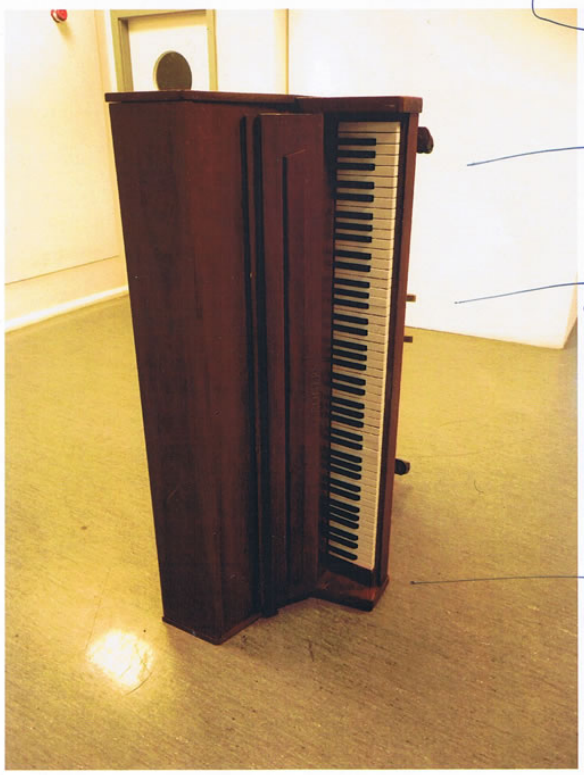
Cons - lack of 'live' sound lets the piece down (visitors tapping bulb to check...) maybe a mix?

For some visitors their favourite piece in the show - others didn't get it at all.


memory triptych
thicker plate would be nice (5mm)
presenting haiku is scarier than presenting anything else
like the dust / rip effect
sounds mash together + not separated
haiku about loss of child - no sound
feelings of loss, sadness - rust
wires visual clue to lack of sound in 3rd panel
about time, + time required
very personal piece. Does it work?
like the triptych appearance
increase clarity of sounds, or try presenting individually
Aesthetics of sounds + object don't really match - even if subjects do - the two feel a bit too far apart to me

inspires interest, exploration + play

Piano Arrangement low-hi



hinders up high

requires 2nd person to play pedals

forlorn, helpless

un-ergonomic

Low notes near ground (low down)

An act? an accident? somehow shocking (would not be so shocking if it were a synth).

Becomes more sculptural

- compare Christian Marclay's altered instruments

intriguing, slightly menacing - attract / repel alien. Sounds reinforce this (abstract, low, incessant). Tactile - feel the sound with skin, fingertips, cheek. Danger of explosion. Minimal modern? 'Playschool' blue - not quite fits sound

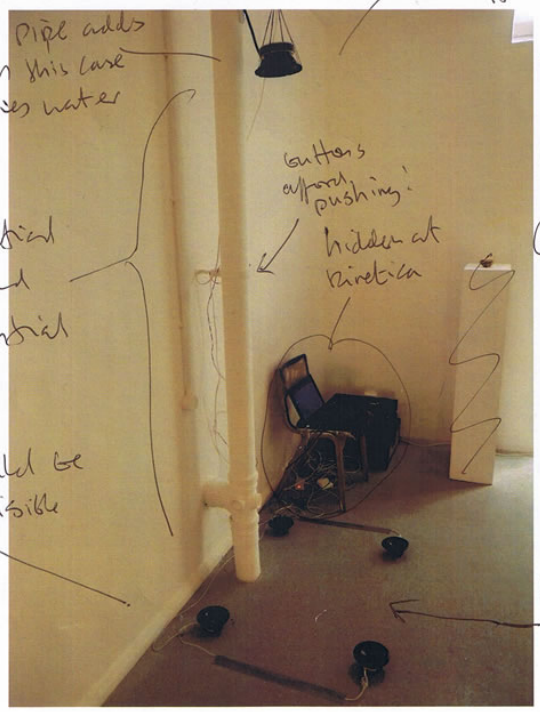
Does sound fit shape? Size, volume, pitch?
Does sound fit colour? Colour shld be darker.

Beats imply something within

constancy of sound is good (sphere a 'grounded' shape)

looks like a prototype. looks electronic - speakers + wires

SHOWER



Breakthroughs -
trying out in bradley kitchen
① Spatialisation is essential ⇕
② 'surround sound' at feet really adds to illusion

c'est ne pas un douche! - magritte surrealists

(but it makes us feel like it is because of the sound)

experience: 'weird' uncomfortable, 'cleansing', enjoyable, cf uncanny valley?

- a sound with only the same spatial arrangement + name as the object (no object apparent)

a personal favourite but divisive...

