
Genres and techniques of soundscape composition as developed at Simon Fraser University

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The soundscape composition, as pioneered at Simon Fraser University since the early 1970s, has evolved rapidly to explore a full range of approaches from the 'found sound' representation of acoustic environments through to the incorporation of highly abstracted sonic transformations. The structural approaches similarly range from being analogues of real-world experience, such as listening from a fixed spatial perspective or moving through a connected series of acoustic spaces, to those that mirror both nonlinear mental experiences of memory recall, dreams, and free association, as well as artificial sonic constructs made familiar and possible by modern 'schizophonic' audio techniques of sonic layering and embedding. The octophonic surround-sound playback format as used in contemporary soundscape presentations has achieved a remarkable sense of immersion in a recreated or imaginary sonic environment. Specific works realised at SFU are analysed that illustrate each of these approaches.

1. BACKGROUND

The pioneering work of the World Soundscape Project (WSP) at Simon Fraser University (SFU), although primarily intended as educational and archival, nevertheless fostered the development of a style of electroacoustic music which I have termed 'soundscape composition' (Truax 1984, 1996, 2000). At first, the intent was to document and represent recordings of various sonic environments to the listener in order to foster awareness of sounds that are often ignored, and hence to promote the importance of the soundscape in the life of the community. The first such systematic study was *The Vancouver Soundscape*, published in 1973, consisting of a booklet and two long-play records.

The studio techniques used at that time consisted mainly of transparent editing and mixing of untransformed original recordings, selected for their aural interest and representativeness of the soundscape in question. Of equal technical importance was the attention given to the recording technique, and today the tape archive which remains from those efforts, as recorded across both Canada and Europe between 1972 and 1975, is of excellent quality, having been recorded with a stereo Nagra IV-S and a pair of AKG condenser microphones. A complete catalogue and subject index, both in print

form and on the studio website, make this collection accessible to users for a wide variety of purposes.

During the production in 1974 of a ten-part radio series for the CBC called *Soundscape of Canada*, a significant change occurred in the use of the recorded material, in this case derived from a cross-Canada recording tour in 1973. As with *The Vancouver Soundscape*, collectively authored works continued to be assembled such as the 'Summer Solstice' where short segments from each hourly recording over a twenty-four-hour period were transparently edited together to create a one-hour experience of that specific soundscape. A similar technique was used in 1975 with one of the five European villages which the WSP studied, namely Cembra, Italy. However, most of the other radio programmes in the *Soundscape of Canada* series were individually authored. In several cases, the radio documentary format was used, although with many more sound examples than in the conventional approach. However, in other cases, more extensive transformation was used with the sounds and their composition, such as Bruce Davis' *Work and Games*, Barry Truax' *Soundscape Study* and *Maritime Sound Diary*, and Howard Broomfield's *A Radio Program About Radio Programs*, all composed in 1974.

After 1975, when Schafer left SFU, both teaching and compositional work continued on an individual basis, most notably with Hildegard Westerkamp's work which ranged from soundwalking (McCartney 1998) and radio-phonetic programming (Westerkamp 1994), which influenced *Kits Beach Soundwalk* (1989), through to concert pieces such as *Fantasie for Horns* (1978), *A Walk Through The City* (1981) and *Cricket Voice* (1987), all based on environmental sound and its processing in the analog studio. Except for his text-soundscape work, *The Blind Man* (1979), Barry Truax' electroacoustic work has centred on digital sound synthesis up to 1986 and digital signal processing of sampled sounds ever since. Most of these early synthesised works had a strong environmental character, particularly those realised in the quadraphonic format, culminating with *Riverrun* (1986), which was realised entirely with real-time granular synthesis (Truax 1988, 1990). His works in the 1990s were often based on environmental sounds processed with a granulation technique (Truax 1992a, 1994a, b),

such as *Pacific* (1990), *Basilica* (1992) and *Song of Songs* (1992).

In the early 1990s, the WSP tape collection was extended with DAT recordings from the Vancouver area made by Robert MacNevin, and in 1996, with the assistance of the Goethe Foundation, four composers, two Canadian (Darren Copeland and Claude Schryer) and two from Germany (Sabine Breitsameter and Hans Ulrich Werner), were invited to visit SFU and work with the entire tape collection. The results were performed at the studio's first eight-channel concert at CBC Vancouver in June, 1996, and published in 1997 as a two CD set, including the *The Vancouver Soundscape 1973* and *Soundscape Vancouver 1996*. The two CDs document both how the soundscape of Vancouver had changed during that period, as well as how far soundscape composition had evolved.

