

Masters Composition Portfolio

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Additional material: two audio compact discs

Disc one contains four musical works:

1. *Flotsam and Jetsam* (7'43")
2. *Animikii* (5'17")
3. *The Workshop* (6'36")
4. *Drops* (8'44")

Disc two contains various musical examples

Introduction:

This portfolio will consist of three related parts. The first will part will be an essay in which I will consider listening in relation to ‘acousmatic’¹ music looking at some of the ideas and concepts that have been influential in the development of my own approach to listening over the course of this masters. I will also attempt to justify this approach with reference to ecological acoustics and the importance of the role of source recognition to listener interpretation, and as a result composition. As will become evident from this study two dominant influences that have emerged in relation to my compositional listening practice over the course of this masters, are the, to some extent contradictory, positions occupied by the *soundscape* and *musique concrete* traditions. I will try and reconcile elements of these influences by arguing that Denis Smalley’s recent ‘space-form’ approach to listening and composition can act as a middle ground providing an approach that takes account of the referential and indicative aspects of sounds and the role played by ‘source-bonding’, whilst at the same considering relations at the intrinsic level of ‘spectromorphology’ (Smalley, 2007). Following on from this, the second part of this portfolio will consist of a more direct commentary on my own compositions, which I will relate to the discussion in the first half. I will therefore talk about specific elements of my compositions in light of my earlier considerations, directly applying some of the terms and concepts that were introduced in the first part to aspects of my own work. The final, and third part will be recordings of the compositions themselves.

¹ The term ‘acousmatic’ is derived from the name given to the disciples of Pythagoras known as the ‘Akousmatikoi’ who it is said listened to their master’s teachings from behind a vale, therefore not directly seeing the cause of the sounds (see also appendix). I will use the term both to denote a listening situation in which the sources of the sounds are not seen and to describe a genre of music which is specifically designed to be exhibited in these conditions.

Development of a Compositional Listening Strategy: An Introduction to my Approach and Influences

An important strength in my opinion, of approaches to analysis and composition, in relation to music that is specifically designed to be presented in acousmatic listening conditions, is the fact that, in contrast to many more traditional approaches to composition and analysis, it is a musical approach in which the act of listening is given a genuinely central role. The composition of acousmatic music is an inherently analytical process. The perspective one has in respect to listening therefore provides the base from which the compositional process starts and is central to shaping how the resulting composition itself evolves and progresses. For these reasons a consideration of the various approaches to listening that have played a role in the development of my compositional thinking, as well as introducing terms and concepts that will prove useful in the second half of this portfolio, will help to shed light on some of the underlying and guiding principles and processes behind the composition of my pieces.

An obvious place to begin when considering listening in relation to acousmatic music are the theories of Pierre Schaeffer (1966), the original development of the concept of the 'acousmatic' and the very beginnings of the *musique concrete* tradition. This represents both the beginnings of acousmatic music as a genre, and the theoretical base from which my own studies began. In the 1960s Schaeffer developed a theory of listening relating to the acousmatic reduction achieved by various new technologies such as radio, the phonograph, and magnetic tape. This theory involved a specialised form of listening that he dubbed 'reduced listening' (*l'écoute réduite*) in which sounds are attended to independent of cause or meaning (Chion, 1990: p29). Schaeffer's aim was therefore to shift attention away from the actual physical cause of the sound towards the phenomenon of sound itself. He thought that acousmatic listening conditions would encourage this form of listening because the listener cannot see the cause of the sound they are hearing and are therefore provoked into concentration on essential, inherent, qualities of the sounds that are not directly related to their causes.

The Schaefferian practice of reduced listening has proved a very useful tool for me as both a listener and composer, and it marks an important point in my development as Schaeffer's observations prompted me to attend to sounds in more depth than I had previously done and to notice and form relationships between elements of sounds that would otherwise have remained hidden. They also made me consider the whole phenomenon of sound, illustrated the primacy and malleability of the listening experience, and prompted me to ask myself not only how I listen, but also how *should* listen: what specific elements of sound *should* I be listening out for as a composer? In other words, Schaeffer's theories helped show me the intentional, and changeable, nature of listening and the importance of the development of listening *strategy* in relation to composition.

I have previously discussed the fact that, in spite of the benefits discussed above, the practice of reduced listening in an idealised form is very difficult for reasons relating to our predisposed evolutionary makeup (see appendix). A further problem I find with this practice concerns the relationship between listener and composer and between intention and reception. For me, as a composer in the studio, the task of reduced listening is obviously made easier with the ability to repeat sounds over and over until extrinsic causal connections melt away, but what of concert goers listening a piece for the first time? Just because a work might have been composed through a process of reduced listening and is exhibited in acousmatic listening conditions doesn't necessarily mean that this is how listeners will, or should, listen to the piece in question.

One problem for listeners is that although in some cases acousmatic listening conditions might indeed encourage reduced listening as Schaeffer thought they would, the opposite can also occur: in taking away the aid of sight, acousmatic conditions can actually intensify our search for the origins of the sound, this is what Michael Chion calls 'causal listening' (Chion, 1990: p25). As Chion points out: 'Confronted with a sound from a loudspeaker that is presenting itself without a visual calling card, the listener is led all the more intently to ask, 'what is that?'' (Chion, 1990: p32).

It is perhaps easy to forget that, despite *promoting* an approach to compositional listening that attempts to detach sound from source Schaeffer does accept that there are various other

types of perceptual experience open to listeners² and would therefore agree that the above listener response is at least possible, even if it is not desired. He allows that ordinary listeners can perceive sounds in other ways than the way he promotes as an approach to compositional listening, but the problem is that if this is how listeners can naturally and instinctually respond to sounds then this aspect of listener's perception and interpretation of sound cannot be ignored when composing acousmatic music. So not only is Schaeffer's approach one that is often difficult to implement *fully*, it also seems that, in many instances, it is not a desirable approach from a compositional perspective as the very causal links his approach tries to sever can prove highly important in respect to musical interpretation and as a result composition, as I will now demonstrate.

At the other end of the spectrum in relation to listening are the 'ecological' approaches of people such as Luke Windsor who has developed a theory of listening based on the perceptual theories of the psychologist James Gibson (Windsor, 1995 and 2000). In contrast to Schaeffer, Windsor emphasizes the importance of the role played by causal listening and therefore outlines an approach that takes into account the relationship between the sound and the environment that produces it. He states:

'within the field of ecological acoustics, sounds are not viewed as being perceived as abstract entities related only one to another... nor are they perceived as standing for concepts or things, as signs. Instead they are seen as providing unmediated contact between listeners and significant environmental occurrences' (Windsor, 2000: p10)

Windsor proposes that to understand listening in relation to acousmatic music we must place the genre in a wider perceptual context. So in order to understand 'musical' or 'culturally mediated' listening we must first get to grips with 'everyday' listening (Windsor, 1995: p11). From the perspective of ecological acoustics everyday perception is seen as being part of a dynamic relationship between an organism and its environment.