Steep + grass is quite subtle + natural looking

Steampunk

-ve effect on wildlife? alarm calls?

level/water

both like leaves or fruit - semi natural

directional

breakthroughs: piezos + balsa (Uess) - sensitivity of

contemporaries - Max - the outdoor sound walk? Use of horns?

light - sound

sounds - too continuous? - dry occassional / softer (good volume)

~~[illegible]~~

quiet but present (julius - 'big gray')

unfolding experience

- following trail - consciousness of environment expands

a sonification of sunlight - most obvious when shadows play on the PV cell (wind blowing branches)

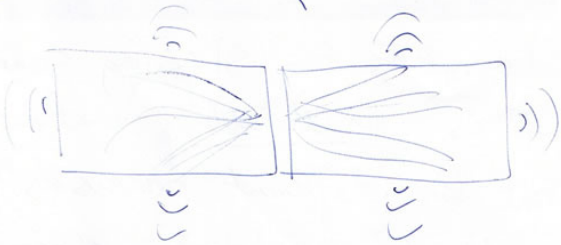
Stereo Rain Paintings

dont like wires / (floor) naturalistic, mix of flowing, violent (?) splashing + slow resting

patterns very effective

Cant focus on both at once

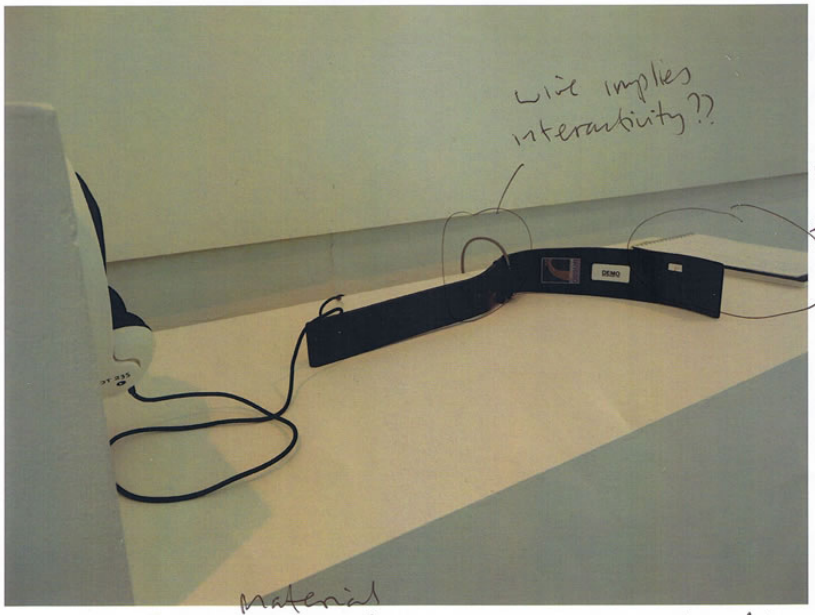
try -



on floor?

rain sounds a little 'tinny' - prob because of piezo discs used to record - tho maybe this does reinforce materiality of steel.

SUBTLE OBJECTS - 'SUPERABLED' carbon prosthetic electronics sound



what is it? Carbon fiber - technical, the future

wrong orientation

interesting shape

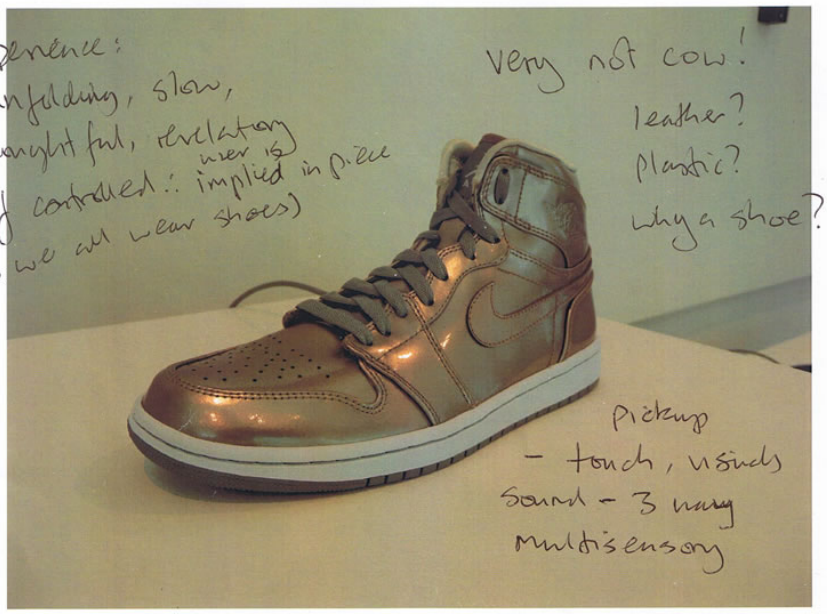
sounds about redefinition of 'dis-abled' as 'super-abled' due to technology.