During the past five years, soundscape composition both at SFU and elsewhere has become centred on the standardised digital audio workstation approach of multi-track assembly and digital signal processing. At SFU, we have been developing computer control of the eight-channel spatialisation of environmental sound (Traux 1998), first via a prototype unit called the DM-8 created by Harmonic Functions of Vancouver, and currently with Richmond Sound Design's sixteen-channel matrix mixer called the AudioBox, also designed by Harmonic Functions. We are using Chris Rolfe's ABControl software with this unit which facilitates dynamic sound trajectories in a multi-speaker space. Although this system has also been used for other types of electroacoustic music, its surround-sound application to soundscape composition seems particularly effective and has become extremely popular with audiences. A large catalogue of pieces by composers associated with SFU as well as others (such as those associated with Darren Copeland's Sound Travels project) has been created, and concerts of these works are regularly performed internationally. In less than thirty years, the soundscape composition appears to have come of age.

2. MACRO COMPOSITIONAL APPROACHES

Soundscape compositions are as distinctly different from each other as those in any other style of electroacoustic music. However, if we take the history of SFU's contributions to the genre as examples, we can see some fairly simple patterns emerging, as well as many differences in detail. One of the most obvious traits is not that the pieces use environmental sound materials, but rather that most pieces can be placed on a continuum between what might be called 'found sound' and 'abstracted' approaches. In other words, the soundscape composition cannot be defined as any piece using soundscape recordings as its source materials, mainly because contemporary signal processing techniques can easily render such

sounds unrecognisable and completely abstract, i.e. with few if any real-world referents.

The soundscape composition always keeps a clear degree of recognisability in its sounds, even if some of them are in fact heavily processed, in order that the listener's recognition of and associations with these sounds may be invoked. Or, to put it even more simply, it is always clear what the soundscape composition is 'about', although with the absence of visual and other contextual cues, the composer may assist the listener with an explicit title and program notes. With highly clear and vivid sound materials, this information is probably unnecessary, but in other cases, a fair degree of ambiguity may exist in a soundscape recording and the listener may need to be oriented with an appropriate text. Where few if any of the environmental sounds used in a piece are recognisable, the listener will probably hear it as an abstract sound organisation, not as a soundscape composition with real-world associations. Of course, many composers like to create an imaginary world with processed sounds of various origins, and if the result is heard as a coherent soundscape, even if unrealistic in its details, one can make a connection to the soundscape composition approach. One such example might be Trevor Wishart's *Red Bird*, with its factory and garden 'landscapes', as described by the composer (Wishart 1986, 1996), realised almost exclusively with vocal sounds.

At another extreme, one might wonder whether a seemingly random collage of environmental sounds might work as a soundscape composition, particularly if most or all of the sounds are individually recognisable. The problem here is that the arbitrary juxtaposition of the sounds prevents any coherent sense of a real or imagined environment from occurring. In addition, the lack of apparent semantic relationship between the sounds prevents a syntax from being developed in the listener's mind, hence it is impossible to construct a narrative for the piece. This does not mean that montage cannot be occasionally useful. In my short work, *Pacific Fanfare* (1996), a set of Vancouver's soundmarks are edited together during the opening 30" of the piece, with fairly abrupt transitions between them. However, they are all clearly perceived as sound signals, and a Vancouverite might recognise them all as being of local origin (some are historical recordings of signals that no longer exist). The collage they create is not a coherent soundscape, but all of the elements are unique sounds in the city. Moreover, during the rest of the piece, these same sounds that were heard unprocessed at the start are heard in time-stretched and resonated versions which allow the listener to explore aurally both the sounds' harmonic character and their symbolic associations. In other words, listening to the composition is not just a matter of recognising specific sounds, but of meditating on them in depth.

To return to the continuum mentioned above, namely

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from found sound to abstracted sound, we can see that a range of approaches in soundscape composition is possible, both within a piece and between pieces. The found sound approach characterises the early work of the WSP where no transformations were used, only editing and sometimes mixing, similar and contemporaneous with the *Presque Rien* works of Luc Ferrari in Europe. It should be noted that any mixing that was done used only sounds recorded in the same location, that is, ones which would blend seamlessly together because they had the same acoustic character and perspective. In some cases, an original recording was used in its entirety with no modification, except possibly some equalisation for wind noise. Striking examples of such a 'found sound' composition are the various New Year's recordings made in Vancouver harbour, one of which (recorded by Hildegard Westerkamp) is included in the *Vancouver Soundscape* double CD. All of the boats anchored in Vancouver harbour sound their whistles at midnight, each with its own rhythm and overall duration. The mountains on the north side of the harbour reflect the sounds back and the result is a highly blended mix of pitches, timbres and durations, all in a wonderfully stochastic counterpoint. The overall shape of the acoustic event is also unique, starting with a few tentative blasts, then a grand chorus whose components gradually cease over the next ten minutes or more, giving the event a kind of exponential decay following an explosive attack. As the closer horns stop, one can hear the quieter more distant ones, hence the entire 'composition' is both spatially and rhythmically quite complex.