² In *Traite des Objets Musicaux* Schaeffer outlines four listening modes (les quatre ecoutes) and two of these modes involve the perception of extrinsic aspects of the sound. These two modes are what Schaeffer calls 'comprendre' and 'ecouter'. 'Ecouter' is a mode of listening in which sounds are attended to in order to gain information about their sources. 'Comprendre' on the other hand is a symbolic, meaning-gathering mode in which sounds are attended to as signs. (Schaeffer, 1966: p103-28 cited in Smalley, 1992)

Sounds provide a direct link between the perceiver and events in their environment, and our perceptual systems have evolved to pick up 'invariant acoustic structures' that specify such events. Windsor cites the work of people such as Vanderveer (1979) and Gaver (1993) to support this view that this kind of causal listening is in fact primary, and as a result is harder to ignore than Schaeffer might have hoped (Windsor, 2000: p14). He then applies this approach to acousmatic listening showing how an ecological approach can also help us understand culturally mediated listening of this kind. So from this perspective the perception and analysis of acousmatic works, as with everyday listening, can be understood in terms of the direct perception of acoustic invariances that specify events.

Windsor advances his theory from an analytical perspective and explicitly states that his theory is not meant to *prescribe* a specific compositional listening strategy in relation to acousmatic works in the way Schaeffer's theory does, but is meant instead to be a *descriptive* theory (Windsor, 1995: p12). It seems to me, however, that if his description of everyday and culturally mediated listening and interpretation is correct then this surely must be taken into account when composing such works. In acousmatic music the point of contact between composer and listener is direct aural engagement with the sounds themselves. As a result, if one of the objectives of a composer is some form of communication with the people who listen to his or her work, then how these people listen to and interpret sounds is going to be of central importance to how the composer approaches his or her material. Therefore, if correct, an ecologically inspired understanding of listening, as well as illustrating some weaknesses with Schaeffer's approach, can be taken to suggest, or at the very least justify, an approach to material that takes into account the importance of source recognition and the various roles of the referential aspects of sound.

Another approach to listening that emphasises the importance of this relationship between sound and source, the world of the work and the 'external' world, and the relationship between perceivers and their environment is that of the 'soundscape' artist. The elements Schaeffer would have us ignore are the very things the soundscape artist uses. As the composer Barry Truax points out: 'In the soundscape composition... it is precisely the environmental context that is preserved, enhanced and exploited by the composer' (Truax,

1984: p207). Another composer, and the original proponent of soundscape art was Murray Schafer. He defines the term 'soundscape' as:

'The sonic environment. Technically, any portion of the sonic environment regarded as a field for study. The term may refer to actual environments, or abstract constructions such as musical compositions and tape montages, particularly when considered as environments' (Schafer, 1977: p275)

The direction taken by soundscape composers therefore represents an approach to sound in respect to listening strategy and composition that treats the musical work as if it were a soundscape, utilizing the power of sound to transport the listener to other spaces and times. This power is primarily down to the perceived relationship between a sound and its source and the ability of the referential and indicative aspects of the various sounds used to subjectively conjure up associations and memories in the mind of the listener, therefore communicating meaning. This approach to listening and composition has been very influential to me as all my compositions contain direct real-world references of some kind. Thinking in this way has therefore supplied me with a useful organizing principle in respect to the construction of my works, even if some of them contain sounds whose sources are unrecognisable and therefore cannot strictly be described as 'soundscape' compositions.

The importance of the role played by source recognition ('real' or imagined), demonstrated by both the ecological and soundscape approaches, has become more and more evident to me as this year has gone by and I have had the chance to actually perform my music and to speak to people who do not necessarily have a background in the composition and study of acousmatic music. By suggesting up to this point that, in relation to listening, attention must be paid to the importance of referential aspects to listener interpretation, and therefore to composition, I am not suggesting that reduced listening has no role to play, but rather that a holistic listening strategy that takes into account the role of both referential and intrinsic aspects should be developed. My stance in relation to compositional listening strategy therefore attempts to both acknowledge the role of reduced listening whilst also accepting the importance of referential, or indicative, aspects of sound.

There are obvious problems with such a stance, as these two positions, at least in their strongest form, might at first glance seem incompatible: we might think that either sounds are used simply as sounds *or* they are used for the meaning that they produce. There is, however, a middle ground that can be reached whereby a multi-levelled approach is taken that operates at both levels and recognises the ‘transcontextuality’ (Smalley, 1992: p542) of sounds in acousmatic works. This is the approach I have tried to take in my compositions. In a 2007 paper entitled ‘Space-form and the acousmatic image’ Denis Smalley outlines an entire listening strategy that holds space as central to analysis and commentary on acousmatic music and provides an extensive catalogue of what he calls ‘space forms’. He defines ‘space-form’ as: ‘an aesthetically created environment which structures transmodal perceptual contingencies through source-bonding³ and spectromorphological relations’ (Smalley, 2007: p40). These ideas build on Smalley’s earlier ‘spectromorphological’ theory which is defined as: ‘an approach to sound materials and music structures which concentrates on the spectrum of available pitches and their shaping in time’ (Smalley, 1986: p61).

As he himself states, Smalley’s ‘space-form’ approach is broadly ecological and therefore has much in common with the approaches of Windsor and the soundscape composers. Despite these links to ecological theory, his approach still retains a strong attachment to the Schafferian tradition, particularly in relation to reduced listening as is evident from the definition of spectromorphology above. Spectromorphology is concerned with intrinsic features and qualities of sounds, where as ‘source-bonding’ concerns the relationship between the sound and an imagined source. Smalley’s ideas can therefore be seen as a midpoint between the Schafferian approach and the ecological and soundscape approaches as he is a proponent of the practice of reduced listening but has accepted more and more the role played by what he calls ‘source-bonding’ in respect to both listening and composition (as is evident in the above definition of his newer concept of ‘space-form’).

The ‘space-form’ approach therefore provides a link between the two stances that have been central to the development of my own compositional approach, incorporating concentration on intrinsic qualities of sound whilst at the same time acknowledging the role

³ Smalley defines source bonding as: ‘the natural tendency to relate sounds to supposed sources and causes, and to relate sounds to each other because they appear to have shared or associated origins’ (Smalley, 1997: p110). See also appendix.

played by source recognition in respect to listening and composition. This relationship between spectromorphological structure and referential meaning is explored throughout all my works in various different guises. Smalley's approach has therefore supplied me with criteria for selecting certain sound materials and a useful framework for understanding various structural relationships that incorporates both these aspects. This has also meant that the notions of space and imagery, in relation to sound and acousmatic music have progressively become a central concern in the construction of my pieces as will become evident in the next part of this portfolio.

