BETWEEN THE REAL AND THE IMAGINARY: ECOSTRUCTURAL APPROACHES TO COMPOSING WITH FIELD RECORDINGS AND ACOUSTIC INSTRUMENTS

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ABSTRACT
This paper discusses recent works incorporating field recordings and acoustic instruments by four Western Australian composers: Sam Gillies, Josten Myburgh, Michael Terren and Lindsay Vickery. In particular, the paper investigates their approaches to issues and techniques of spectral analysis, sonification, coordination of live and prerecorded elements, transcription, resynthesis, transformation and ecostructural considerations. The discussion is framed by an examination of the evolution of the practice of combining field recordings and acoustic instruments as a genre in the context of ideological and technological advancements and impediments. The works are placed in the framework of emerging digital technologies deployed in similar work by James O’Callaghan, Aaron Einbond, Joanna Bailie and Chaz Underriner.

1. INTRODUCTION
Although non-anthropogenic audio was first recorded as early as 1889 (Ranft 1997), the inclusion of environmental recordings into mainstream “concert music” has been slow and piecemeal. The question of how to define the sounds of the environment in relation to ‘music’ has had at least an equally tortuous journey. Perhaps key to this question are the expansion of the ideological framework of “music” and the development of audio technologies that have eroded the distinction between natural/artificial and representational/abstract dichotomies in music.

The use of field recordings in conjunction with, in parallel with, or in counterpoint with acoustic instruments implies a divide between extra-musical, non-aesthetic nature; and the musical, aesthetic human. This human-nature binary, which implies a fundamental typological segregation of humans from nature, informs much of the twentieth century theorisation on the experience of sound and listening.

The steady advances of recording technology have achieved an intrinsic levelling of the listening experience, that has habituated listeners to Cage’s formerly experimental goal “to let the sounds be themselves” (Kostelanetz 1988 p. 42). However, composers and performers were impeded from interaction with ‘extra-musical’ (O’Callaghan 2011) sounds by ideological constraints arising from Modernism. The manner in which humans have emulated the ‘extra-musical’ sounds of the sonic environment as composers and as performers is perhaps the best illustration of the changing ideological framework in which they have been are heard. The shift has seen an attempt to elevate the structure and morphology of natural sounds beyond the manipulations of human-derived aesthetics and formed the basis for what Opie and Brown define as an Eco-structural approach in which structural data derived from environmental sound sources “are used as the dominant material for creating the musical composition” (2006).

In 2014 composer Joanna Bailie asked “If we are not to simply present the sounds of the world to an audience as a kind of musical fait accompli (…), what in fact are we to do with them?” (p. 101). This paper describes a number of techniques developed by four Western Australian composers to answer this question.

2. THE IDEOLOGICAL AND TECHNOLOGICAL EVOLUTION OF FIELD RECORDING PRACTICE
It appeared that when Russolo declared in 1913, “we must break at all cost from this restrictive circle of pure sounds and conquer the infinite variety of noise-sounds (1913 p. 6), that the barriers between music and “noise-sound” were irrevocably breached. However, Futurism’s ideological opposition to the pastoral preoccupations of Romanticism disfavoured the emulation of all but the most active-negative sounds: his examples include, “shouts, screams, snorts, wails, buzzings, percussive noises, howls, death rattles, sob’s” (ibid. p. 10). Indeed, Russolo states the “nature is normally silent” (ibid p. 4). Perhaps unsurprisingly, it was Respighi, a remnant of the Romantic Era, who first employed a field recording in conjunction with acoustic instruments in the

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Orchestrional work *Pini Di Roma* (1925). The inclusion of a gramophone recording of a nightingale can best be described as decorative and even as such was criticized at the time for eschewing the adaptation into ‘musical’ language: “composers should credit their hearers with brains and a little fancy.” (Reilly 1960 p. 248).

The Second World War brought the new technology of magnetic tape and in the hands of Schaefer, Henry and other Musique Concrète composers, a new bridge between composers and extra musical sound might have been expected. However a new ideological impediment arose, that of abstraction. While the acousmatic concepts developed by Schaeffer were arguably necessary and welcome, “they emphasized the ‘formal or ‘intra-musical’ aspects of sound, eschewing sound-identities as ‘extra-musical’ elements which hinder the somehow more refined process of ‘reduced listening’” (O’Callaghan 2011 p. 57).

