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SOUND, SPACE & DIGITISATION

Recent articles in several disparate (though related) fields point to a preoccupation among some scholars with understanding the social construction of space. As space has become more transparently (and technologically) socially constructed, its construction has come under scrutiny and become part of the scholarly conversation about culture and society. One can find the seeds of such discourse in McLuhan's work (and in Harold Innis's (1951) before him) since the 1962 publication of *The Gutenberg Galaxy*, and in his use of the term 'global village'. More recently McLuhan's sometimes elegiac forays have been problematised by way of their relation to culture and community, or as James Carey acknowledges it, 'the uprooting of people from meaningful communities' (1989, 140). In ethnomusicology, questions of identity, authenticity and location have become junctures for self-critical scholars to question traditional positions regarding 'local' musics. For instance, in a study of Jamaican popular music, Wilmer claims that without understanding the influx of 'foreign' music 'the rise of distinctive indigenous Jamaican popular music in the 1960s remains inexplicable' (1987, 19). Ethnomusicology, too, has forged links with recent work in anthropology to examine connections between location and definition (Grenier & Guilbault 1990).

That ethnomusicology has looked to anthropology is not surprising. Anthropology provides a fertile ground for discourse about space, location and identity, and it is there that some of the most compelling writing can be found. Perhaps most notable is an essay by Gupta and Ferguson in which they note that place, space and culture do not necessarily

connect. We live in an era 'where "here" and "there" become blurred' (Gupta & Ferguson 1992, 10).

Popular music is an important site at which to examine the social construction of space for two reasons. First, its existence, and its claims to authenticity, are predicated on its relationship to community. As Frith writes, and according to fans and musicians alike, popular music and musicians 'begin their careers by expressing the interests of a real community, and the problem of their authenticity only emerges later, when they are recording stars' (1981, 75). Part of the reason a problem with authenticity 'emerges later' is simply that space and place cannot be adequately recorded and reproduced, but more on that in a moment. Suffice it for now that community – a sense of place, to borrow from Meyrowitz (1985) – is a key element of popular music, whether that sense is constructed or not. Cohen calls this sense a 'unity of audience and performers' (Cohen 1991, 40). Second, the consumption of popular music itself takes place in sanctioned spaces. These may be concert halls, discos and clubs (Chambers 1985), automobiles, bedrooms or headphones (Jones 1992).

In both cases, there is an element of space that is communicated via music, whether it is performed live before an audience or reproduced in a recording. Consequently, some elements of space are constructed as part of the act of music making. That construction has been a major force in the evolution of audio recording technology, a force that has gained greater strength with gains in knowledge of the digitisation of sound.

The historical development of audio recording

The evolution of audio recording technology shows technical development spurred by desire for control over spatial and temporal aural dimensions (Jones 1992). In particular control over spatial dimensions has been emphasised, as sound recording captures (to varying degrees) not only the sound directly from the sound source but also that sound reflected from boundaries near the sound source. Sound recording thus captures ambient sound, or, put another way, the sound of the space surrounding the sound source.

This evolution followed two distinct paths. The first is live location recording, the second is close-miking, or recording sound in as isolated and anechoic a fashion as possible. The former seeks to capture as well as possible the aural characteristics of the space within which music was performed, and the latter seeks to recreate, or create anew, the space the music will occupy. Both recording methods make claims about fidelity, or realism, and thus, ultimately, to authenticity, though it could be argued that the displacement of the recording in the environment of the consumer makes such claims debatable (Jones 1992).

Indeed, claims about fidelity and realism occur at the level of production, but rarely at the level of consumption. Throughout the history of sound reproduction reality was spoken of unproblematically. As a reporter for *Fortune* magazine summed it up in an article about the development of stereo: 'Realistic reproduction of sound is what the engineers are after' (Boehm 1958, 165). There is little doubt that the illusion of reality is what audio engineers aim for. Roy Allison, an engineer at Acoustic Research in 1959, said: 'The day is coming when we will be able, finally, to produce a consistent illusion of really "being there"' (Hodges 1978, 26). Fidelity and realism at the level of consumption are unproblematic because their transmission is opaque. As with visual apprehension of film or television, the boundaries delimiting real sound are perceptible and the distinction between real space and recorded space is made clearly.