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Commentary:

Flotsam and Jetsam

When I started composing this piece I had just acquired a computer, my own copy of *Pro Tools* and a copy of *Ableton Live*. For this reason, one important aim in composing this piece was simply to become more familiar, and experiment with this new software. The piece was therefore constructed in part by experimenting and improvising with effects on *Ableton Live* and recording these improvisations in real-time into *Pro Tools* using the *Rewire*⁴ function. I then started to organise these materials and to record further passages in so that they formed direct relationships with other structural elements of the piece as it developed.

This piece is purely comprised of environmental recordings and is a prime example of the fusion, mentioned in the first part of this portfolio, of elements of both the musique concrete and soundscape traditions in respect to my approach to the materials and the materials used. So sounds are combined and organised with respect to both indicative, referential characteristics and also at a spectromorphological level, with various ‘tilts’ towards either one of these deeply interconnected positions occurring throughout the piece. In spite of this, the *overall* ‘tilt’ in this piece, at least in respect to its actual construction, is more towards the spectromorphological aspects of the sounds.

The sounds used to construct the piece were predominantly taken from recordings made by the sea and along the coastline half an hour from my family home in South West Scotland. These were combined with sounds recorded in the music studios at Glasgow University and a variety of other sounds that I had collected from various other locations in the past. The majority of the sounds used have a distinctly granular quality and were initially selected for

⁴This is a software protocol that allows remote control and data transfer among audio editing software.

reasons relating to either their texture or the particular images they created. The recurrent image of water and the sea, achieved through various forms of source-bonding, provides the piece with an underlying theme throughout, tying together the various other materials and images used.

One particular image I had in my mind when I began composing the piece was that of a coastline that is slowly enveloped by rain and wind, which intensifies before gradually receding in a series of waves leaving various bits and pieces behind it. This resulted in the piece having a predominantly fixed spatial perspective with emphasis being placed more on progression through time rather than space. In spite of this lack of definite movement *between* spaces, the space in question does ‘move’ in the sense that it fluctuates between being ‘real’ and ‘unreal’⁵.

The piece starts with some heavily source-bonded snapping sounds and gentle undulations of a mixture of rain sounds that have had the lower frequencies removed using a band pass filter, and the sound of crackling dry leaves. The sound of bubbling water is then introduced, faintly at first before gradually getting denser and more intense. This sound has been processed in various ways giving it the unnatural impression of being thicker and more viscous than real water could be whilst remaining recognisably the sound of water. In this first part I wanted to explore textural qualities of these various natural sounds and the various patterns they create when combined with others.

As the passage progresses the perspective is gradually opened out. This subtle opening out effect is added to by introduction of the unprocessed sound of running water and the source-bonding influence of soft undulating wind-like morphologies. A more constant all-encompassing version of this wind-like sound slowly drops in pitch signifying a decrease in energy and intensity. At 3’14” (sound example 1) some distant wave sounds can be heard which act as a distance cue opening out the scene further into distal space. The overall virtual space slowly begins to become more close and enclosed again emphasising proximate space with the reintroduction of the viscous watery sound from earlier. There is

⁵In his book *On Sonic Art* Trevor Wishart suggests that, in an acoustic work ‘real’ or ‘unreal’ objects and spaces can be combined in a number of ways including ‘unreal-object/real space’, ‘real-object/unreal space’ and ‘real-object/real space’, creating differing ‘landscapes’, or virtual spaces, along a continuum between real and unreal, including the surreal (Wishart, 1996: p139-147).

then a sharp movement from distal to proximate space in the form of the sound of a wave crashing on rocks (sound example 2). ‘Distal’ and ‘proximate’ space are terms used by Denis Smalley to describe perspective in what he calls ‘prospective space’, which is the frontal image in ‘perspectival space’. This concerns position, movement and scale amongst spectromorphologies as ‘seen’ from the listener’s vantage point (Smalley, 2007: p49) (I introduce these terms now as they will be used throughout this commentary at various points).

There is also a more general movement over the course of the whole piece from the use of more strongly source-bonded material towards material with a more remote relationship its ‘real world’ causes, or a move from ‘mimetic’ to ‘aural’ discourse⁶. This move is initiated at 4’06” (sound example 3) when a metallic sound enters with a harmonic texture that becomes gradually more spread out as the sound moves around in space. This sound was produced using a piece of software known as *SoundHack* that I used a great deal in this piece, and to some degree in all my further pieces. It is a widely used free software package made by Tom Erbe. I have used it in my pieces predominantly for pitch and duration change as it includes a phase vocoder that allows for changes in pitch and time which often produce interesting results even if the processed sound often bares little perceptual relation to its original. In this case a single metallic attack was time stretched by a factor of thirty transforming the single attack into long spectrally rich sound.

This sound then begins to interact with a watery sound that undulates at different rates following the metallic sound around in virtual space. The watery sound is a version of the original viscous watery sound that has been processed using the ‘grain delay’ effect in *Ableton Live*. Grain delay dissects audio by frequency into various grains and then staggers the delay timings of these grains. It has a useful XY interface that allows you to manipulate two parameters from a selection of six simultaneously in real-time. I have used it in this case to give the watery sound a pulsing morphology that and rises in frequency in preparation for the climactic gestural impact that occurs at 4’30” (sound example 4).

⁶ Simon Emmerson places the forms of discourse open to composers on a continuum between these two polarities (Emmerson, 1986: p19).

After this point various other metallicly based morphologies enter creating pulsing and undulating sound shapes that interact and evolve moving discourse even further into the aural domain. At 6'05" (sound example 5) there is a smooth gesture that marks the beginning of a more gesturally carried passage in which the imagery becomes 'drier' with the links to the image of water becoming less direct. The scene finally opens out with the return of the sound of the sea and the piece ends on a dramatic wave movement from distal to proximate space (sound example 6) reminiscent of the similar movement at 3'51". This wave sound is juxtaposed with the earlier gestural sound from 6'05". The general morphological character of the wave sound is similar to this second sound and other earlier less heavily source-bonded gestural sounds, but it also has the obvious referential aspect of being the sound of a wave crashing on a shore line. It therefore acts as ending to the more abstract gestures at a spectromorphological level whilst at the same time re-connecting with the overall general theme of the piece at the level of narrative.

On reflection it has become obvious that one flaw in this piece is perhaps the sheer density of the sounds at various points in the piece. Although one of my aims was to try and create varying textures from various natural sounds at times the density detracts from the individual sounds and their evolution. Also, some of the effects used alter the left and right channels in different ways which breaks up the stereo image, decreasing spatial solidarity and this was something I wanted to try and avoid in subsequent pieces.