The use of what would now be termed field recordings comprised of recognizable sonic objects in early works such as *Étude Aux Chemin de Fer* (1948), quickly gave way to what was literally a ‘Voil of Orpheus’ (1952): acousmatic works comprising abstracted recordings shorn of their relationship to their sonic origin. So strong was the magnetism of the Avant Garde, that Schaeffer and Poullin initially developed a keyboard-controlled device capable of replaying tape loops in equally tempered steps (Behnen 2008).

However Musique Concrète did much to lift the constraints of the metrical/chromatic grid imposed by traditional music notation and led to a re-evaluation of acoustic instrumental performance. In the “Musique Concrète Instrumentale” of Lachenmann that sought to illuminate “instrumental sounds as mechanical processes” (Lachenmann 1996 p. 212) and Free Improvisation (Bailey 1993) a new space was opened for the emulation of natural sounds with “extended techniques” that exponentially expanded the timbral pallet of acoustic instruments.

The breakdown of Avant Garde dogma in the late 1960s that issued in the Postmodernist era arguably dissolved the final barrier to the embrace of “extra-musical” sound. The rupture is dramatically illustrated by Ferrari’s *Presque rien ou le lever du jour au bord de la mer* (1967–70), which he claimed consisted of an “unretouched recording of morning in a fishing village by the Black Sea” (Drott 2009 p. 145). Normandeau describes the incredulity with which it was greeted: “And everyone was shocked. It was a big debate: Was that music? Where does it stop? Where are the boundaries?” (Woloshyn 2011). The boundaries at which “music stopped” were shifting. In Acousmatic music and in instrumental music the “two-dimensional lattice” (Wishart 1996:23) on which music had been hung was dissolving.

Robert Erickson (1917) was perhaps the first to propose a path forward for the genre with his works *Pacific Sirens* [1968] and 9 1/2 for Henry (and Wilbur and Orville) [1970] both for instruments and field recordings of the ocean and human transportation respectively, and scores based on spectrographic analysis of their sonic features. In 1987 he wrote of the process that the stimulus for his music “is usually some noise or some non-music sound composing the environment in which I live, its sounds, its ambience, noting that many others “Compose against it, or in spite of it or never-the-less” (Dunbar and Erickson). His *Sound Structure in Music* (1975) was one of the first extended discussions of the spectrogram as a means for analytical engagement with the timbral complexity of sound.

*Pacific Sirens* employed proportional notation, with an external time source (stopwatches), together with a transcription of sound/frequency morphologies (presumably taken from a spectrogram) and directed the “improvising” performer’s to “listen into” “the spectral complexes of the environmental noise and appropriately blend and protrude” (Mackay 2007 p. 27). Timbral and spatial qualities of the sound are not scored and the frequencies of the field recording are overlaid against a staff that, in part as a result of the filtering processes applied to the field recording, does not include sharps of flats (Fig. 1).

Figure 1. Robert Erickson *Pacific Sirens* [1968].

Likewise, Alvin Lucier’s (1931) (Hartford) Memory Space (1970), continuing the trajectory of “Musique Concrète Instrumentale”, invited the performer to enter into and later return to an “inside performance space” and emulate the ‘language’ of “urban, rural, hostile, benign” ‘extra-musical sounds’ (Lucier and Simon 1980).

In 1972 R. Murray Schafer (1933), Hildegard Westerkamp (1946) and Barry Truax (1947) created the Vancouver World Soundscape Project (1972) at Simon Fraser University, identifying field recordings as art-works in themselves. This was perhaps reflected the ideological the resurgence of the Environmental Movement following the publication of modern foundational texts such as Rachael Carson’s *Silent Spring* (1962) (dealing with the effects of man-made pollutants on wildlife) and Paul Ehrlich’s *The Population Bomb* (1968) – (concerned with the impact of the exponential growth of the human population).