Interesting background, pistorius story.

Found object (duchamp)

Breakthrough: Balancing sounds in Denon (omitting musical sound that took too much attention, using 6 sounds that were fairly equal in terms of 'attention grabbing')

SUBTLE OBJECTS – 'PICKUP'

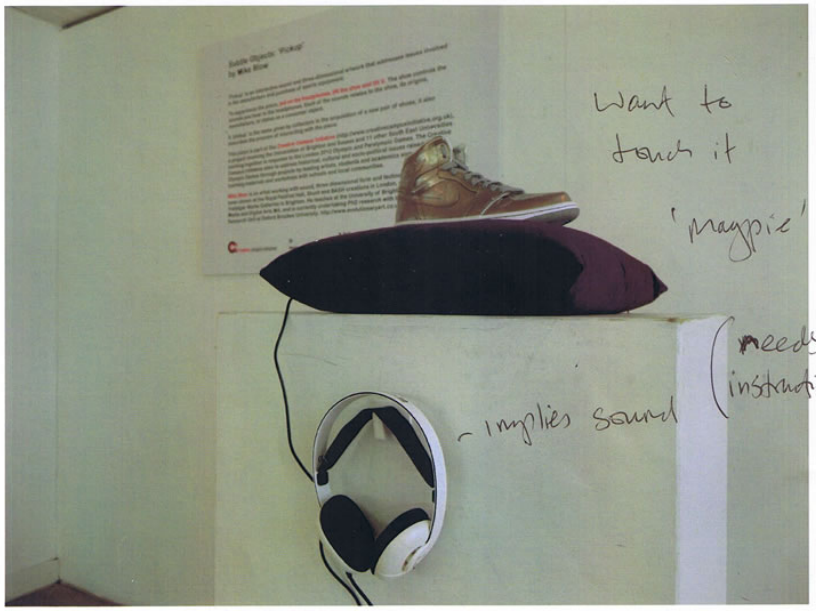


tilt accelerometer –
intuitive? iPhones, Wii

Single shoe – lost? surreal? out of context

how much integration is there between sound + object?
sounds add 'layers' to story / understanding of shoe.
layers can be mixed to create personal explorations
& narratives
– ✂ or for effect (shoe DJ) ⌐sence of excitement /empowerment

SUBTLE OBJECTS - 'PICKUP'



Odd object in an art context. But suitably shiny / attractive / fetishistic. Cushion?? In retrospect, not sure it works...

Found object (duchamp) tech is hidden — no distraction

one-person experience (sonically)

Mom's ('box')

sounds focus on creation + consumption, implying global economy + 'collector status' of shoe.

Also enhance appreciation of aspects of shoe: stitching, rubber sole, leather (used to be a cow)

changes → responds

user ↔ work

responds ← changes

'fake' shit driving machine sound

SUNDIAL

Nice Curves (plastic strip + power wire)

these stands should be pointing down / (use short stands)

Outdoor drums - in nature - Wilderness

Chrome stands + kit work well

generate enough power in direct sunlight to turn motors, but not in oblique or cloudy light.

Is link between sound + environment clear enough?

It's as if the drums are being 'measured' or experimented on - comical when the all start

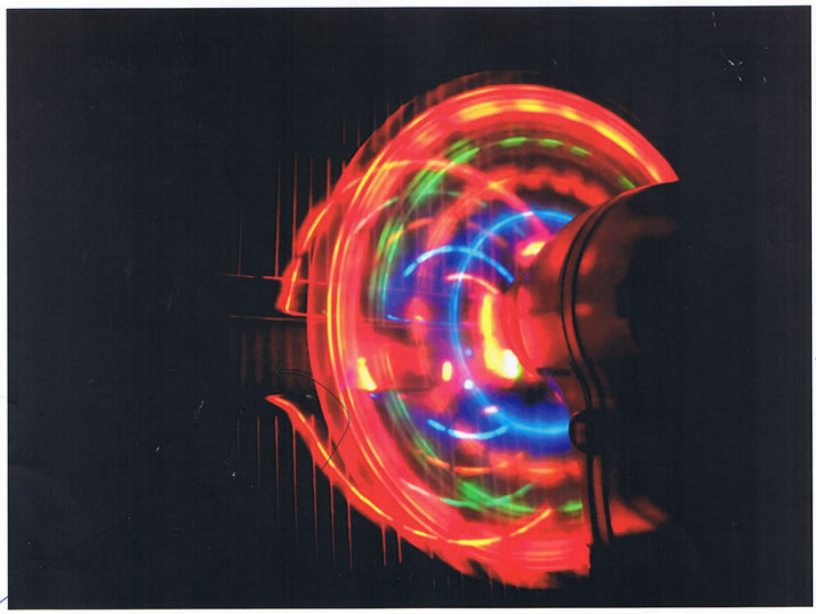
visitors love solar power aspect

may be an easier way e.g. vibrating motors placed directly on drums - tho I like the look of this version

- engaging movement

REFLECT-O-MATIC

Interesting changing sounds with light patterns



Do sounds + colours match??

noise of fans
fans wear out - quality

Very photogenic - but much too reliant on existing objects - would be good to use same concept with custom-built hardwear.