The other end of the continuum I have referred to as 'abstracted', following Emmerson (1986). He describes this property as involving both the sound itself as mimetic of the real world, and its organisation or syntax as derived from real-world events and their patterns. In other words, in an abstracted syntax, such as that favoured by acousmatic composers, it is the properties of the sound and sound patterns used that determine how the sounds are organised. He distinguishes this form of syntax from abstract syntax where sounds are placed in arbitrary relationships based on some other criteria or pattern of organisation. In terms of soundscape composition, a processed sound often creates a sense of its being abstracted from its real-world origins. For instance, the techniques of time stretching and resonating mentioned above enlarge but do not necessarily distort beyond recognition the sounds to which they are applied. In fact, they may still appear recognisable but 'larger than life'. In my work *Basilica* (1992), the bells of the Basilica of Notre Dame in Quebec City are stretched in time, and transpositions an octave down and a twelfth up are added, with the result transforming the sound of the bells into a large resonant space reminiscent of the interior of the church itself.

In works that are created with primarily abstracted sounds, it becomes particularly poignant if the piece

returns, even if momentarily, to the untransformed original material. The classic example is Denis Smalley's *Pentes* (1974), where after a substantial exposition of abstracted textures and complex explosive gestures, settling finally into a rich drone, a haunting melody played on the Northumbrian pipes slowly emerges into the foreground. Equally intriguing is the after-effect of this appearance where the shift in context colours the perception of subsequent sounds. A similar instance is heard in Peter Manning's soundscape composition *In Memoriam CPR* (2000), a homage to the sounds of the Canadian Pacific Railway's transcontinental train. The energy of the train is suggested in the large opening octophonic texture which has been abstracted from its source, like a surreal ghost. However, at two points in this evolving soundscape, original train horn patterns are heard, starting in their realism but effective in the resulting contrast.

A similar degree of abstraction may be found in Hildegard Westerkamp's *Beneath the Forest Floor* (1992), first in the low-pitched, repetitive thumping sound that becomes a recurring motif in the piece. The composer has revealed privately that the sound is an extreme transformation of another sound heard in the piece. However, surrounded by the forest ambience, this ambiguous sound evokes a variety of images in listeners that are closely related to the rain forest, such as hitting a hollow log, stamping on the porous cedar forest floor, perhaps a mysterious underground sound, or even the projection of an internal human sound. Other sound patterns, not just individual sounds, are also abstracted in the piece. For instance, the higher-frequency sounds of water and chipmunks rush across the stereo field in a fashion that is literally unrealistic but remarkably evocative all the same. The effect, first, is that a high degree of attention is drawn to these rushing sounds, much more than if they were presented more statically and 'naturally'. Secondly, an analogy is created to the experience of high-frequency sounds appearing and disappearing suddenly in the forest, because of the high degree of absorption of these sounds in such an environment. One often encounters a stream suddenly, for instance, and seldom hears it from a distance. It is interesting to note that the composer achieved much of this effect with a 'wandering' technique where the microphone was moved quickly across the stereo field to create a sense of enhanced motion (Westerkamp 1994). Therefore, even the original recording technique can abstract a sound, essentially enhancing the sound without destroying its recognisability.

3. STRUCTURAL APPROACHES

It is probably both pointless and impossible to attempt to classify all of the structural approaches to soundscape composition, but there are clearly a few normative models which may serve as points of reference. These

models (which roughly correspond to each of the three *Presque Rien* works by Luc Ferrari) may be distinguished by the type of aural perspective on which they are based, namely:

- (1) fixed spatial perspective emphasising the flow of time, or a discrete series of fixed perspectives;
- (2) moving spatial perspective or journey emphasising a smoothly connected space/time flow;
- (3) variable spatial perspective emphasising a discontinuous space/time flow.

In the fixed perspective approach, it is the flow of sound events in time which determines the structure of the piece. Although there is an obvious sense in which this is true of all music, the importance of the time flow in this case is that the listener experiences this flow as created by the relationships between the sounds that are heard, as distinct from it being created by the apparent movement of the listener. In short, time is created by the movement of the sound, not that of the listener. We have already noted that the flow of time may be entirely unedited, or compressed from a longer duration. It may also be 'densified' by layering various segments from the same environment, either in stereo or in multi-channel reproduction. In my work, *Pendlerdrøm* (1997), all of the realistic sections in the octophonic version are created with four untransformed stereo recordings in Copenhagen train station taken from nearby points in the original recording, but layered as apparently simultaneous in four pairs of adjacent channels in the octophonic space. Admittedly, they portray the station as somewhat busier than it actually was at the time, but not to such a degree that the activity level seems implausible. In fact, such a densification of a recording may even seem *more* realistic to the listener since memory is known to shorten the experience of time when we are not paying particular attention to specific events. When recordings with a well-defined stereophonic perspective are placed in separate loudspeakers surrounding the listener, a highly realistic impression of being inside that space is experienced (Traux 1998).