Animikii

A central concern in this piece was to take the notion of space, and movement in space, into conscious consideration during the process of composition, paying particular attention to the notion of 'perspectival space' and various aspects of 'spectral space'⁷. Despite the spatial aspects discussed in relation to the last piece, space was not a central concern during the actual process of composition as it was not until after it was finished that I began to consciously consider space and its role in relation to acousmatic music. A further theme running through the piece that also relates to space is the juxtaposition of 'realistic' sound

⁷'Spectral space' is defined by Smalley as: 'the impression of space or spaciousness produced by occupancy of, and motion within the audible range of frequencies' (Smalley, 2007: p56)

images with more abstract sound images to create unreal object/real space relationships. My aim was to utilize the ambiguity afforded by the acousmatic listening situation to create entities whose origins are unknown but who possess many of the spectromorphological characteristics connected with flight, and then to place these ‘unreal’ objects in a ‘real’ space.

The title is the Native American name for mythical beings that are said to be giant birds that can fire lightning from their eyes and whose beating wings are responsible for the sound of thunder. I was told about these beings by a Suquamish friend of my father who happened to be staying at my family home during a thunderstorm. At the time I already had various recordings of thunder and rain made during a particularly dramatic thunderstorm in Glasgow and had been trying to turn them into a piece. The idea of these beings, and the general image of flight, as with the watery imagery in the last piece, therefore acts as a general guiding premise that influenced various aspects of the construction of this piece. Structure is predominantly carried by gesture, with various other source-bonding and referential aspects also playing an important role in how the piece was constructed. A structural role is also played by the pattern of the storm itself with the overall form of the piece generally mirroring that of the storm with series of climaxes and lulls. This general idea of the build up and release of pressure and tension is also used at lower spectromorphological level throughout the piece, as I will later illustrate.

The piece begins with some small bassy gestures made by passing recordings of heavy machinery through various effects in order to reconfigure the spectral components of the sound to the point where they have almost no resemblance to their origins. One effect used was the ‘grain delay’ tool in *Ableton Live* mentioned earlier. These machine-based sounds were then animated using a plugin for *Pro Tools* called *Panorama 5* which is designed by *Wave Arts*. This plugin reproduces psychoacoustic sound localisation and distance cues allowing you add movement to sounds and to pan in three dimensions. It was used extensively throughout the piece to create various gestures and trajectories with connotative connections to the idea of flight.

At 0’12” (sound example 7) there is a sound which might encourage source-bonds such as the starting of an engine, or the increasing rotation of helicopter blades, but can more

generally be viewed as indicating a rapid increase in energy. It begins strongly situated in proximate space and moves from right to left expanding and then contracting as its pitch rises and its elevation takes on a metaphorical dimension as it ‘rises’ in spectral space. The sound also moves from proximate space to distal/elevated space and back again, performing a loop before moving into distal space again. As this happens a second more bassy undulating sound moves across the virtual acoustic space from left to right.

This general movement in perspectival space from proximate to distal/elevated space, and the accelerating contraction of the dimensions of the sound shape with a simultaneous rise in frequency, is a structural motif that is used at various times in the piece (1’05”, 1’06” sound examples 8 and 9 respectively). It is often followed by the source-bonded influence of the sound of thunder which elevates the image further and cements the move from proximate into distal/elevated space. Towards the end of the piece the faint source-bonded influence of a passing aeroplane is added, again re-enforcing movements from proximate to elevated space. This is combined with the more proximate, elevated influence of closely microphoned flapping bird’s wings (sound example 10). These wing-beat sounds, as well as suggesting this more intimate elevation, operate at a spectromorphological level through their interactions with the morphologically similar trajectory-based sounds whilst at the same time re-enforcing the overall theme of flight.

The notion of ‘gravitation’ is also relevant, particularly in relation to these predominantly trajectory-based spectromorphologies and I found Smalley’s related notions of ‘planes’ and ‘diagonal forces’ particularly useful when constructing this piece. As was originally pointed out by François Bayle (Bayle, 1993: p76 cited in Smalley, 2007: p45) whilst sounds move in spectral space they can exhibit gravitational tendencies. In gravitational terms a ‘plane’ represent a point of relative stability whereas ‘diagonal forces’ involve motion that is attracted towards or leaves this plane (Smalley, 2007: p46). This kind of behaviour is found throughout the piece. A clear example of occurs at 1’46” (sound example 11) where a steady bass drone provides a plane from which a diagonal force emerges and then returns to ‘ground’ at 1’53”, helping to emphasise the build up and release of tension as the rain sounds enter. The general spectromorphological character of these heavily trajectory-based sound shapes also helps to accentuate the sense that the air is

thick, or denser than usual, conveying the muggy, close feeling felt as pressure builds before a lightning strike.

The central climax of the piece occurs at 2'35 when there is a particularly loud thunder sound and the movement of the various predominantly trajectory-based spectromorphologies becomes more intense. Leading up to this passage the sound of two barking dogs is heard (sound example 12). These sounds were not recorded during the storm but were placed in the virtual environment predominantly for semantic reasons due to their source-bonded nature. They seem to be barking at some unseen foe and this helps to add to the sense of tension and general unease. To add to this, the final bark of one of the dogs has been deliberately raised in pitch, again in an attempt to convey a sense of rising fear and foreboding (a good example of the power of signal processing to manipulate not only spectromorphological aspects but also referential meaning by changing the character of source-bonds).

As well as exploring the notion of space and movement I also wanted this piece to play on, and explore, the uneasy 'schizophonic' (Schafer 1977 p88) situation that acousmatic listening creates by using sounds that all our instincts would seem to indicate pose some form of threat, or at least that instinctively demand some form of active physical response on the part of the listener (such as running for cover for example). Sounds are perceived contextually and therefore a listener listening to this piece in a concert hall will know that the sounds pose no real threat. But sometimes our natural instincts, taken from our experience of everyday listening can transcend this context to some extent and spill over into the culturally mediated concert experience. One example of this being when people in a cinema jump, or scream, at a frightening bit in the action despite knowing deep down that it poses no real threat to them.

The Workshop

This piece is very different from the last in respect to both structure and materials used. It was composed entirely using sounds that I recorded in my father's clog and shoe workshop over a period of four days in March this year. This includes the sounds of various machines

and tools that are used for making the clogs and shoes and an old broken radio that I found sitting at the back of the workshop in amongst some old machines. I discovered that this radio had some loose connections and as a result would cut out and in again in a variety of ways whenever you tried to tune it into a station. I liked the various clicks and crackles it made as you tried to tune it in and the grainy, fuzzy quality the old speakers added to any station you succeeded in finding. As a result I decided to give the radio sounds various structural roles in the piece whilst also taking the general image of broken equipment as a loose guiding premise in respect to the overall aesthetic of the piece.