Experiment with ~~[illegible]~~ LEDs to make different sounds - like the light - sound conversion.

Very visceral.

More an 'assemblage' than finished work.

HI-TECH

DYNAMIC

FAIRGROUND RIDE

Strange mix of frantic action (fans) + contemplative sound

TORCH SONG

pickups + mics on infrastructure

like the look of the control panel (after PETER VOGEL)

explor-atory

compo-sitional

Sounds + object (darkened room) match very well
- mysterious re-imagining of the space
- unknown processes and potentialities

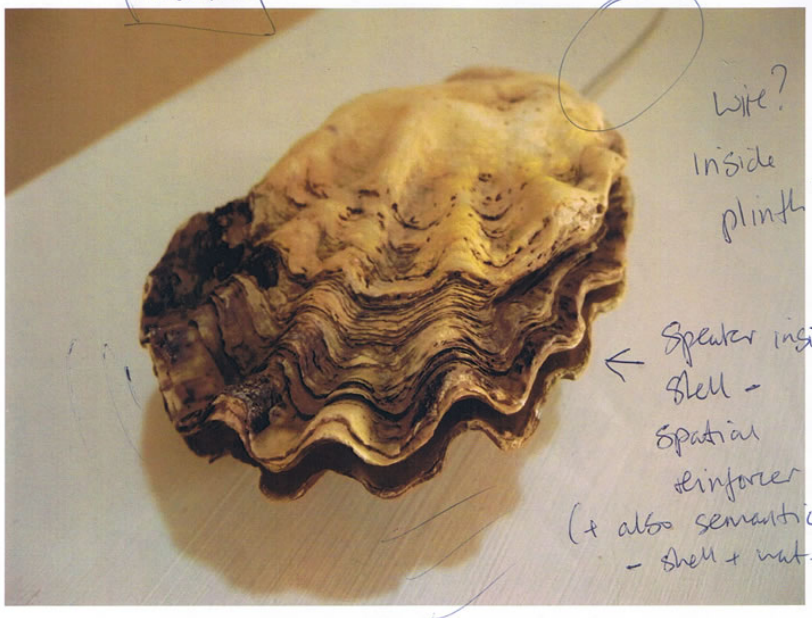
- playful + interactive

a visual reference to peter vogels sound sculptures - a personal favourite!

Quite intuitive
- also visitors show other visitors how to use + collaborate on compositions

is it clear that the building is the 'object'?

Volume



Wire? Inside plinth?

← Speaker inside shell - spatial reinforcer (+ also semantic - shell + water)