Thus, when someone listens to a recording they do not claim to 'be there'. Yet recording production is invariably concerned with recording a 'there' at which the consumer

could 'be'. Thus originates, for audio recording at least, the blurring between 'here' and 'there' that Gupta and Ferguson identified.

The growth of the recording industry and the concomitant economic realities of mass production and recording tipped the scales away from location recording and toward studio recording. Three forces were at work: cost, control and realism (or fidelity). Regarding cost, it was less expensive to bring the musician to the recorder than vice versa, and having equipment already set up in the studio meant that attention could be focused on controlling recording. Studio recording meant that engineers and producers had increased control over the recording process and over the recording itself. And the innovation of signal processing equipment (echo and reverberation chambers, equalisers, limiters) permitted the recreation of acoustic (ie, performance) space beyond the acoustic limits of the studio. The introduction of tape recording cemented the studio's place as the primary site of recording as editing became the driving force behind innovation and design of recording technology (Jones 1992). Digital audio technology allows for particularly precise editing, as sound can be represented visually in a variety of ways and edits themselves are non-destructive, that is, one can always return to a non-edited or pre-edit version. Consequently audio editing has come to resemble word processing, insofar as editing is quick and easy, and the danger of somehow harming the non-edited version is taken away.

Audio production has wobbled between location and studio recording, in a debate that crosses into the domain of the consumer whose assessment of a recording incorporates ideas of 'live-ness', authenticity, fakery, and illusion. What is paramount in recording is the production of acoustic, or ambient, space that surrounds the recorded music. This is accomplished through a variety of production decisions, including use of stereo imaging. For consumers, such decisions are primarily related to loudspeaker positioning and listening room characteristics and not to program content.

Even surround sound systems that allow consumers to control some spatial parameters of a recorded sound source allow control only

over the entire program, and not control of spatial characteristics associated with individual sound sources. Such systems exist in part to allow production opportunities that better handle the complexity of sound sources in a recording. Binaural recording and reproduction systems intend to reproduce the human hearing system. Such systems are largely unsuccessful because they require a great deal of precision and control of microphone and speaker (or headphone) location. Once a listener (or performer) moves even slightly out of the optimum location the binaural effect collapses, as often is the case with a surround effect.

Audio production relies on control over individual elements within a recording to create a sense of space. Any recording made with more than one or two sound sources relies on control of a variety of audio parameters for each source. Alten (1986, 279-280) identified the parameters that can be controlled as:

- distance, created mainly by relative loudness;
- direction of movement;
- frequency, which also helps to establish distance and direction of movement;
- position, also established mainly through loudness;
- openness, which is established by echo with a longer than normal time between repeats;
- ambience that is extremely quiet; and
- dimension of indoor space, which is usually established by means of reverberation.

Though brief and simplistic, Alten's list of parameters reveals the dimensions along which audio can be controlled. Each parameter is a kind of signal, or cue, the listener interprets (Moulton 1985), and such cues are the building blocks from which the listener interprets the space within which individual sounds occur and the overall sound is situated. Control of these parameters, or cues, is made possible largely through use of digital audio technology of sufficient processing power to allow 'realistic' audio imaging (Kendall & Martens 1984).

The most common device for the creation of ambient space is the digital reverberation (digital reverb) unit, which functions to simulate acoustic environments. Without going into technical detail, suffice it to say that

those characteristics which affect the reflection, direction and absorption of sound are malleable. Digital reverb units act to combine those characteristics so that a sound passed through a digital reverb unit will sound as if it is occurring within the 'room' created by the unit.

The use of quotation marks around the word 'room' signifies the ensuing knot concerning conceptions of reality and virtual reality, the 'here' and the 'there'. The aural cues from the sound passing through the digital reverb tell the listener that the sound is located within a room with particular acoustic characteristics. But that room is entirely a fabrication. Various audio equipment makers even give pre-programmed room names, like 'concert hall', or 'broom closet'.

