design, education, interdisciplinary, labyrinth, landscape, matter, practice, room, soundscape, space, studies

The Aural Eye: Soundscape Practice and Pedagogy in Design Education[1]

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Abstract: *Human aural experience can be equally considered along spatial and temporal continuums. We hear at all times of the day and night, and within all places and spaces: built, natural, public, private and virtual. The territory – both physical and philosophical – between music composition for interior listening and traditional sound based research within environmental acoustics is gradually being occupied by the listener-centred approach of soundscape studies. Soundscape design is emerging as an interdisciplinary field within design education, and one that not only challenges the ocular-centric nature of most design education, but one that could provide a useful mode through which to investigate the coincidences between different design disciplines.*

This paper draws on the author's own practice as a sound designer in a variety of spatial sound projects in built and virtual contexts to discuss ideas of landscape, interiority, space and place as experienced through listening. This will include aspects of Canopies: chimerical acoustic environments *for the Southgate soundscape system,* Ecstasis: human presence in digital environments *for an interactive VR system and stereoscopic projections, and* The Occupation of Space: Soundsites *project with the Melbourne blind community.*[2]

The ideas and technologies underpinning these projects also form the basis of a new pedagogy of sound and listening housed in the Spatial Information Architecture Laboratory's (SIAL) Sound Studios at RMIT University. The place and role of the Sound Studio's program in providing an aural perspective that compliments the visual methodologies of co-located design disciplines is discussed.

Keywords: *soundscape studies, design education, interdisciplinary practice*

Introduction – on the term 'aural eye'

Sub-vocalisation is a necessary skill developed to varying degrees by score based composers and musicians. It is an ability to 'hear' or conjure up in one's aural imagination, the sound of individual instruments and their combinations into extensive orchestrations as represented by a printed score. The skill can be equated with learning to read written words where children first read aloud, then more frequently to themselves until their aural memory develops and they can silently recall the sounds of words. I use the invented term 'aural eye', as personal shorthand for a process of looking and internalised listening, of translating between a visual

field and engaging the aural imagination. Ihde (Bull & Back, 2003) discusses the related phenomena of *auditory imagination* familiar to musicians and composers, but one that focuses purely on music and sound and not its intersection with visual perception of the world.

With particular compositions I experience sound as a surface, a veil, a terrain over a substratum that is the actual composition, which is energy distributed in time. When looking into a visual field, static or dynamic, for the purpose of realising an allied sound design, this soundless sub-vocalisation becomes a means to unearth this energetic substratum. I experience this *a priori* sensation of sound as a highly physicalised one, where sound(s) appear within my imagination, embodied with qualities such as weight, presence, degree of ephemerality, rugosity or turbulence. This process of translation lies beneath each of the sound based projects discussed here that engage visual fields in different ways and contexts.

Soundscape design and composition

Notions of landscape and interior appear in the theoretical discourses of soundscape practices and electroacoustic music. In the *Handbook for Acoustic Ecology* (Truax, 1999), soundscape design is defined as a:

> *…new inter-discipline combining the talents of scientists, social scientists and artists (particularly musicians)… [who attempt]…to discover principles and to develop techniques by which the social, psychological and aesthetic quality of the acoustic environment or soundscape may be improved...*

Closely related to soundscape design is soundscape composition, which is a type of electroacoustic composition where sounds from and about a specific context, usually a specific place, are the primary material for the work. The sense of the '…original context and associations of the material play a significant role in its creation and reception' (Truax, 1999). Soundscape composition is '…context embedded, and even though it may incorporate seemingly abstract material from time to time, the piece never loses sight of what it is "about"' (Entry for *soundscape* composition at *Ears*, 2005).

The difference between a soundscape composition and soundscape design can also be one of scale of endeavour. The composer of a soundscape composition is concerned with the creation of a work usually for concert or broadcast presentation and limited duration, between a few minutes and one hour. The soundscape designer is usually occupied with the integration of a complex weave of relationships to create an aural experience in an everyday environment.