water drips - occassional, quiet, forces visitor to engage
sound

Strange tension between small object and large sound

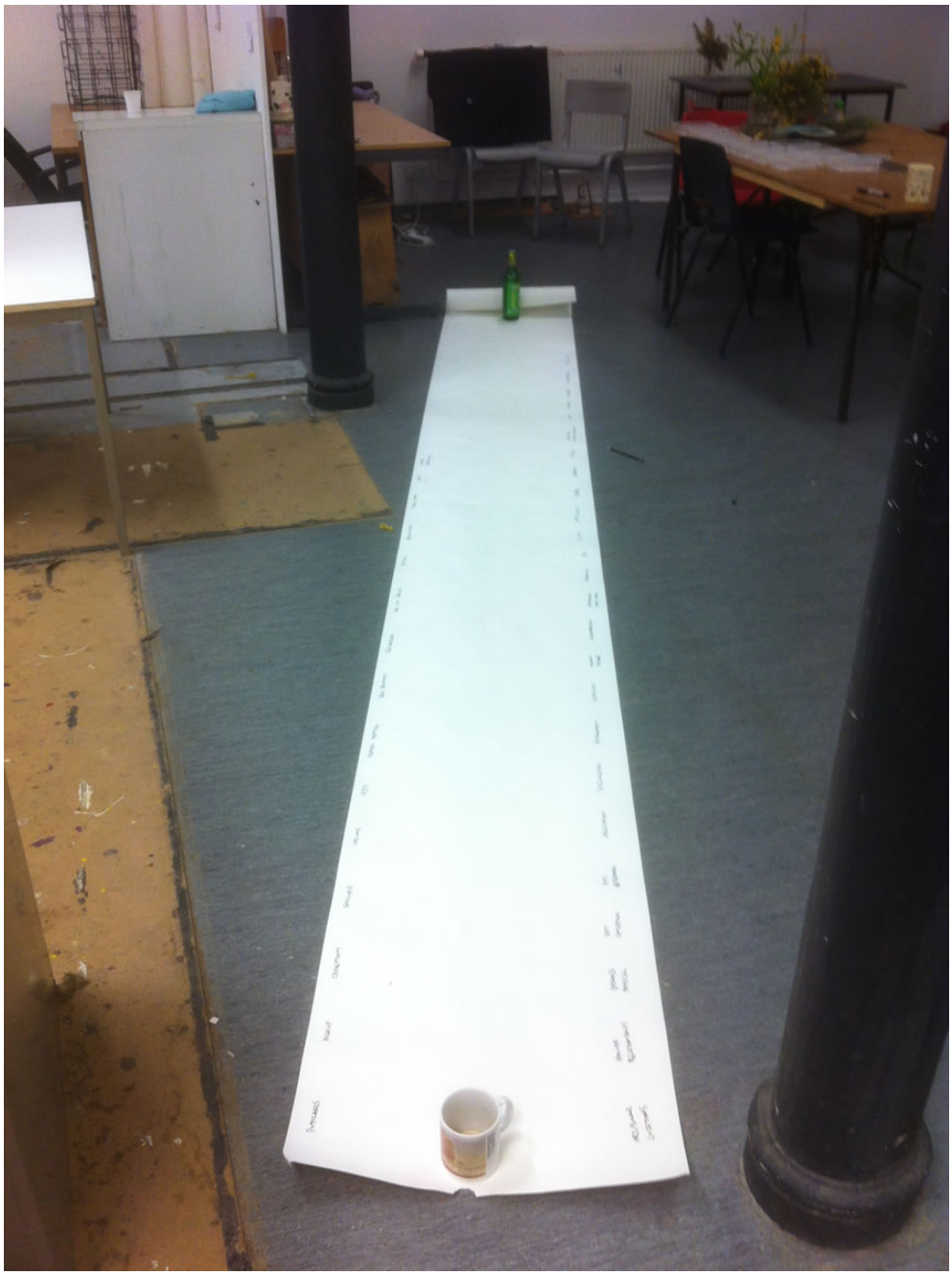
(unresolvable?) - or can you create the object in your imagination? (3rd form)

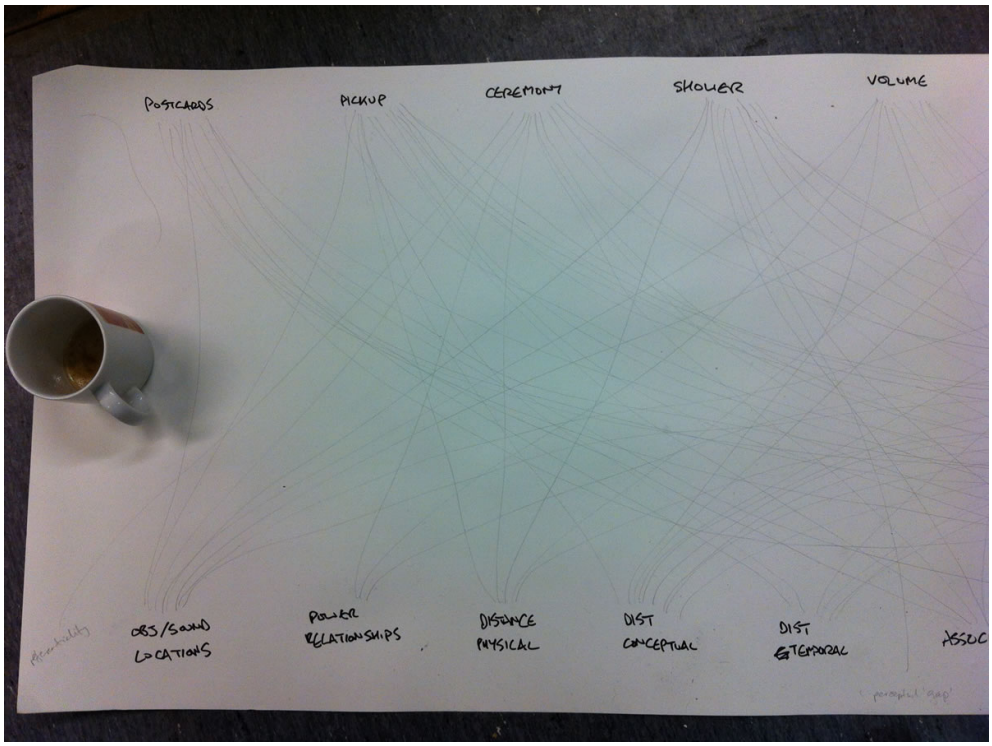
e.g. Janet Cardiffs 'Muriel Lake'.