The term “Soundscape” was invented in 1967 by Schafer (Schafer 2006) and his colleague Westerkamp noted that compositions based on soundscape recording should be “rooted in themes of the sound environment” (Westerkamp, 2002: 53).

This is an important distinction, elevating the structure and morphology of natural sounds beyond the manipulations of human-derived aesthetics, signalling

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engagement with identifiable ‘extra-musical’ sounds in field recordings on their own terms rather than abstraction of them into pre-existing ‘musical’ schemas. It is not a coincidence that this final ideological shift coincided with the advent of the Postmodernist era and rejection of Modernist dogma. The shift from analog to digital recording also provided crucial new tools for analyzing field recordings with a grid finer than that of human perception. The spectrogram allowed for the analysis and “visual representation of sonic events that were extremely difficult to capture with traditional notation, and for much more precise emulation of continuous timbral features with acoustic instruments through “instrumental synthesis” (Grisey 2000). Although not specifically concerned with field recordings, Spectral Music, “deriving fields of musical relations from sound itself” (Pressnitzer 1999 p. 3) was perhaps more predisposed to the investigation of environmental sounds. The alignment of ideology and technology that had occurred by the 1990s provided the foundation for what can be considered contemporary practice in this genre and formed the basis for what was later termed Eco-structuralism in which “structures must be derived from natural sound sources” (Opie and Brown 2006). Barry Truax’ Dominion [1991] for Chamber Orchestra and two digital soundtracks combining field recordings, spectral analysis, granular synthesis and instrumental transcription is perhaps the seminal work for contemporary practice, which aims to allow complex human interaction with the ‘extra-musical’ soundworld.

3. APPROACHES TO COMBINING INSTRUMENTS AND FIELD RECORDINGS

Since the advent of the music involving live instruments and fixed media Bruno Maderna’s Musica su due Dimensioni (1952) (Neidhöfer 2007) composers have faced the issue of the absence of interaction between performer and tape, in which live performance nuances cannot be accommodated and performative visual cues found in ensemble playing are lacking. Field recordings can be particularly problematical to combine with live performers with for a number of reasons including the absence of metrical sign posts, free temperament, diversity of timbre and sonic morphology and particularly in the case of non anthropogenic sounds, extremes of frequency, and polyphonic and spatial density. The role of human performers, even when they are performing with instruments designed to replicate environmental sounds, for example the bird and insect calls of Kagel’s Bestiarium [1976], is at best emulative and mimetic in such works. Field recordings are always innately ‘human music’. They are ‘framed’ both physically by the technology that has excerpted them from the sonic environment and ideologically by the ideological frame (Goffman1975) with which they are perceived by the human listener. Finally, field recordings are always ‘human music’ because they are perceived, by human listeners, through the pre-semantic grouping and streaming filter of the auditory system (Bregman 1990). Di Scipio describes these circumstances as “irreducible listening” (Di Scipio 2015). In music in which the intention is the placement of instruments as a component of a field recording’s sonic world (as opposed to those in which instruments are deliberately placed in juxtaposition to it), the methods of coordination, transcription, resynthesis and transformation of the field recording are crucial, “as modifying these can either break the sound into two or more streams or merge it with other streams, which can be distracting and reduce ecological validity (Mechtley 2013 p. 57). Development of techniques for enhancing and expanding this interaction is still in progress. A number of works by Western Australian composers exploring these issues are discussed here.