The two types of endeavour might be two realisations of a larger project when, for example, a soundscape design is the basis of a soundscape composition or a soundscape research project is later 'applied' in a soundscape composition. Two examples from my own practice illustrate these definitions. Material from the first manifestation of the soundscape design *Canopies: chimerical acoustic environments* for a 160 loudspeaker soundscape system along a riverside cultural precinct in Melbourne, was later re-worked for a twelve-minute composition for concert presentation. And in the case of *The Occupation of Space: Soundsites*, an eight-month process of interviews, workshops and research into how the blind community of Melbourne use sound to negotiate physical space, resulted in an exhibition of twenty-four acoustic moments, or small soundscape compositions based on the findings and observations of the preceding research phase.

Interiority: *Canopies, chimerical acoustic environments*

In electroacoustic music[3] practice, the term 'interiority' '…designates the qualities of sound that do not refer to external causes/sources' (Entry for *interiority* at *Ears*, 2005). It is the perceived qualities, without concern for what the sound is, or what might have brought the sound into being e.g. a hand striking a metallic bowl, or wind entangled in a mesh of pine needles. When attention is drawn away from a sound's exteriority, or reference, the reduced experience can be at least as full and complicated in its own way, and words such as mass, grain, turbulence are used to describe these qualities of sounds, in and of themselves.

The interior qualities of a sound impart to a listener a sense of energy, both received and embedded. Received energy is also explained as a gestural activity that brings a sound into being. Embedded energy appears to be an insertion of energy after an initial or source sound is in motion. In his seminal paper on Spectromorphology, composer Denis Smalley proposes that the qualities of energy within a sound reveal the level of human agency related to the production of that sound (Smalley, 1997). A sound with unvarying qualities appears unnatural, in the sense of not appearing in nature, or lacks an envelope of energy with onset, build-up, sustain and dissipation[4]. It is the flat-line[5] sounds of machinery and electronic devices that in listening theories quickly produce conditions of informational redundancy.

In contemporary software-based sound design, the interior of a sound is crafted by signal processing that is controlled directly by a datascape of real-time interaction, automation, or combinations of both. Real-time interaction provides one method by which traditional human music performance gestures might be mapped onto a sound, with the possibility the sound will maintain some degree of a musically referential character. While this allows a composer/ sound designer to make, for example, a more convincing string sound by 'bowing' the sound,

it can also be used to create atypical sonic events such as 'bowing' a bell or flute sound. Automation allows super-human qualities to be mapped onto a sound: durations much longer than could be sustained through muscular effort or the breath, speeds of articulation beyond the fifteen to twenty attacks per seconds possible through human muscular effort, or simultaneous changes in many parameters effecting a single sound.

This practice of synthesising or processing a sound is to design or redesign its interiority, a process sometimes referred to as micro-composition, and is one that occupied by far the greatest amount of production time in the creation of *Canopies*. The basic sounds for *Canopies* were built from a series of studio improvisations, to design detailed and intricate material as a contrapuntal response to a site inundated with low frequency or flat-line sounds, which included a constant low frequency din from traffic and plant equipment (mainly air-conditioners), transportation sounds from Flinders Street Station and the throb of diesel engines of tourist boats passing by and idling at the wharf adjacent to the promenade. The intended effect was to create a lattice of sounds in an urban environment, hovering just above the threshold of aural perceptibility, as a virtual acoustic environment subtly present to the listener.

Canopies intersects with the notion of interiority in electroacoustic practice through the introduction of substantially more elaborate sounds than those in the existing conditions into the acoustic environment of the site. A new auditory plane is opened on the site through sounds whose timbres are in the middle to high range of human auditory perception (400–8000 hertz) and are richly textured and varied. The sound sources for the work that were processed included a set of wood-chimes, a collection of shells, a set of beads, small brass bells, cymbals and processed vocal improvisations. With no obvious visual reference on site to the external source of these sounds, the attention of the listener is drawn, even if momentarily, into a strange world enveloping an otherwise ordinary urban precinct (Harvey, 2000).