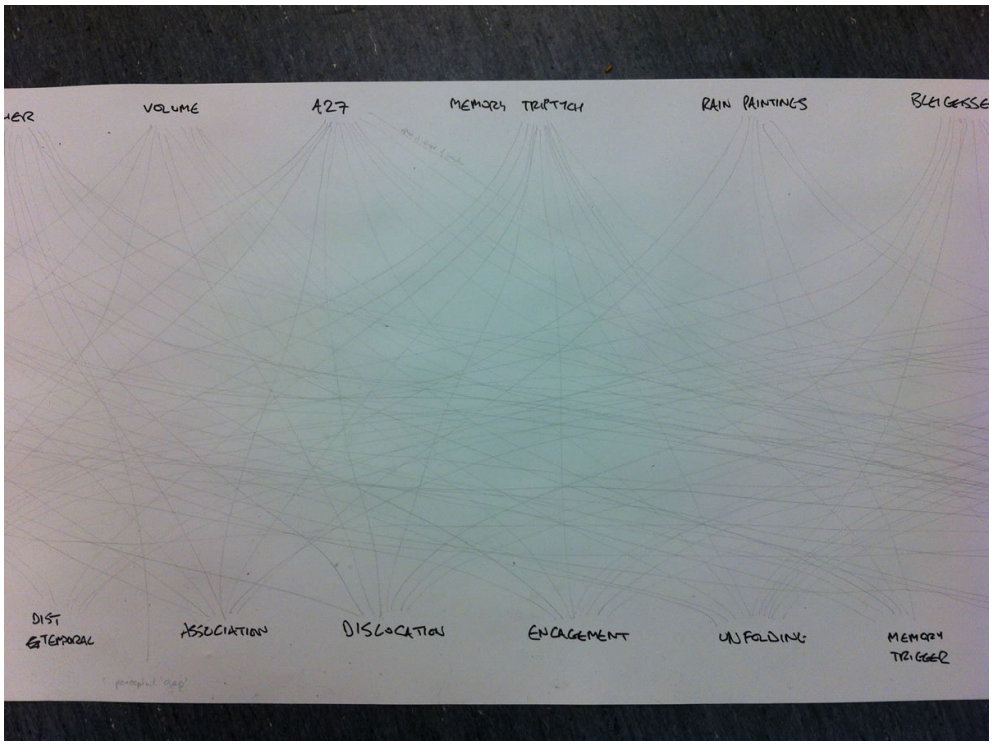
(the size discrepancy was not the point of that piece - it was much more narrative)