3.1. Coordination, Transcription and Notation

Composers have developed a number of practices to resolve the problem of synchronization between acoustic instruments and fixed media. Barry Truax’ Dominion [1991] (Fig. 2) for Chamber Orchestra and two digital soundtracks uses proportional traditional notation, temporally partitioned into 6 second “measures” and coordinated by a conductor using a “timer”. Principle sonic events are annotated (often with traditional notation) with descriptions of their source together and some indications of elements to emulate with extended techniques. Joanna Bailie’s Trains for solo cello and tape (2014) (Fig. 3) employs traditional notation with defined tempo/meter in conjunction with onset times for each phrase, while Chaz Underriner’s nocturne series: 1 for two electric guitars and field recording (2012) (Fig. 4) simply provides onset and duration times for notated musical events. Traditional notation has also been used by composers such as Hildegard Westerkamp Fantasie for Horns II [1979], in which equally tempered, metrical music is placed in the context of a field recording and more recently by Aaron Einbond whose Sonic Postcards series (2012-14) (Fig. 5) attempt to capture the complexity of the sonic environment through extended techniques, coordinating the performance via click-track. Myburgh’s works a window in Sicily [2016] for guitar and electronics and a painted mirror of nothing [2016] (Fig. 6) for clarinet and electronics, both influenced by the reductionist Wandelweiser composers employs the same method as Underriner (who is a member of that group). In Myburgh’s works the pitches and their ordering is chosen by intuition and temporally placed at defined periods in small groups. In a painted mirror of nothing, the instrument is an ‘eraser’ for the tones; as a tone is near disappearance, the instrument plays the same tone, and as the instrument disappears one becomes aware that the tone has disappeared as well. In a window in Sicily, because the tones and guitar are playing the same pitch, when the guitar enters its almost imperceptible: the sound of the guitar ‘colours’ the tones with a faint vibration, almost acting less as a sound in itself and more of a disturbance in the air. Richer
harmonies are used to create the impression of single tones emerging out of denser ones. These techniques focus the listener on sonic events as they appear and disappear.

While the electronics have an active role in this piece, much of the work can be performed like a ‘tape work’, there are opportunities to engage in improvisation, which are particularly important especially at the end. The guitarist is also asked to improvise with both melodic and noise-based material, and also needs to use an ebow and a small speaker. Myburgh argues that this approach results in fictional, yet somehow plausible, soundscapes created through obfuscating the (imaginary) source material.


Shelter began as a tape composition before being adapted to include acoustic instruments. The resulting score is coordinated via the Decibel ScorePlayer which is proportionally notated to respond to the sonic changes in the fixed electronics. The electronics were analysed for pitch and partial content using the IRCAM software Orchids (Carpentier et al. 2012) that provided clusters of tonal materials that were selected and arranged for the selected instrumentation of bass clarinet and electric guitar. Open notation is utilised to try to reduce the potential ‘musicality’ of a performance, and attenuate the performers to interacting with the sound world of Shelter. The notation centres a drone or constant pitch – the most relevant pitch or overtone evident in the electronic material, with optional pitches separated and placed throughout the score to provide the performers with different performance options, and the ability to exert a degree of control over which elements of the sound world are reinforced (Fig. 7).


Michael Terren’s As Rendered for flute, bass clarinet, piano, violin, cello and laptop (2014) (Fig. 8), Gillies Shelter for three instruments and electronics [2015-6] and Vickery’s works small waves raised by the evening [2016] for bass clarinet, electric guitar and harp and electronics, and nature forms II [2016] for flute, clarinet, viola, cello, percussion, hybrid field recording and electronics, bascule [2016] for ensemble and electronics utilize proportionally notated scores. The instruments are coordinated via synchronised scrolling
presentation in an iPad application, the Decibel Scoreplayer (Hope et al.), allowing the instrumentalist to see a visualisation of the sounds before they are performed (and sounded).

The notation in *As Rendered* is graphical and proportional, consisting of figures representing approximate pitch vertically. The sounds are colour-coded according to different timbral sonorities: red indicates a maximally noisy timbre, with no defined pitch; purple indicates a pure tone, played with as little noise as possible; brown-shaded figures are partially noisy, while retaining its tone; and pink figures indicate key noise or other small incidental noises.

In Vickery’s *nature forms II* (Fig. 9) the frequency/amplitude morphology of features of the field recording to be emulated by the performers is communicated by extracting shapes directly from the spectrogram, a process has previously termed the “spectral trace” (Vickery 2014b). The colour-coded parts are annotated with pitch, dynamics and articulation indications. The percussion part uses notation created by Vickery’s generative software work *The Semantics of Reduction* (2014), detected accents in the field recording, (in the case of this work the chirping of crickets) generate graphical symbols of varying vertical position, size and colour, determined by the frequency, amplitude and timbre of a speech recording at the accent point.