The fixed perspective approach can be greatly enhanced by the inclusion of a narrative, poetic or oral history component. Whether it is accompanied by a fixed ambience (such as the train in Glenn Gould's *Idea of North*) or multiple layers of other sounds, the narrative component anchors the piece to an implicitly fixed location. In Sabine Breitsameter's *The Hidden Tune*, on the *Soundscape Vancouver 1996* CD, the female voice and the West Coast Indian voice provide separate but complementary commentaries on the pre-industrial soundscape of the city. Darren Copeland's *Recharting The Senses* from the same CD uses the voices of blind people to convey the sense of aural orientation (and disorientation) they experience in society. The poetry of Norbert Ruebsaat similarly anchors Hildegard Westerkamp's *A Walk Through the City* (1981), despite the

innovative use of different aural perspectives with the writer's voice, ranging from close-miked whispering to distantly miked shouting. In Andra McCartney's short work, *Arcade '94*, the vulnerable-sounding teenagers' voices mixed with the heavy video arcade ambience establishes a clear commentary on the social situation.

Finally, the fixed perspective approach may include a series of such perspectives in succession where the transitions between them are too rapid or ill-defined to create a sense of travel. The film cut may well be a reference here, and sound editing can be equally abrupt, but in practice most soundscape composers seem to prefer less drastic transitions, perhaps because they have no counterpart in the acoustic world. Acousmatic composers are well known to favour doors and their associated sounds as transitional cues, probably because they create the aural experience of a quickly changing acoustic perspective. Given listeners' familiarity with the technique of the cross-fade between sounds and images in audio-visual media, transitions do not seem to pose a problem for most listeners, even though there may be no apparent rational explanation for them.

In Hildegard Westerkamp's *Talking Rain* (1997), the transitions between the opening rain forest scenes are accomplished with the passing of a car on a wet pavement sweeping across the stereo field. This might seem incongruous at first, but later in the work, the aural scene changes equally abruptly to a rain-soaked city street with a predictably dramatic shift of character which has been presaged by these earlier cues (MacCormac 1999). My extended work, *Island* (2000), is constructed entirely around a series of six scenes, with approximately 30' transitions between them. The overall premise is a visit to a magical island of the mind where highly realistic sounds (in the octophonic format described above) are combined with digital transformations of one or more elements of each environment in order to create a sense of mystery and symbolism. The six scenes centre around delicate waves on a shoreline, a rapidly moving stream (the only section where the listener may appear to be actively in motion), a resonant cistern or cave, a windy mountain lake, a cricket-filled night-time forest, and finally a windy shoreline with a strong wave surge. It seemed unnecessary to provide any aural clues such as footsteps between scenes since the transitions (particularly from the cistern to the lake) are just as arbitrary as the total duration of the 'visit' (19').

In each scene, one or two of the elements of the realistic soundscape are abstracted through transformation to create the sense of magic in the scene. For instance, low-pass and high-pass versions of the waves at the start and end of the piece are used to activate a resonator with a high degree of feedback, creating a drone for the low-pitched sounds and a delicate grainy texture at the other end of the spectrum. Only the macro rhythm of the waves stimulating the resonator betrays the origin of the

sound. Similar resonators are used in the river and cistern scenes to enhance the timbre of the water sounds, which in the latter case are drops falling into a naturally resonant space (the original recording being in a well). A stretched version of these resonated sounds creates a choral-like texture at key points. In the mountain lake scene, the cry of a passing raven is slowed down (and transposed down a fifth) and some of the chattering squirrels are similarly enhanced. In the night-time forest, analogous treatments are given to a passing mosquito and the chirping crickets, respectively. Having heard the very slow, low-pitched drone of the transformed mosquito moving around the octophonic space for three minutes, the listener may be startled to hear the original mosquito recording (which appears twice) where it buzzed rapidly past the microphones in a characteristic trajectory. Because each auditory scene is essentially static (except for the river where overlapping twelve-second segments of the water sound rush past the listener on either side), the listener is free to concentrate on how the flow of original and transformed sounds creates its own mood and symbolism. The effect may be similar to the experience of meditation where one releases all intentionality and the mind remains open to whatever may occur.

3.1. The moving perspective

The narrative, the epic, the myth and the novel have always entranced people with the experience of a journey, whether literal in the sense of an adventure, psychological in the sense of the developmental stages of life, or symbolic in the sense of conflict and resolution. Soundscape compositions that propose the illusion of a moving perspective may function at any or all of these levels. Motion is the very basis of sound, first at the level of vibration, then at the level of gesture or pattern, and finally at the macro level of longer term change, whether cyclic or otherwise. The auditory system is well equipped to deal with the detection of both motion in the environment and the dynamic motion of the listener relative to the environment. Philosophers have argued that the auditory sense is largely responsible for our experience of both time and space in ways that are unique (and complementary) to that created with our visual faculty. Therefore, the composer who creates the illusion of relative motion between the listener and the auditory space has a rich palette of meaning from which to draw.