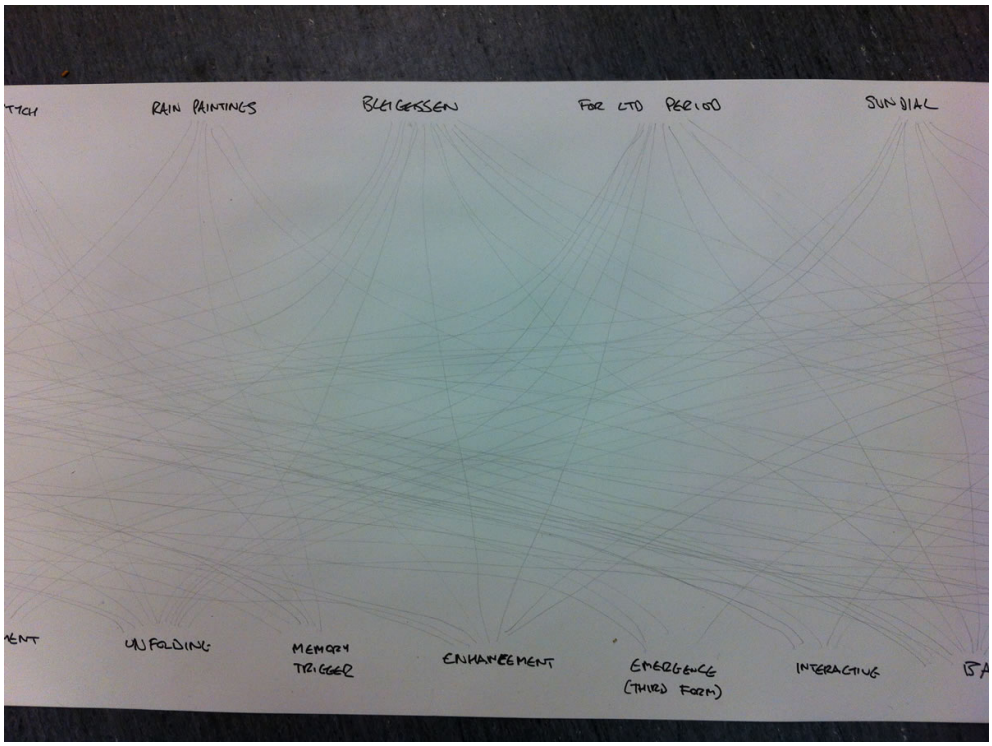
willow line

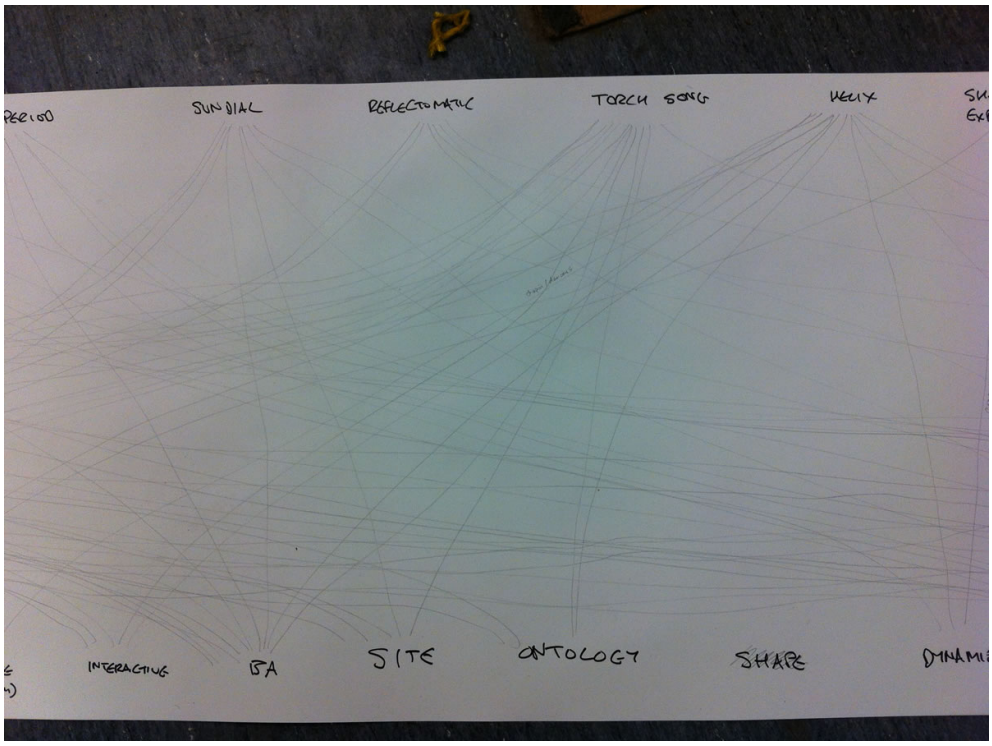
A promising work – do more with this
Sound 1 min either side of photo, with
moment photo taken audible as 'click'.
- applicable to any scene
- lovely tension between changing, temporal
  sound & static image.
- replaying an extended moment in time
- brings image to life – sound + image
  become greater than their sum – a halfway
  movie. C.f. Julius 'Dyke line'