The parameters digital reverb units manipulate are very precise. Some units allow users to determine not only the size of a room, but such things as the type of wall coverings therein. More complex are digital reverbs such as the Quantec Room Simulator (QRS) which use information from room measurements to recreate those rooms in the QRS. For the film *The Cotton Club*, for instance, the soundtrack was recorded and processed through a QRS that was programmed with the physical characteristics of the original Cotton Club, including details such as the number and types of chairs and tables in the room. In this case digital reverb can be considered a device for construction of virtual reality (VR) by aural means.

Some of the impetus for innovation in spatial location in the audio engineering field has come from its uses in cinema, as movie theatres increasingly employ Dolby Surround Sound and other forms of audio playback technology. Indeed, as Cruz-Neira et al point out, 'the early attempts of the entertainment industry to achieve better suspension of disbelief laid the foundations for current virtual reality research' (1992, 65). But a still bigger impetus for innovation is the increased use of stereo television broadcasting, particularly via cable. Not only does that combination enhance both aural and visual components of those media, the juncture of high-tech audio with video provides a marketplace for audio productions in addition to the audio-only media already present, and it brings those components into the home.

Audio technology's goal is the re-creation of a sense of space, and development of that technology has fused with visual media; both technologies have a common goal (re-creation, reproduction and distribution of reality). The realisation of the technologies occurs in the sphere of entertainment, for it is there that the economic and artistic conditions meet and provide an environment within which audio technological developments related to spatial location are fused with visual media.

Still, available systems only halfway hit virtual reality's target, which is the creation of three-dimensional environments. In a true virtual reality sound system, sound sources would emanate from anywhere within space. As Jaron Lanier said:

The world is out there stationary relative to you, which means it moves when you move your head, therefore you can't have true 3-D without head-tracking and when you have that, the sound will actually change according to how you listen. So at some point in the future, there will be a true 3-D home stereo system that will know how you are tilting your head at the time and will move the sounds around to compensate for your head movement. So you'll not only be able to listen to a 3-D string quartet, but you'll be able to get up and walk around them. (Stone 1992, SR35).

Thus, in Lanier's setting, the 'here' and the 'there' are one. Sound processing equipment to produce such audio effects is not yet available, but current audio research by companies such as AKG, Crystal River Engineering and Audio Cybernetics Studios has such a system as its goal. Since it is easier to control sound heard through headphones, most audio VR systems produce their best effects with headphones. A good deal of innovation in this area evolved from binaural recording (Gierlich & Genuit 1989), which shared a goal in common with audio VR, namely, the creation of a kind of artificial 'head' which records sound in concordance with ear/body relationships. Though implementation of Lanier's 'true 3-D' in recording and reproduction equipment is not near, that the goal of true 3-D sound can be reached is certain. The author has heard such systems at work in a Minneapolis recording

studio. The results are surprising, as Christopher Currell recalls from an incident during development of a virtual audio system:

I've fooled myself... when I was checking the headphones, I heard a knock and the door opening. I turned around and it was shut. I *made* the tape, I should know. It fooled me anyway (Sirius & Drew 1991, 23).

It should be noted that any kind of virtual audio is still a passive experience, relying on playback of prerecorded material (Foster et al 1991). The recording can change little based on the listener's actions or movements, and consequently virtual audio has not reached virtual reality's twin goals, accuracy and interactivity.

Sound and surroundings

The construction of space by aural means is possible because sound itself is spatially structuring. Hosokawa provides ample evidence of this in an examination of the Sony walkman:

... there is the walkman listener, who is found in the world of *listening to music alone*. This listener seems to cut the auditory contact with the outer world where he really lives; seeking the perfection of his 'individual' zone of listening (1984, 167).

What, then, when the individual zone and the environment intersect? Hosokawa provides interesting insight:

The walkman, in fact, has no meaningless context; at the same time, paradoxically, no context is strictly appropriate for it. Every context (or no context) can be justified, appropriated and legitimated by its singularity and autonomy ... The practical meaning of the walkman is generated in the distance it poses between the reality and the real ... (171).