It may not be coincidental that it was a recording project designed to depict motion and a journey during the preparation of the 1973 *Vancouver Soundscape* recordings that I have identified as being the beginnings of soundscape composition at SFU (Truax 1996). The subject was the 'Entry to the Harbour' track where the journey was supposed to take the listener from the entrance to Vancouver Harbour where an historical foghorn (the

Point Atkinson diaphone) was located, under the Lions Gate bridge with its traffic, past more buoys and smaller horns, into the inner harbour where the trip would end with the docking and unloading of a boat, and passengers greeting their waiting friends. In fact, such a ferry ride was possible at that time, though unfortunately discontinued today, given the spectacular approach to the city which it offered. A recording made on such a ferry trip was dominated by the boat's motor noise, and hence a simulation of the trip with characteristic foreshortening of its duration was proposed using studio techniques such as cross-fading and reverberation to produce the illusion of the various sounds approaching and receding. Listened to critically, the track has many irrational flaws such as the ambience of lapping waves which suggests a shoreline perspective, not that of a boat. The transition to the docking scene is fairly rapid, and the overall duration of the piece is much too short for the space traversed. However, most listeners seem able and willing to suspend disbelief, perhaps aided by the experience of film sequences where stabilised aerial shots taken from a plane and jump cuts between parts of a trip give the viewer a similar sense of rapid travel. Provided with an itinerary of the route, a local listener can easily follow the tour, and others can imagine similar scenes. However, the overall aural trajectory of the work, from the large open space of the foghorn echoing off the mountains at the start to the confines of a small baggage room at the end allows the piece to be interpreted on a symbolic level, either as the evolution of city over time (from mill town to metropolis), or the geographic tension between urban growth and forested wilderness. Whatever the interpretation, the hand of the composer became more evident in soundscape composition with this work.

The techniques for simulating motion are not limited to those imitating the real world, such as the cross-fade for motion away from one source toward another (with a change of the ratio of direct to reverberated sound as an added clue if appropriate), or stereo panning for lateral motion (a notoriously unstable cue with loudspeaker reproduction). The apparent motion may be from a realistic sound towards an abstracted version of it, or vice versa. Here the classical studio technique called the parallel circuit and its variants are useful. In analog studio practice, the parallel circuit involved splitting the original signal into identical copies, each of which could be processed separately. Normally, an unprocessed copy was preserved and each of the transformed versions was brought back into a mixer on separate channels so that any combination of all the independent versions could be mixed, usually dynamically. Realising this circuit today using multitrack software is rarely done because of the large number of tracks it would require. Moreover, to create dynamic signal processing on each version and a dynamic mix of all of the versions together is also beyond the capabilities of the standard digital

ambiences in the eight-track mix while these transitions are taking over, and only fading them out slowly eases the listener into the transformed soundscape.

Likewise, when the time comes to emerge from the daydream and re-enter the realistic soundscape, there is another fairly long period of overlap between them, the two transitions mirroring the experience of 'drifting off' and 'waking up'. The second and final such awakening is triggered by the announcement of the commuter's station on the P.A. system, but is answered by a highly enlarged and resonated version of one of the slams of a train compartment door heard earlier in the piece, suggesting the experience of 'waking with a start'. In fact, during the second daydream sequence in *Pendlerdrøm*, what is called the 'waterfall effect' in memory (i.e. where recently heard events are repeated in one's head) is imitated as well. Sound fragments that were heard embedded in the realistic portions of the soundscape return in resonated loops, such as the disembodied voice from the P.A. system making announcements, the brakes of the train, and various electronic signals. In short, the soundscape composition deals not only with listeners' abilities to identify and make sense out of acoustic environments and how they change, but also with the patterns and habits of listening and memory. The effect is to immerse the listener, particularly with the octophonic format, in soundscapes that range from the plausible to the highly abstracted with the possibility of smooth transitions between them.

3.2. Variable perspective

Not surprisingly, soundscape composers often depart from the fixed or moving perspectives that have clear analogues in the real world, and invent new ways of organising and presenting their material. Sometimes the perspective changes too rapidly to suggest plausible actual movement, or else multiple 'scenes' are presented simultaneously. The fact that the latter approach can work within the genre of the soundscape composition is probably due in part to listeners being familiar with 'schizophonic' listening situations, that is, where one or more sounds are embedded within an arbitrary soundscape via loudspeakers (Truax 1992b, 2000). Although such disembodiment once seemed to prove 'the magic of technology', and R. Murray Schafer pointed to the 'nervousness' of this experience (Schafer 1969, 1977), its familiarity, even banality in daily life, has progressed to the point where the consumer expects to be able to choose an audio environment in which to be embedded via such 'accompaniment media' as the radio, CD player, Walkman or Discman (Truax 2001). Moreover, listeners are competent to decode multiple such embeddings of sounds that originated at widely varying times and places as long as there appears to be a logical order to their combination. Even conflicting and overlapping occurrences can be tolerated, even if attention to any one

element is difficult. In short, there seems to be no inherent limit to the degree of complication of contemporary audio environments. The problem they present to the composer is how to avoid the inevitable 'tuning out' response by the listener, assuming that the opposite listening stance is desired.