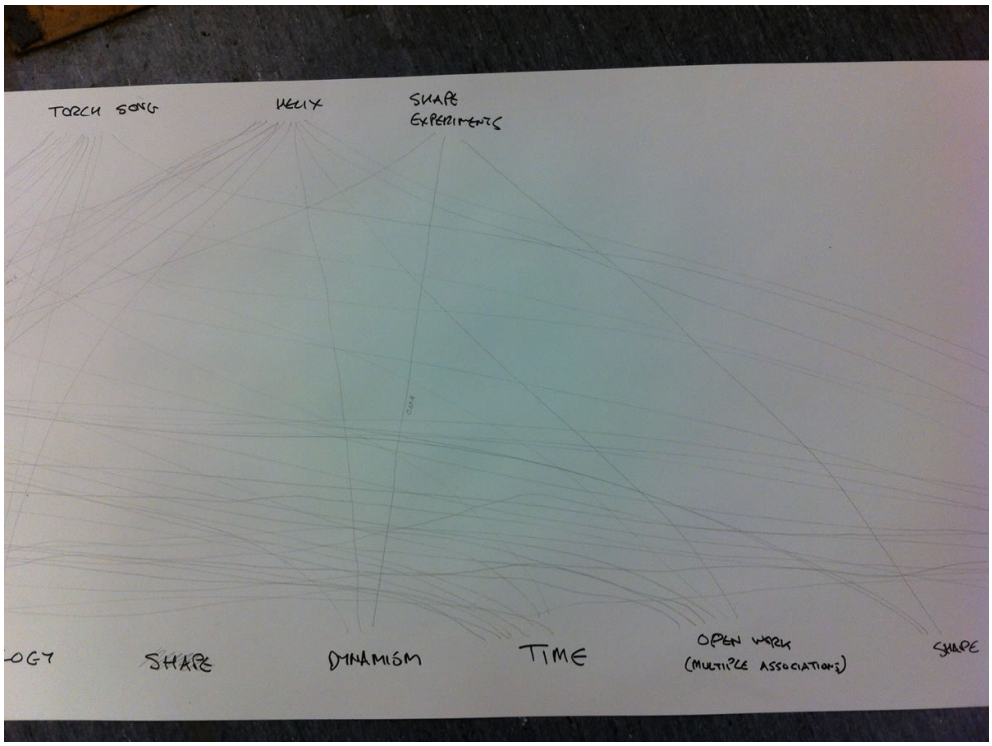


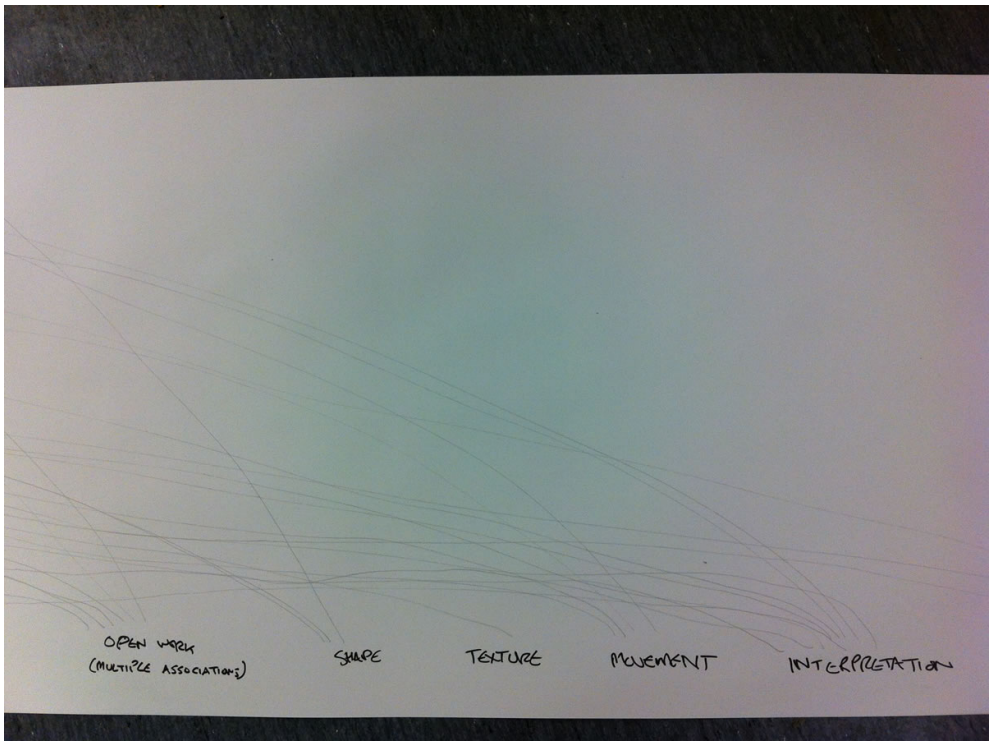

POSTCARDS
PICKUP
CEREMONY
SHOWER
VOLUME
OBJ/SOUND LOCATIONS
POWER RELATIONSHIPS
DISTANCE PHYSICAL
DIST CONCEPTUAL
DIST &TEMPORAL


VOLUME
427
MEMORY TRIPTYCH
RAIN PAINTINGS
DIST &TEMPORAL
ASSOCIATION
DISLOCATION
ENCAGEMENT
UNFOLDING
MEMORY TRIGGER


RAIN PAINTINGS
BLEIGIESSEN
FOR LTD PERIOD
SUN DIAL
UNFOLDING
MEMORY TRIGGER
ENHANCEMENT
EMERGENCE (THIRD FORM)
INTERACTING


SUN DIAL
REFLECTOMATIC
TORCH SONG
HELIX
INTERACTING
SITE
ONTOLOGY
SHARE


TORCH SONG
HELIX
SHAPE EXPERIMENTS
SHAPE
DYNAMISM
TIME
OPEN WORK (MULTIPLE ASSOCIATIONS)
SHAPE


OPEN WORK (MULTIPLE ASSOCIATIONS)
SHAPE
TEXTURE
MOVEMENT
INTERPRETATION


MOVEMENT
INTERPRETATION
REFLECTION

Appendix 4

Published Papers and Presentations

Pages 224 onward removed