Hosokawa describes uses of the walkman as a form of urban strategy, a means of imposing noise upon the noise of the city, a way to interpose an aural intercession into the environment. The result is Hosokawa's 'meaningless context', sound (walkman) and event (environment) are separated. To some extent, the listener can edit the aural component of the surroundings, in a fashion that recalls some of Baudrillard's comments

about the hyperreal and simulation. The hyperreal, Baudrillard wrote, is the 'realisation of a living satellite', in which 'each person sees himself at the controls of a hypothetical machine, isolated in a position of perfect and remote sovereignty, at an infinite distance from his universe of origin' (1983, 128).

Granted the walkman wearer is not isolated to the extent Baudrillard seems determined to impose on his postmodern subject, but it is the idea of control that is central to his theme. There is a reliance on editing, in this case of the environment, that appears to recur across a variety of media (film, video, music). Editing is a part of what James Beniger (1986) has characterised as the 'control revolution', implemented by technology that affects the production, distribution and consumption of mass communication.⁷

Where are we (now)?

In an examination of a work by Edgar Varese, Biocca (1985) makes clear the significant links between perception, technology and communication that inform our understanding of space and the resulting meanings we make from that understanding, ones regarding location, identity, and reality. It is not, as Hosokawa suggests, that we have a 'meaningless context' but rather that meaning is not structured by context. Varese, in an unfinished project, sought to do away with borders by way of simultaneous broadcast of a score titled 'L'Espèce', that is, 'Space'. Not unlike information technology appropriated by cyberpunk partisans, communication by sound was, for Varese, the means by which to overcome space, or, in other words, a communication medium by which space in its *literal* sense is overcome. Not only is space observed across some distance, as with sight and with technologies that extend that sense, but it is, so to speak, colonised, filled with sound. Varese's 'L'Espèce' is not a collapsed space such as Baudrillard's 'absolute space' of simulation, a flat surface; it is a space that is abundant, full, all around ... and *meaningful*.

It is important for us to consider the connections between space and spatial location, community, authenticity, and 'otherness', as Gupta & Ferguson, Carey and others mentioned earlier in this article do. And

yet it is important to consider the very ways in which we understand space as we consume, mould and edit it. Such work is under way in visual communication, partly because virtual reality demands it, and because virtual reality is thought of as a primarily visual space. As such its creation can be understood as a part of the ongoing technological visualisation and deauralisation of space (Carey 1987). A particularly insightful analysis of space from a visual perspective is Vivian Sobchack's examination of visual science fiction texts:

If the digital 'bit' has fragmented our experience and representation of space, then the character of electronic dispersal has dislocated our experience and sense of 'place'. We are culturally producing and electronically disseminating a new world geography that politically and economically defies traditional notions of spatial 'location' ... (1986, 232-233).

Beniger finds such fragmentation necessary for the transformation of:

currently diverse forms of information into a generalised medium for processing and exchange by the social system, much as, centuries ago, the institution of common currencies and exchange rates began to transform local markets into a single world economy. We might therefore expect the implications of digitalisation to be as profound for macro sociology ... (1986, 25-25).

In a manner of speaking, Beniger finds digitisation the means by which we can re-emerge from Babel, one continuous, unified, digitised society. His is not conjecture in the ordinary sense; not a prophecy, but an observation. One only has to examine the evidence of a variety of media technologies to find the verity of his words, to look at MIDI (Musical Instrument Digital Interface) technology which has achieved the generalisation of information Beniger writes about. Or, for evidence of our desire to generalise information, a perhaps more strongly felt example is the frustration (fuelling that desire) when we use two computers with different operating systems that refuse to communicate with each other despite speaking a digital language.

What is likely via the digitisation of space, currently by aural means but before long visually as well, is a communication about

space by means of sound, through its digitisation. The elements that actualise space, namely, sounds, are transformed into a common currency (the digital), and re-actualised in an aural environment modified by adjustments to sound while in the digital domain. It is, as Morris has said in another context, 'a traffic in negotiable proximities' (1988, 41).

The implications for communication are great, but they are rarely examined in the context of orality and aural communication. Writing from a position as a media practitioner in the 1960s and 1970s, Tony Schwartz glimpsed some of those implications:

Sound need no longer be contained within a physical environment that defines the boundaries for sound ... The geographic location of an audience ... become[s] less meaningful for those who create communication (1973, 47-51).