Today's standard multi-track editing approach facilitates the creation of simultaneous layers of arbitrary sound events and ambiances. The fact that they do not create a coherent *single* image of a soundscape, but rather a complex imaginary one, does not prevent the technique from producing work that has similar aims to those of other, more realistic forms of soundscape composition. These works may be conceived as radio dramas, such as David Kolber's work, *In God's Country*, realised at SFU, where simulated radio broadcasts, quotations of historical speeches, period music, and 'interior' memories and imaginary characters overlay the naturalistic dialogue between the two main characters. An extended case in point is Claude Schryer's *Vancouver Soundscape Revisited* (1996) which is comprised of nine sections, each with its own title and theme. The overall organisational scheme is that there are two groups of four sections, all produced with multiple sound sources, separated by a short sequence described as 'quiet footsteps in the forest', presumably to contrast with the heavily layered sections before and after.

Schryer's compositional style is poised between the acousmatic and the soundscape approaches. He describes his process with this piece as starting with editing and cataloguing various sequences from the WSP library according to 'spectrum, category, function, pitch and context'. He then experimented with various combinations and modifications of the material until, as he puts it in the published programme notes, 'an interesting "sonic alchemy" was found'. By this we can assume that some perceptual, conceptual, or perhaps just intuitive, connection was used to link the wide variety of sounds found in each section. For instance, in the second and longest section called 'Fire', just under four minutes in duration, we hear Chinese firecrackers, folk-dancing, Krishna musicians, a baseball game, tennis, church bells, a mechanical piano, gulls in the harbour, the nine o'clock gun, electronic telephone, Main Street bus, and a large number of natural and processed boat horns and sirens. How are we to make sense of such a diverse repertoire? If we take the title as a clue, only the first sound, the firecrackers, is a literal referent, and so we might hear the sequence as a stream of associations with somewhat tenuous links – celebration to dancing, music, sports, a detour via the harbour, and back to various transportation sounds, all of which are pitched and have characteristic rhythmic patterns. The matching of pitches takes a humorous turn in the next section, 'Dronesong', where boat horns complete the song of a drunken singer whose final note is well known from its appearance on

audio workstation, though it could be simulated with a digital mixer that has a large number of auxiliary send lines. However it might be realised, the technique provides an efficient way to suggest 'motion' between an original sound and a potentially complex, abstracted extension. The opening sequence of my piece, *The Blind Man*, for instance, transforms the bells of Salzburg Cathedral as recorded by the WSP into a complex filtered version that emphasises their sustained partials while eliminating most of their attack character, hence suggesting a parallel to a line of Norbert Ruebsaat's title poem, 'already it has come / and is leaving again'. The work was realised in the electroacoustic music studio in Bourges, France, where separate banks of filters could be assigned to both the left and right channel signals independently, thereby allowing a large number of bell partials to be isolated and mixed on each channel, blurring the original sound but somehow recalling it.

A variation on the parallel circuit approach is to layer a part of a sound with the whole. One of the most difficult challenges in soundscape composition arises with recordings of complex soundscapes which contain many simultaneous sources. With good reason, the acousmatic approach avoided this problem by using closely miked 'sound objects' which were acoustically isolated in the recording studio. The soundscape recordist can also choose to mike certain sources more closely and hence be able to work with a specific sound independently of others in the environment (Copeland 1995). The individual processed sound can even be re-mixed with an ambient recording where with careful equalisation and mixing levels it can become integrated within a coherent soundscape, yet be individually controllable. Jack Body's early work, *Musik Dari Jalan* (1974), based on the cries and sound signals of Indonesian street vendors, cleverly alternates between treating these sounds as isolated sound objects subject to studio manipulation, and embedding them within a characteristic street ambience, the transitions between these two treatments being perhaps the most fascinating moments of the piece.

Traditional signal processing techniques can only isolate a component sound from a complex whole when the desired and undesired components occupy different frequency ranges (i.e. through filtering) or signal level ranges (i.e. through an expander or gate where low-level background sounds may be eliminated, for instance). However, when a particular sound event in a soundscape is loud enough, even if momentarily, it will mask the surrounding ambience and therefore can be extracted by editing. When this is done at the micro level of granular synthesis, the brief sound sample is enveloped to prevent a transient click from being introduced, thereby allowing arbitrary re-combination of grains for purposes of time stretching, for instance. At the macro level, careful editing allows a longer segment of a sound to be looped without a noticeable transient. These two techniques suggest two possible approaches to creating a smooth

transition between an original sound and its transformed extension. The first is to layer the original with a granulated layer that is synchronised but unstretched, then subsequently stretched, for instance during the steady state and/or decay of the sound. The second approach is to layer the original sound with a loop of the 'part' which is subsequently processed.