In this piece I wanted to explore the notion of space but in a different way to how I had in the previous piece. I approached space in this piece from more directly mimetic perspective consistently using more heavily source-bonded sounds and taking into consideration various notions derived from cinema such as ‘offscreen sound’, ‘offscreen space’ and ‘territory sound’. These terms are used by the composer Michel Chion in relation to sound for film in his 1994 book *Audio-Vision: Sound on Screen*. ‘Territory sounds’ are analogous to ‘keynote sounds’ (Schaffer, 1977) in soundscape terminology, and therefore refer to the various background sounds that signify a particular space. For Chion, ‘offscreen space’ is the space referred to by sounds whose source is not present in the visual frame, and is therefore entirely a product of the combination the aural and visual (Chion 1990: p83. see also appendix). I would suggest however that this general idea can be usefully applied to acousmatic music (see also appendix). I will refer instead to ‘offscene space’, however, to try and avoid confusion.

One particular inspiration when composing this piece was the sound designer Walter Murch and his sound designs for films such as THX 1138, indeed, in many respects I composed this piece as you might compose a sound design for film: moving from scene to scene, moment to moment. Unlike with sound design for film, however, I have taken a much more active approach to the materials with various the territory sounds such as hums, buzzes general rooms ambience being used to create layers that are fragmented and fractured in various ways, making spaces, perspectives and times overlap and blur. For this reason structure of the piece could plausibly be described as a ‘mosaic of moments’ exhibiting what Stockhausen has called ‘moment form’ (Harvey, 1975: p81).

The clicks and crackles of the radio are used to break up the various passages of action almost as if the stations are being changed. Often, movements in between spaces and perspectives are too rapid to represent actual plausible movement. In addition, various spaces/times are occasionally presented simultaneously, however, sometimes this is not perceptible and therefore only really relevant from the composer's perspective. As is evident from this, space and perspective in this piece become malleable entities that are manipulated for artistic effect. In some cases various radio sounds create what we could call 'nested' acousmatic sound (obviously all the sound is 'acousmatic' in this situation however, in spite of this I think this idea is still relevant), for example at 3'35", 4'34" and 4'57" (sound examples 13, 14 and 15 respectively). These sounds provide a metaphorical link to 'offscene space', or to a space that is audibly outside what we could call the 'action', extending the space created outwards into the world beyond the workshop space itself. The notion of 'territory sound' plays a role in our understanding of this in the sense that the various hums, buzzes and general room ambience that envelope the scene, signify a particular space and time. We can therefore hear at certain points that the radio itself is situated 'in' the scene in a believable manner, whilst at other points the radio sounds become detached, moving around in the space in an unrealistic way whilst the space itself often remains 'real', in Trevor Wishart's terms mentioned earlier.

Despite the frequent use of what we could describe as 'lo-fi' (Schafer, 1977) sounds, which stand contrary to the whole ethos of the 'soundscape' movement, I did compose the piece as if it were a 'soundscape' of sorts, concentrating on referential aspects of the sounds. The inherent musicality and spectromorphological qualities of the sounds were not ignored however, and there are various passages in which this comes to the forefront. At 4'04" (sound example 16) white noise sounds, the sound of a fire and the sound of leather being cut are combined primarily for the textures they create and at 5'10 (sound example 17) the various radio sounds interact in a way that makes them shed their real world associations to some extent, and become objects of aural, as opposed to mimetic discourse. This piece, therefore, despite its obvious difference to earlier pieces, again combines the conscious structural use of both referential and intrinsic elements of the sounds.

Drops

This piece begins by the sea. The keynote sounds of distant waves, sea gulls and other small birds can be heard in the background whilst the sound of small rocks being rolled down a hard surface provides the dominant sound signal. This recording was made on the small island of Eigg on the west coast of Scotland and the surface that the rocks are rolling down is a huge slope of strangely formed sandstone on Laig bay on the western side of the island which has a nicely undulating surface that caused the rocks bounce in various rhythms as they tumble down it. They roll from distal into proximate space, moving further into proximate space on each roll. Both object and space in this passage are “real”.

The sound image of a rock rolling down a hill initiates the theme of the piece. As the title suggests this piece is loosely concerned with ‘drops’ of various forms. This refers both to the frequent use of the sound image of a water droplet but also to theme of movement from high to low regions of spectral space. The title therefore refers to various source-bonded images but also to various spectromorphological characteristics and more connotative images exhibited in the piece. I have also tried to explore the power of various types of signal processing to transform sound images altering both the morphological character of the sounds and the meanings that they contain.

At 0’25” (sound example 18) the rock plunges into a watery reverberant space, its movement acting as a bridge between open and enclosed spaces. The majority of the sounds used in this passage were also recorded on the isle of Eigg in a small cave at high tide when the waves were washing in and out. Other watery sounds were added and made to sound consistent with other sounds using *convolution reverb*. This process allows you to impose the characteristics of a pre-analysed sound environment onto another sound. This is done by measuring the impulse response of a given environment and then imposing the response times of that environment onto another sound. I chose an impulse response from a space that was similar in size to the cave I had recorded the other water sounds in, and then applied it to various other water sounds and added them to create a more dynamic space.

This first section of the piece has a moving spatial perspective with a very definite narrative structure: moving from an open space, to an enclosed space, to an ‘underwater’ enclosed

space. It is not until 1'07" (sound example 19) that the narrative and syntax become more abstracted with the introduction of a strange background texture made from time stretched ocean sounds that have been passed through a spectral filter. These sounds retain mildly perceivable morphological links to water and the sea and yet the relationship to these origins has become less direct. At this point discourse starts to move from being strongly mimetic to being more aurally based.

At 1'23" (sound example 20) there are some sounds made from individual water droplet sounds that have been lowered in pitch, time stretched, had reverb added to them and have had their high frequencies removed, placing them in distal space. These sounds trigger a movement of elements of the water-based background texture into the foreground of the sound image. They then move from right to left, whilst simultaneously, and repetitively, moving from distal to proximate space, before rising and dropping in spectral space, and finally fading away. Another significant event that occurs at various times in the piece is the iterative gesture that first appears at 1'47" (sound example 21) signalling the start of a passage containing various other iterative water based gestures. This sound was constructed using the sound of a single drop of water that is repeated and made to drop in pitch whilst the repetitions simultaneously decrease in speed signifying a decrease in energy. This sound typifies the theme of the whole piece by simultaneously being a recognisable sound of a 'drop' of water whilst also 'dropping' in spectral space.