Landscape: *Ecstasis, human presence in digital environments*

> *Aural landscape – encapsulates sound's inherent propensity to suggest physical space (both real and imagined) in playback* (Entry for aural landscape at *Ears*, 2005).
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> *The (indoors) listening space encloses and may either confine or expand the composed space. This ultimate space where the listener perceives is therefore a superimposed space, a nesting of the composed spaces within a listening space* (Smalley, 1991, p. 121).

In the chapter devoted to sound landscape in *On Sonic Art* Wishart (1985) defines one aspect of '…the landscape of a sound image as the imagined source of the perceived sounds'. Source recognition is often a problem for sighted listeners who tend to favour visual verification of a sound's location, proximity and type, while unsighted listeners must rely mainly on their aural experience and possibly on tactile or olfactory senses. Sighted listeners tend to experience disorientation if they are unable to identify the source of a sound. The term 'source' is used here both as a physical location in space and 'thing'. From our earliest years, discovering the link between sounds and their source helps us to explore the aural aspects of our environment, while the uncoupling of sounds from their source is the basis of a large majority of electroacoustic concert and installation works. Wishart further proposes that this disorientation and the sense of strangeness is the reason why so much electronic sound was used in early science fiction films. He gives three components of a sonic phenomenon that defines a sense of a landscape as aurally perceived:

1. *The nature of the perceived acoustic space.*
2. *The disposition of sound-objects within the space.*
3. *The recognition of individual sound-objects* (Wishart, 1985, p. 76).

Ecstasis is 'a multi-user "experiential" installation [which] involves up to four participants that simultaneously explore the virtual environment by use of a multi-user head tracking system. The work is determined not only by one's own decisions for movement within the environment but also by the sum of the activities of all participants. The work consists of a large wrap-around screen with blended output from six separate projectors producing a panoramic stereoscopic 3D image, 7.8 metres wide. Combined with an 8 channel 3 dimensional sound field the work powerfully envelopes the participants who are moving between their perceptions of the virtual environment and the actual environment' (Entry for *Ecstasis* at http://www.beap.org/2004).

In designing the soundscapes for *Ecstasis* I developed a software environment to dynamically modulate the first two landscape-forming phenomena listed by Wishart, and present a myriad of individual sound objects to the listener throughout the twenty minutes average duration that an audience experiences the work. The visuals for *Ecstasis* involve stereoscopic projections which constantly modulate with images appearing inside and seemingly outside the bounds of the screen.

Such a physically engaging and compelling visual experience could easily overwhelm the soundscape of the work. The concept and creation of aural envelopment was critical to establishing a sufficient presence for the soundscape. Envelopment is a subjective impression

by the listener where they experience '…the difference between feeling inside the sound and feeling on the outside observing it, as through a window' (Thompson, 2004, p. 320). This concept arose in the early 1960s through Leo Beranek's studies of concert hall design (Beranek, 1992). It became apparent that an effect of envelopment is created by small time differences perceived by a listener, between the arrival of direct sound from a source and what are called the first reflections of sound off surfaces of the room. Lateral reflections (that is, from side walls) are of particular importance to the creation of envelopment.

A sense of envelopment in *Ecstasis* is created through the close integration of a number of compositional, physical and software resources. The audience is surrounded by an eight channel sound system, at all times up to three layers of sonic material is positioned either statically and/or in motion around the listeners, and most notably, sounds are processed around the eight channels using small time differences or delays from many locations. For example, audio processing modules were designed to take a single sound, and distribute it sixteen times across eight channels with individual time delays ranging from ten milliseconds to around five seconds. Standard reverberation effects were also used with these delay methods. Depending on the sound source used for this processing, the effect could range from a smearing of the sound around the listener to clouds of rapid specks or sonic points.