Both techniques are used at the opening of my soundscape composition, *La Sera di Benevento* (1999), a piece about a small Italian village near Naples during a hot afternoon. For a loop to remain plausible, it must exploit the listener's familiarity with repetitive sounds in the environment, the most obvious examples being those produced by machines. *La Sera* opens with a train arriving at the local station. It sounds its whistle (at 12") and at a certain moment in the original recording (29" in the piece) there is a clearly audible squeaking sound produced by the train, and it is this sound which I have looped and mixed with the original recording where in fact the squeak was not heard again. However, a repetitive sound associated with a moving train is plausible enough to convince most listeners that it is naturally occurring. As it becomes established, another blast of the train whistle is heard, but because it is brief, only the most perceptive listener will notice that it has been granulated and now has some texture. However, when it is repeated, it is stretched dramatically (by a factor of forty) such that its pitch becomes part of a steady texture, one that all listeners will realise is a transformed sound. In fact it is the third transformation, the first two (the squeaky loop and the granulated but unstretched whistle) having been seamlessly integrated into the soundscape. The purpose of this 'deception' is to make the transition to the processed soundscape as smooth as possible. The processing involves tuning the pitch of the whistle to the resonant frequencies imposed on the train sounds which are combined with a stretched version.

The moving perspective in *La Sera di Benevento* and *Pendlerdrøm* is not only a physical movement in the space (from the train station to a piazza with a fountain in the first case, and within the train station into a local commuter train in the second case), but also a movement in attention from the outer world to the inner world of the daydream. The blurring of the auditory image with the abstracted transformed sounds easily suggests this transition. The larger social context of the Italian siesta and the commuter's habituation to the daily travel also suggests the naturalness of these dreamlike sections. With *Pendlerdrøm* a similar technique was used for the transitions, namely a loop based on characteristic train sounds. In the first transition (2:30–3:00), it is the repetitive left-to-right passing of the cars of the train across the stereo field, along with the characteristic 'thump-thump' rhythm of the wheels on the track. In the second transition (7:00–7:30), the loop is made from the same accelerating rhythm of the commuter train recorded inside the compartment. Keeping some of the realistic

the earlier *Vancouver Soundscape* recordings. A similarly humorous juxtaposition occurs in 'Beans' where the commentator on the Grouse Mountain gondola refers to the spectacular view of Vancouver, and the listener is treated instead to a barrage of city noise. Other sections, such as 'Noise', 'Industry' and 'Horn' follow the aural theme of their title, but in every mix there is an intricate interplay between sound and image where musical juxtapositions combine with soundscape associations.

4. CONCLUSION

The soundscape composition, as pioneered at Simon Fraser University since the early 1970s, has evolved rapidly to explore a full range of approaches from the 'found sound' representation of acoustic environments through to the incorporation of highly abstracted sonic transformations. The structural approaches similarly range from being analogues of real-world experience, such as listening from a fixed spatial perspective or moving through a connected series of acoustic spaces, to those that mirror both nonlinear mental experiences of memory recall, dreams, and free association, as well as artificial sonic constructs made familiar and possible by modern 'schizophonic' audio techniques of sonic layering and embedding. The octophonic surround-sound playback format as used in contemporary soundscape presentations has achieved a remarkable sense of immersion in a recreated or imaginary sonic environment. Not surprisingly, audience response to such concerts has been markedly more enthusiastic than to conventional stereophonic presentations. The increasing interest of composers in this genre, supported by the ongoing development of sophisticated digital audio tools, both for sound design and projection, suggests that many future developments are in store.

At present, soundscape composers rely on high-quality recordings of environmental sound as source material, since no synthesis methods have been devised which can produce realistic environmental sounds (as distinct from speech and musical instrument synthesis which have received more attention). However, following the micro-level approach of granular synthesis and wavelet analysis/resynthesis methods, current research directions may very well provide in the future the basis for an approach that differs from real-world sampling. Micro-level control of frequency, time and spatial properties may become integrated into specific methods of sound design, thereby allowing complex sounds and sound environments to be precisely controlled and generated (Keller and Truax 1998). Damián Keller's work ... *soretas de punta* (1998), and his larger piece, *touch 'n' go / toco y me voy* (1999), show the potential of this direction (Keller 2000). The simulation of arbitrary soundscapes with real-world realism (and its extensions) would serve more than aesthetic purposes. For instance, simulated sonic environments for studying

and training the blind and hard of hearing would become possible, as well as the more obvious educational and entertainment applications which, to date, have been dominated by the visual aspects of 'virtual reality' simulations supported by fairly low-level auditory cues, usually heard on headphones. Soundscape composition presents an interdisciplinary challenge to its developers, both in terms of research and its designed applications. But the question remains whether its practice will further isolate individuals in surrogate realities, or fulfil the original goals of the World Soundscape Project in attuning listeners to the importance and subtle complexities of acoustic ecology. It is here that its practitioners can have an important influence.