The single low water drop sound that occurred at 1'23" is repeated at 2'07", again acting as a trigger for a movement from distal to proximate space (sound example 22). This time however, the sound that makes this movement in perspectival space is an altered version of the low 'drop' sound itself that was first heard at 1'12", then again at 1'34" and 1'50". It rapidly approaches, whilst at the same time spreading out horizontally, creating a triangular shape from a centred point in distal, prospective space. In earlier instances this movement was not complete but this time the sound realizes goals. The iterative, gestural sound from 1'47" then returns with more force and sweeps down the middle of this triangular outline, whilst another watery sound washes from right to left in proximate space.

Various iterative water based morphologies continue until 4'05" when the scene moves from a contained space to an outdoor type space (sound example 23). This movement from

inside to outside happens throughout the piece, happening again at 5'23" (sound example 24), although at this point the move isn't entirely complete. At this point tension is created between this idea of 'contained' and 'outdoor' space with the appearance of a strongly source bonded seagull sound image and heavily processed water sounds. The sea gulls, a typically 'outdoor' sound, have reverb on them thus placing them in a contained space and creating a contradictory image. The scene becomes even more abstract when the sea gull image enters but in an altered form with spectromorphological characteristics that mirror the earlier iterative drop sounds (sound example 25). At one point the sea gull based sound image seems to drop from the sky. Signal processing is therefore again used to directly alter the indicative nature of the materials. There is then a gradual move into an outdoor seascape again which becomes abstracted before finally returning at 7'50" (sound example 26) to a similar space to the one we started the piece in with the keynote sounds of the sea in the distance and the faint sound of seagulls, however, this time the sound of a fire can be heard in proximate space.

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Conclusion:

I was only introduced to the *musique concrete* and *soundscape* traditions of composition and musical thought three years ago when I studied a module in music technology during my undergraduate degree at Glasgow University. Prior to this I had used computer programs such as *Cubase* in a very limited manner but had never tried to compose on a computer in any serious way. This therefore marked the beginning of a steep learning curve for me in respect to compositional method. It also marked a distinct change how I viewed sound and its apprehension and interpretation: my previous perspective, which predominantly reflected the ideologies of absolute music, came under question and I found many of these ideas could no longer be sustained in light of my new discoveries. The central problems I encountered related to the idea of musical autonomy and of music as a primarily abstract art form, which it became clear I could no longer sustain in light of these new ideas. As I have shown through both my essay and subsequent commentary all my music contains sounds that have *unavoidably* referential meanings, and these aspects simply cannot be ignored. They have an important role to play in musical understanding and interpretation and the job of the composer is to align these meanings in interesting ways with the more intrinsic elements of the work as I hope I have done.

Performances: past and future

I performed an undergraduate piece of mine called *Wet Sunday* at the Sound Thought festival in November last year at Glasgow University. This is a festival organised by postgraduate students at the university to showcase work going on in the department. The piece was diffused over an eight-channel system set up in the university concert hall. I also performed this piece at the *International Computer Music Conference (ICMC) 2008* held at Queen's University Belfast, at the end of August this year. One of the works included in this portfolio will also be performed in the University of Glasgow's *Musica Electronica* concert in October and another will be performed at this year's Sound Thought in November.

Notes and directions for future performances

All of the pieces contained in this portfolio were originally composed on a 2-channel system and were primarily designed for diffusion in a concert situation. All also *ideally* require a minimum of eight speakers to achieve their full potential.

Flotsam and Jetsam

When diffusing this work the sound should be made to slowly and repeatedly immerse the listeners and then recede in a series of waves mirroring aspects of the theme of the piece itself. It should start predominantly in the front pair of speakers and gradually spread backwards across the other pairs of speakers until 2'00", by which time the listeners should be entirely immersed in sound. At this point some gentle movement should be added by the performer to emphasize the movement of the high pitched wind-like morphologies that occur most notably at 2'01", 2'04", 2'12" and 2'15". The sound should then gradually

return to being predominantly at the front by 3'00". Some movement from front to back should happen between 3'00" and 3'49" but the sound should stay predominantly towards the front of the performance space.

At 3'49" there should be a sharp movement from front to back, mirroring the movement of the wave sound that moves from distal to proximate space. Again movement should be added by the performer to emphasize the movement of the various elements, such as the movement of the metallic sound that enters at 4'06". At 4'19" the sharp move from front to back that occurred at 3'49" should be repeated. From this point until 7'17" the levels and movement of the sounds in the performance space is left to the performer's discretion. At this point the sharp movement from front to back should be repeated for a final time again emphasising the movement of the wave sound from distal to proximate space.

Animikii

When performing this piece, as with the last, the movement of the various gestural elements in the work should be emphasized, as far as is possible, by the performer through movements of the faders. Particularly important points are the movements from proximate space to distal/elevated space of the trajectory-based sounds (for example at 1'06" and 3'40"). At these points the sound should be made to move from the back to the front of the performance space. Other important points are the various climaxes throughout the piece (for example 1'53" and 2'35"), which should be emphasized by a gradual increases in gain. During periods where all the elements are reasonably static and the scene is predominantly 'real' (for example between 1'53 and 2'35"), the sound should completely surround the listeners and should therefore be coming from all the speakers at equal levels with very little movement of the faders. As the piece ends the sound should slowly move towards the front of the performance space and be allowed to fade away gradually.

The Workshop

With this piece the performer should take a much less active role than in the last two pieces. As the piece is more to do with the with the space created by the various forms of source bonding than with space created by movement and as a result the sounds should

predominantly be left to do the work themselves. Changes in levels of the various channels should be quick and should happen at times when the scene or perspective changes for example at 2'55" and 3'27". Of all the works included in this portfolio this piece is perhaps the best suited to act as part of an installation, as due to its structure and the sounds used in its construction it could be successfully played without any active diffusion at all.

Drops

As with *Flotsam and Jetsam* this piece should start with the sound predominantly towards the front of the performance space. At 0'25", as the rock plunges into a reverberant space, the other faders should be brought up and the sound should completely surround the listeners. The faders should then be used to emphasize and exaggerate the motion of the watery wave like sounds as they wash back and forward and side to side. The sound should then gradually move towards the front of the listening space again before rapidly moving from front to back at 1'47" in order to emphasize the iterative gestural sound that occurs, moving from distal to proximate space. This process should be repeated when the same sound occurs again at 2'13" and 3'24". Other important moments in the piece are the movements from and enclosed to and open 'outdoor' spaces (for example 4'03", 5'23" and 7'50"). At these points the sound should again be made to surround the listeners and remain static with all the channels at equal levels, in order to re-create the original environment as truly as is possible. During the 20 seconds prior to the final static period between 7'50" and 8'32", the piece should be at its highest level. At 7'14" the sound should move quickly to the back of the performance space and then rush forwards at 7'18" and this process should be repeated between 7'25" and 7'36". The piece should end with the sound in the front pair of speakers where it originated.