As one's aural focus in the listening moment rapidly oscillates between and fuses all three landscape-forming elements noted above, a technical method was developed that allowed these three elements to be readily accessible during development, as well as the final 'run-time' presentation of *Ecstasis*. The persistent modulation of sounds in the final design forms a continuum with the visuals of the work and a transforming landscape of sound enveloping the listener continues and completes a sense of visual immersion for the audience.

Soundsites: sighted and unsighted listening

But what of listening outside of a formal cultural setting of a concert hall or gallery installation? The three landscape forming components of a sonic phenomenon proposed by Wishart specifically relate to sound-based performance without recognisable performer or source. The electroacoustic music setting Wishart is describing is a particularly non-visual mode of aural experience, usually referred to as 'acousmatic listening'[6] and is discussed extensively in electroacoustic literature.

In the *Soundsites* project, non-visual experience of places by the blind community was investigated, and communicated to a sighted audience by means of a sound exhibition. The project started with interviews with members of the blind community in Melbourne with

ages from eight to seventy, over an eight-month period. Even those people blind since birth or from early childhood struggled to describe their uniquely aural experience of the world, usually due to the ability of individuals, and/or the availability of language, to describe aural experience. Sight-impaired people live in a culture that relies almost exclusively on sighted verification of things, events and ideas.

However, the description by interviewees of their experience of physical space often resonated with Wishart's three components of aural landscape. For example, several older interviewees described how individual sound objects had changed perceived acoustic space in particular, the ways that vehicle and road construction techniques had combined to change the sound from cars since the 1970s. Other differences in acoustic spaces included how wealthy suburbs sounded different to less wealthy ones, how the subtle changes in ambient sound from a building offset provides navigational cues through the city, or the effect of modern shop-front design in changing the qualities of the 'sonic shoreline'[7] in contemporary streets.

The interdisciplinary field of soundscape studies includes aural-centric classifications of a range of events, conditions and listening contexts, often adapting terms from descriptors used for landscape.[8] Although no interviewees were aware of soundscape terminology or formal environmental listening strategies, I observed how blind teenagers undertaking mobility training did gain some training in environmental listening. At the time of *Soundsites*, there were no formal listening training or aural-specific descriptors in use at the host organisations of the project.

From soundscape practice to design education

The intention in this paper of relating ideas of interiority, landscape and listening to actual sounding projects has been to show how electroacoustic composition and soundscape design can be applied to influencing and investigating complex aural interactions of people within built or virtual environments, and the role of a sound designer in that endeavour.

I find practice is a domain with degrees of autonomy to play. The qualification 'degrees of autonomy' recognises the imposition of external or self-imposed constraints on the work. Practice is used to generate and assess knowledge that synthesises technical, conceptual and perceptual aspects of an aural understanding of the world. In choosing to work outside the highly formalised milieu of concert hall music, my practice has intersected with a broad range of human behaviour settings as do other design disciplines. Acknowledging the experience of the listener in these settings, my approach to soundscape pedagogy aims to cultivate in

design students a critical listening ability and an aptitude with sound based concepts further examined in projects using electroacoustic technologies.

The link between spatial sound practice and soundscape pedagogy can be demonstrated with reference to part of the teaching program in the SIAL Sound Studios where the traditional linear stereo soundscape composition has been extended into interactive three-dimensional[9] realisations. By embedding carefully edited sounds of urban environments within interactive design projects based in games engines, students use sound in both communicational and representational modes. Through these projects, students investigate the relationships created between sound, visual form, occupation and usage – albeit at this stage the sound is evocative rather than realistic. Realism here refers to the modelling of complex environmental acoustic parameters such as real-time reverberation through convolution. However, this 'sound-sketch' in a games engine maintains useful acoustic phenomena for a listener in physical space such as precedence effects, localisation and distance cues, as well as a programmatic relationship between sound and place.