REFERENCES

- Copeland, D. 1995. Cruising for a fixing in this 'art of fixed sounds'. *Musicworks* 61: 51-3.
- Emmerson, S. 1986. The relation of language to materials. In S. Emmerson (ed.) *The Language of Electroacoustic Music*. London: Macmillan.
- Keller, D. 2000. Compositional processes from an ecological perspective. *Leonardo Music Journal* 10: 55-60.
- Keller, D., and Truax, B. 1998. Ecologically-based granular synthesis. *Proc. of the Int. Computer Music Conf.* Ann Arbor, MI: ICMA.
- MacCormac, S. 1999. Conversing with nature: Reflections on Hildegard Westerkamp's *Talking Rain*. *Musicworks* 74: 8-13.
- McCartney, A. 1998. Soundwalking in the park with Hildegard Westerkamp. *Musicworks* 72: 6-15.
- Schafer, R. M. 1969. *The New Soundscape*. Vienna: Universal Edition.
- Schafer, R. M. 1977. *The Tuning of the World*. New York: Knopf.
- Truax, B. 1984. *Acoustic Communication*. Norwood, NJ: Ablex Publishing Corporation. 2nd edition, 2001.
- Truax, B. 1988. Real-time granular synthesis with a digital signal processor. *Computer Music Journal* 12(2): 14-26.
- Truax, B. 1990. Composing with real-time granular sound. *Perspectives of New Music* 28(2): 120-34.
- Truax, B. 1992a. Composing with time-shifted environmental sound. *Leonardo Music Journal* 2(1): 37-40.
- Truax, B. 1992b. Electroacoustic music and the soundscape: the inner and outer world. In J. Paynter, T. Howell, R. Orton and P. Seymour (eds.) *Companion to Contemporary Musical Thought*, pp. 374-98. London: Routledge.
- Truax, B. 1994a. The inner and outer complexity of music. *Perspectives of New Music* 32(1): 176-93.
- Truax, B. 1994b. Discovering inner complexity: Time-shifting and transposition with a real-time granulation technique. *Computer Music Journal* 18(2): 38-48 (sound sheet examples in 18(1)).
- Truax, B. 1996. Soundscape, acoustic communication & environmental sound composition. *Contemporary Music Review* 15(1): 49-65.
- Truax, B. 1998. Composition and diffusion: space in sound in space. *Organised Sound* 3(2): 141-6.

- Truax, B. 2000. The aesthetics of computer music: a questionable concept reconsidered. *Organised Sound* 5(3): 119–26.
- Truax, B. 2001. *Acoustic Communication*, 2nd edition. Westport, CT: Ablex Publishing.
- Westerkamp, H. 1994. The soundscape on radio. In D. Augaitis and D. Lander (eds.) *Radio Rethink*. Banff, Alberta: Walter Phillips Gallery.
- Wishart, T. 1986. Sound symbols and landscapes. In S. Emmerson (ed.) *The Language of Electroacoustic Music*. London: Macmillan.
- Wishart, T. 1996. *On Sonic Art*. S. Emmerson (ed.). Harwood Academic Publishers.

DISCOGRAPHY

- Keller, Damián. 1998. *Harangue II*. Earsay productions, ES98005 (... *soretes de punta*).
- Keller, Damián. 1999. *Touch 'n' go / Toco y me voy*. Enhanced compact disc. Earsay productions, ES99002.
- McCartney, Andra. 1995. *DISContact! II*. Canadian Electroacoustic Community (*Arcade '94*).
- Schryer, Claude. 1997. *Autour*. Empreintes Digitales, IMED 9736 (*Vancouver Soundscape Revisited*).
- Truax, Barry. 1987. *Digital Soundscapes*. Cambridge Street Publishing, CSR-CD 8701 (*The Blind Man*).

- Truax, Barry. 1991. *Pacific Rim*. Cambridge Street Publishing, CSR-CD 9101 (*Pacific*).
- Truax, Barry. 1994. *Song of Songs*. Cambridge Street Publishing, CSR-CD 9401 (*Basilica, Song of Songs*).
- Truax, Barry. 2001. *Islands*. Cambridge Street Publishing, CSR-CD 0101 (*Pacific Fanfare; Pendlerdrøm; La Sera di Benevento; Dominion; Island*).
- Westerkamp, Hildegard. 1996. *Transformations*. Empreintes Digitales, IMED 9631 (*A Walk Through the City; Fantasie for Horns; Kits Beach Soundwalk; Cricket Voice; Beneath The Forest Floor*).
- Westerkamp, Hildegard. 1998. *Harangue I*. Earsay Productions, ES98001 (*Talking Rain*).
- Westerkamp, Hildegard. 1998. *Harangue II*. Earsay productions, ES98005 (*Gently Penetrating*).
- World Soundscape Project. 1997. *The Vancouver Soundscape 1973 / Soundscape Vancouver 1996*. Cambridge Street Publishing, CSR-2CD 9701.

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