Berland assessed the implications of Schwartz's assertion in regard to radio and its audiences. She wrote that 'social processes cannot be understood outside of space. If spatial and social processes are indistinguishable, then the production of audiences is inseparable from the production of spatial relationships' (1990, 186). At stake is what Meyrowitz has termed a social 'sense of place':

... the word 'sense' and the word 'place' have two meanings each: 'sense' referring to both perception and logic; 'place' meaning both social position and physical location ... social roles ... can be understood only in terms of social situations, which, until recently, have been tied to physical place, and ... the logic of situational behaviours has much to do with patterns of information flow, that is, much to do with the human senses and their technological extensions (1985, 308).

It is not difficult to imagine the changes performance may undergo when incorporating virtual audio. Recording enabled the transference of a social concert space to a private, or at least less public, space, separate from the performance situation (and the performance time). Benjamin addresses this issue. 'Even the most perfect reproduction of a work of art is lacking in one element', he

writes, 'its unique existence at the place where it happens to be' (1969, 222). In virtual audio a social concert space may be perceptible but not present.

It is more difficult to imagine the consequences of changes in the apprehension of sound and the subsequent meaning-making humans perform. Ong succinctly described the perceptual change visual society induced:

The centring action of sound (the field of sound is not spread out before me but is all around me) affects man's sense of the cosmos ... For oral cultures, the cosmos is an ongoing event with man at its centre ... Only after print ... would human beings, when they thought about the cosmos or universe or 'world', think primarily of something laid out before their eyes ... a vast surface or assemblage of surfaces (vision presents surfaces) ... (1982, 73).

Perhaps virtual audio re-centres the listener by providing a sense that audio is no longer a 'surface' projected from a speaker (or stereo speakers). It is once again 'all around', and that all around *moves* with 'me'. Returning to Ong's remarks about the 'centring action of sound', what is centring about sound is the space that it has as its context. Virtual audio recontextualises that sense of space, giving it motion, and reproducibility. This may suggest an interesting connection between sound, public space, and motion. Sennett writes:

The erasure of alive public space contains an even more perverse idea - that of making space contingent upon motion ... the public space is an area to move through not be in ... public space has become a derivative of movement (1978, 14).

It is arresting to think of virtual reality, and virtual audio in particular, as technologies that thus reconstitute nature in a particularly natural way. And, as such, virtual reality can be considered a particularly modernist endeavour. David Bolter claims such efforts, as regards conceptions of space, began with Newton, whose notion of absolute space 'guaranteed the mathematisation of space ...' (1984, 94). What is most interesting about virtual audio technology is that it seeks to mathematise (or, in other words, digitise) not only space, but its perception. It concentrates not on nature per se, but on human nature, on

the means by which nature is apperceived. It is a technology actively involving the user, the consumer, though it remains another example of Jensen's modernity story:

[a] technological transformation ... both 'natural' and 'human-made' [that] inevitably elide[s] ... deeper questions about human nature, the social order, the relationships among culture, society, and power, and the constructedness of past, present, and future (1991, 97).

To a degree, virtual audio (and VR) relies on the notion that humans are hard-wired, so to speak, that they will respond to stimuli (aural, and visual) in a predetermined fashion. The technological transformation is thus all the more 'natural' for the consumer is involved in the transformation. As Bolter points out, 'what is unique about electronic space, unique in the history of technology and the philosophy of space, is its popularity, its accessibility' (1984, 98), and thus the transformation of space (and sound) by digitisation is pervasive, in much the same way editing, as was noted earlier, is pervasive and in the domain of the consumer. Not only does the digitisation of space seem natural, and common, but its naturalness is based in its construction of, and during, its own consumption.

Endnote

1. What is particularly revolutionary about editing is that, especially in regard to audio technology, it becomes increasingly the domain of the consumer. The cassette allows the recombination of songs into custom-designed 'albums', surround sound allows control over spatial parameters at the juncture of recorded and listener environments, the compact disc allows 'programming' of song sequences, and the walkman, as previously argued, allows for editing the aural component of perception of the environment. It is as if, at least aurally, we are able to edit life itself (Jones, in press).

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