While design students are visually astute, their listening skills and general awareness of the acoustic environment is often underdeveloped. However, their ability to imagine spaces in three dimensions and consider the motion of an observer through space is an important skill that can be harnessed when researching actual, or designing a virtual soundscape. Listeners experience the acoustic environment as circumambient. Providing a pedagogical resource that can partly replicate this relationship is effective to demonstrating the immersive qualities of a soundscape.

The intention of combining listening, research, presentation and design based activities within the Sound Studio's program is to make young designers, about to enter professional practice, aware of the aesthetic, social, cultural, health and environmental aspects of the soundscape. The approach locates a basis for the students' future technical understanding of sound within an empirical knowledge gained through their own critical listening (Harvey & Moloney, 2005). And hopefully inspires the student to integrate into their design practice, their emergent knowledge of aural experience.

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Endnotes

[1] This paper was delivered at the INSIDEOUT Conference on April 23, 2005, with a new Max/MSP software environment, enabling as a multi-channel, polyphonic performative sound presentation. Discussion of the environment will appear in the author's forthcoming PhD exegesis.

[2] *Canopies* was premiered between January 18–April 21, 2000, Southgate Soundscape System, Melbourne. *Soundsites* was first exhibited October 9–30, 1999 at Span Galleries, Melbourne, 16–28 October, 2000 at the Seymour Centre, Sydney for the Paralympics Arts Festival, October 9–12 2003 at Latvian House, Toronto for SOUNDplay and Tranz-Tech Festival. *Ecstasis* has been extensively shown at RMIT University's Virtual Reality Centre Melbourne, and September 8 to December 12, 2004 at John Curtin Gallery for the Biennial of Electronic Arts Perth (BEAP).

[3] There are several competing definitions for this term, it is used throughout this paper to indicate '…music in which electronic technology, now primarily computer-based, is used to access, generate, explore and configure sound materials, and in which loudspeakers are the prime medium of transmission' (Entry for *electroacoustic music* at *Ears*, 2005).

[4] Otherwise described in early electronic music as ADSR – attach, decay, sustain, release.

[5] 'A sound or sound object whose amplitude [loudness] is relatively unchanging. However, in any natural sound the spectrum is always changing…and there are usually slight fluctuations in amplitude even in what appears to be a steady sound. Mechanical or electrical sounds (e.g. hums) are usually examples of stationary sound that are almost completely unchanging. They may be called flatline sounds or drones because of their steadiness' (Truax, 1999).

[6] Chion (1983) offers the following definition of 'acousmatic' as '…indicating a noise which is heard without the causes from which it originates being seen…to describe an experience which is very common today but whose consequences are more or less unrecognised, consisting of listening to the radio, records, telephone, tape recorder etc., sounds whose cause is invisible. Acousmatic listening is opposed to *direct* listening, which is the "natural" situation where sound sources are present and visible. The acousmatic situation changes the way we hear. By isolating the sound from the "audiovisual complex" to which it initially belonged, it creates favourable conditions for a *reduced listening* which concentrates on the sound for its own sake, as *sound object*, independent of its causes or its meaning (although reduced listening can also take place, though with greater difficulty, in a direct listening situation).'

[7] 'Shoreline' is a term used in blind mobility training. It appears to indicate any physical part of an environment where a horizontal meets a vertical, and is useful as a navigational aid. 'Sonic shoreline' as adopted here, refers to the acoustic typology created by doors, overhangs and set-backs in the built environment. It is also a section title in *Soundsites*.

[8] For example, soundmark from landmark. For a searchable lexicon of soundscape terms, see Truax (1999).

[9] Three-dimensional sound, or 3D audio, has at least two definitions. In sound design for games engines, 3D audio can refer to a sound whose loudness will increase or decrease in response to an avatar's proximity to that sound. The terms are also used for audio systems with speakers circumambient to the audience along x, y and z coordinates relative to a central listening position, usually defined as the origin.