In all four pieces the performer should try and align composed space with listening space (ref). So where possible movements and gestures that occur in the piece should generally be emphasized and enhanced by movements of the faders. As a result the performer should first carefully listen to whichever piece they are performing on a 2-channel system and then try and re-create the gestures and movements they hear in the space they are performing the work.

Appendix:**The spatiality of sound in cinema and acousmatic music: a comparison.**

('Issues of space and media' seminar presentation - revised version of text given in seminar presentation)

As the title suggests in this paper I will compare and examine the spatiality of sound in the fields of cinema and acousmatic music. A central point for discussion when comparing these two different contexts will be the obvious fact that with cinema we have a visual frame containing images, so there is what we might call a ‘direct’ visual aspect in film that is missing in acousmatic music. When we see and listen to a film we experience the combination of the visual and aural. In contrast when we go to a concert of acousmatic music this direct visual element of the experience is not present. Given this I am going to centre this comparison on the presence, or absence, of this direct visual element and the implications of this in respect to the perceived spatiality of the sounds involved. I will attempt to focus this comparison by concentrating predominantly on the relationship between sounds and imagined source-causes, or what we might call ‘intrinsic-to-extrinsic’ (Smalley 1997: p110) linking in our perception of sound. I will consider how this is altered by the inclusion of a direct visual component and in turn how this relates to, and changes our perception of space. I will also show how these differences are reflected in the function of the spatiality of sound in each context. My aim in this paper will not be to reconcile these two fields in relation to the spatiality of sound, but rather to try and clarify the differences between them.

As the composer Francis Dhomont points out the term ‘acousmatic’ is used to refer to ‘a theoretical and practical compositional approach, to particular listening and realization conditions, and to sound projection strategies’ (Dhomont, 1995: p2). The term relates back to students of Pythagoras known as the ‘Akusmatikoi’ who it is said listened to their master’s teachings from behind a veil without having any direct visual contact with him as he spoke. The hope presumably was that this situation would lead the students to focus all their attention on what he was saying. If we apply this idea to the context of a concert of acousmatic music, we hear the sounds from behind what we might call the ‘veil’ of a loudspeaker system. So acousmatic listening occurs in a situation in which you hear a sound without seeing its source and acousmatic music is therefore music that has been composed to be exhibited such a situation. As the writer Simon Emmerson puts it: in the acousmatic situation ‘sound and action are separated in space and time and the causal chain is broken’ (Emmerson, 1999: p136).

This acousmatic listening situation is linked to the practice of what the composer Pierre Schaeffer called ‘reduced listening’ (Schaeffer 1966). Schaeffer emphasised how acousmatic listening could encourage us to appreciate the musical potential of sounds without thinking about causes. The aim was to attend to sounds as ‘objects’ distinct from their origins. However, ‘reduced listening’ in the puritan sense I have just described it, proves to be very difficult even in an acousmatic situation. In my own experience when a sound is heard in an acousmatic situation I can’t help but try and make sense of it by attempting to associate it with a possible imagined source-cause. As the composer Trevor Wishart points out (Wishart 1986: p39), research into behaviour and aural physiology would seem to suggest that this response is actually wired into our perceptual makeup and we are in fact mentally predisposed to try and assign sounds to their sources in this way. This ‘search for origins’ is incorporated by the concept of what Simon Emmerson calls the ‘Darwinian Ear’. Emmerson, like Wishart, sees this response to sound as an instinctual listening behaviour conditioned by our past and evolution.

Reduced listening is the third of what the composer writer and filmmaker Michel Chion calls ‘the three listening modes’ (Chion, 1990: p25). The second of Chion’s modes is what he calls ‘semantic listening’ and the first and most common, he calls ‘causal listening’. This mode relates directly to the just mentioned notion of the ‘Darwinian Ear’ which would suggest that ‘causal listening’ is a predisposed instinctual trait of our perceptual makeup. When listeners engage in causal listening they are attending to the sound in order to gain awareness about the source or cause of the sound event. Causal listening is very important in relation to the comparison I am attempting here as it relates to our perception of the relationship between a sound and a possible source-cause and, as I will demonstrate it is our perception of this relationship that is dramatically effected by the presence or absence of a direct visual element.

So how does all this relate to space? The notion of causal listening relates to an important concept that Denis Smalley uses to help us understand and describe the virtual spatial environment produced when we listen to acousmatic music. It was most recently outlined in a 2007 paper called ‘*space-form and the acousmatic image*’ and is the concept of what Smalley calls ‘source-bonding’. As I have shown with my discussion of causal listening

and my outline of some of the problems involved with the concept of reduced listening, it is a natural human response on hearing a sound that we attempt to attribute the sound to some source or cause. Source-bonding involves just this response. The concept of source-bonding is highly significant as it represents the intrinsic-to-extrinsic link from inside the work to the world outside. Smalley defines it as: ‘the natural tendency to relate sounds to supposed sources and causes, and to relate sounds to each other because they appear to have shared or associated origins’ (Smalley, 1997: p110). The relevance of source bonding to space is that ‘sounds in general, and source-bonded sounds in particular.... carry their space with them’ they are what Smalley calls ‘space bearers’ (Smalley 2007: p38).

If we listen to Luc Ferrari’s *Presque Rien No. 1* at around 1.40, for example, we pick up various cues such as cues about distance and proximity. However, Smalley would argue, and am inclined to agree, it is not these cues that are the primary space bearers. One sound that stands out for me is the sound of a chicken. Chickens are ‘source-causes’ that produce source-bonded spaces. When I hear a sound that I identify as that of a chicken, due to the fact that I know from experience how chickens behave and what form of space they produce through their action, a spatial zone and a mental image are produced in imaginary space that relate to my ideas and real world experience of chickens. This is tied up with the fact that perception, including perception of space, is something that is ‘transmodal’. So just because we are receiving this experience through a single sensory input doesn’t mean that the other senses are not involved. Visual space and aural space are not easily separated: even when they are literally separated as in the acousmatic situation the blocked sense still enters into the experience bringing with it spatial elements. Source-bonding in acousmatic music is a prime instance of this transmodal nature of perception in that as I have shown it is a quasi-visual experience. The sonic materials evoke what we imagine to be the world outside the music and therefore create and alter imaginary spaces.

In this instance I deliberately chose as my example a piece of acousmatic music in which the links between sound and imagined source-cause is reasonably easy to make. However, as Smalley points out this idea of source-bonded space is never entirely absent in relation to acousmatic music, or indeed perhaps any perception of sound. Even if we have a great deal of source-cause ambiguity and as a result no instantly obvious clearly defined link can be made between a sound and an imagined source-cause, we still instinctively try and

construct links. We imagine and invent possible source-bonds. So source-bonding, and as a result the creation of spatial zones in imaginary space still occurs even in very abstract acousmatic music.

In the context of cinema the structure of our perception of this relationship between sound and source-cause is very different, and if source-bonding is important in relation to the spatiality of sound, then alteration of how we perceive this relationship going to be highly significant to this comparison. The experience of space in cinema is more like that of our real-world experience of space in the sense that the auditory and visual senses are directly combined. In cinema we are presented with artificial ‘sources’ and this means that the spatiality of the sounds is always going to relate back to, or be effected by the images in the visual frame. The transmodal nature of our perception mentioned earlier, doesn’t come into play to such a large extent, as we obviously have no need to try and visualise the sounds if they are already visualised for us. So source-bonding, defined earlier as our ‘natural tendency to relate sounds to possible causes’ is going to be dramatically effected by the introduction of images. The production of spatial zones of source-bonded space in our minds is therefore altered due to the fact that the intrinsic-to-extrinsic link is, in a sense, already presented to us. We are presented with ‘ready-made’ visual images and what we might call a kind of ‘influenced source-bonding’ occurs.

Although this is happening all the time in film a phenomenon that demonstrates the power of this influence is what Chion calls ‘syncretism’. Chion defines this as: the ‘spontaneous and irresistible weld produced between a particular auditory phenomenon and visual phenomenon when they occur at the same time’ (Chion, 1990: p63). A good example of this perceptual effect is of an onscreen punch accompanied by something like a ‘thump’ type sound. In the real world a punch makes very little noise and yet if we hear and see a punch and ‘thump’ sound at the same time we can’t avoid connecting one with the other (almost any film involving ninjas contains perfect examples of this). Our instinctual search for a source is stopped by the direct presence of an image. If we had heard the ‘thump’ sound without seeing the onscreen punch an entirely different type of source-bonding might have occurred. As Chion points out, the direct presence of an image can even alter where in actual space we perceive source-causes as being physically located. In cinema where the sound is physically coming from is rarely the same as the place on the screen that the

images would have us believe and yet we hear the sound as coming from these onscreen 'sources'. This is what Chion calls 'spatial magnetization of sound by image' (Chion, 1990: p70).

Another of Chion's notions that relates to causal listening, 'source-bonding' and our perception of the relationship between sound and source-cause is the idea of 'offscreen' space. As I pointed out earlier the term 'acousmatic' is used to describe both a type of music and a set of listening conditions. Given this it becomes evident that in modern daily life we regularly come across what could be described as acousmatic sound, when we listen to someone speak on the telephone or listen to the radio for example. It is also evident that there is acousmatic sound incorporated into film. Chion draws our attention to this contrasting 'acousmatic sound' to what he calls 'visualised sound', or sound accompanied by the sight of its source, pointing out that it is this distinction that provides the basis for the notion of 'offscreen space' in film (Chion, 1990: p72).

The idea of a sound being in 'offscreen space' arguably relies on the relation between sound and image. Put simply, we might assume there has to be a screen for the sound to be 'offscreen', or as Chion puts it: 'sound's offscreenness is entirely a product of the combination of the visual and aural' (Chion, 1990: p83). This point is debatable as the concept of 'offscreen' space could perhaps be usefully applied to radio drama and plausibly even to acousmatic music in various instances, however, I will save discussion of this idea for another time.

Chion suggests that sound can be used to extend or contract offscreen space. The example he uses to illustrate this is the starting sequence of the Bergman film *Persona* (1966). We see some still images a hospital wall, a park and a pile of dirty snow and over these images we hear the sound of church bell and no human sounds; these created the impression of a small slumbering village. If in contrast we had heard footsteps in the snow, then a sound that creates a larger space such as police car sirens and then the church bells the offscreen space would have been extended from small to large. As Chion points out 'ambient extension has no absolute limit except those of the universe' (Chion, 1990: p87).

So far I have been concentrating on the intrinsic-to-extrinsic relationship of ‘source-bonding’, how this is effected by the inclusion of an image and in turn how this effects various aspects of spatial perception of sounds. As a result I have not really discussed specific intrinsic qualities of sound in relation to space. This is in part down to the scepticism mentioned earlier about the concept of reduced listening or the idea of concentrating on entirely on intrinsic properties of the sound. However, I was not trying to claim that this practice was entirely impossible and it is a concept that marks a big difference in how we perceive sound in cinema and acousmatic music.

One important notion that involves concentration on intrinsic characteristics of sound in respect to space is what Smalley calls ‘spectral space’ (Smalley, 2007: p47). Every sound that exists has spectral content and therefore has a place in ‘spectral space’. Spectral space is a sense of vertical space or spaciousness whose limits are defined by the sounds themselves. It covers the distance between the lowest and highest audible sounds. Smalley defines it as: ‘the impression of space and spaciousness produced by occupancy of, and motion within, the range of audible frequencies’ (Smalley, 2007: p56). However, we don’t always notice how individual spectral features of a sound effect our sense of space. This is particularly the case in film for reasons mentioned earlier. As I have shown, in film the intrinsic-to-extrinsic link is made for us in film. The result of this is that the mind doesn’t spontaneously separate out information about spectral boundaries, gravitation, diagonal or the spectral makeup and as a result the phenomenon of spectral space will be to a large extent ignored. So sight re-enforces the perception of certain elements of the sounds and obscures others (Chion, 1990: p32).

In this comparison I have been comparing sound presented in two very different ways. However, I have shown that the differences between the two contexts of sound presentation in respect to our perception of the spatial characteristics of the sound material involved, can be clarified to some extent by considering how they differ with reference to our perception of the relationship between a sound and possible imagined source-causes. I concentrated predominantly on how the way the two contexts are structured influences intrinsic-to-extrinsic linking, but also briefly considered the difference in respect to our perception of *intrinsic* properties of sounds in relation to space showing how in the context of film

perceptual emphasis is drawn away from these intrinsic aspects which in turn effects how we perceive certain spatial characteristics.

The acousmatic composer and the sound designer for film have very different objectives in respect to their use of the spatial characteristics of sound. In cinema, as I have shown, spatial characteristics of sounds are always perceived in relation to the images in the frame and it is this relationship between sound and sight is what is played with and manipulated by the sound designer. This is achieved in part due to, as I have illustrated, the malleability of our capacity for 'causal listening'. As Chion points out, causal listening is not only the most common of the three listening modes it also the most deceptive. In film sound is used to enrich and manipulate how we perceive the image. This enrichment of image by sound is what Chion calls 'added value' (Chion 1990: p8) and this includes spatial enrichment of the image by sound. Spatial aspects of sounds are used to subtly enforce or alter spatial aspects of the image in various ways including the ways discussed above. Acousmatic music on the other hand is a genre that is specifically designed to be free from the constraints of direct visual cues in order that the transmodal elements of perception are accentuated and the listener's imagination set free.

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