![Small waves: comparison between (a) field recording 339-899Hz and (b) piano performance 161-457Hz.](image)

**Figure 10: small waves**: comparison between (a) field recording 339-899Hz and (b) piano performance 161-457Hz.

Small waves draws on concepts and techniques developed in the composer’s *Lyrebird: Environment Player* (2014) in which spectral descriptor of the single strongest detected sinusoidal peak in a recording are represented by the vertical height, size, luminance, hue and saturation of rectangles drawn on a scrolling LCD object (in this case jit.lcd) (Vickery 2016). This process is used to transcribe bullfrog sounds that are emulated in unison by the three instruments. Figure 10 compares the field recording from which small waves was constructed with a pianist’s performance of the *Lyrebird* score, illustrating that pitch, rhythmic and dynamic contours of the bullfrog croaks from the field recording are adhered to with a great deal of precision (albeit an octave lower) (Fig. 10).

These works explore varied aspects of what O’Callaghan terms “mimetic instrumental resynthesis”: Not only do these works use ‘extra-musical’ source materials as the starting point of their analyses, but they also attempt to preserve aspects of the source sound through the transcriptive process to engage in a mimetic discourse (O’Callaghan 2015).

### 3.2. Resynthesis, Transformation and Spatialisation

The issue of emulating spatial qualities of the environment, in which there may be literally thousands of spatially distributed sound sources, within the frame of a musical work is particularly challenging.

In *Shelter*, Gillies aimed to limit formation of the spatial ‘sweet spot’, a phenomenon that confines the optimal listening position for the audience to a small region that is equidistant from each speaker in the array. His approach was to adopt a microsound aesthetic (Roads 2004), in particular drawing from Demers’ characterization of sound “recorded at soft volumes, so much so that playback at what one considers to be a normal volume is often inaudible” (2010, p.74).

Gillies’ focus was an inversion of this idea expressed by Roads in *Microsound* that as sounds become briefer, their amplitude must be increased for them to register audibly (2004, p. 22). The sound materials used vary from unprocessed field recordings to artificially created sounds using Max/MSP. SPAT was used to artificially place sounds in an artificial space, creating the impression of distance and then reduced them to extremely soft volumes, ranging from -20db to -55db. In this way SPAT was used to treat the sounds in a deliberately acoustical way, a process inspired by Francis Rumsey’s *SpatialAudio* (2001, p.35). The result was a very complex, very soft noise, consisting of many layers that the audience must utilize selective listening to navigate through.

The largest sounds in the piece (field recordings of a rainy courtyard) were the most obscured. By placing these sounds at a great distance and facing them away from the audience, via SPAT, Gillies was able to turn a signifier of location and space into indeterminate background noise: the closest sound to the audience was also the smallest - a DSP click. This popping sound creates a frame of reference for the audience's comprehension of the other sounds in the piece and each repetition is quickly masked by a granular treatment of the same sound at a much lower volume.

The second half of the work follows after a sharp cut to digital silence. Gillies initially planned to cut to harsh noise, however after reading Richard Chartier's discussion of digital silence: “The advent of digital audio has greatly increased what composers can do in terms of using the aspect of silence as a compositional element Where it really is silent ... With digital silence there's nothing. An absolute zero = no code.” (Boon 2002). It was decided that silence could, in this context, be just as shocking and carry the same intensity as a blast of noise. One of the familiar drones continues on
to give a connection to the first half, however we also have the introduction of new material is also introduced that occupies the hitherto unexplored bass range. Bass frequencies were deliberately chosen for their quality inside the EMS 8-channel studio - the greater wavelength of bass frequencies makes it much harder to gain a sense of directionality within the studio space, creating a fullness and intensity without adding more sound.

Ultimately, Shelter seeks to engage with a microsound aesthetic to create an equal listening environment for every audience member. By working with softer volumes, the importance is shifted to the audience’s own listening process, thereby reducing the importance of listening in a more central position.

In both a painted mirror of nothing and a window in Sicily, Myburgh uses three basic materials: field recordings, noise, and sine tones. Although the temporal integrity of the field recordings in both works is retained, the recording is heavily processed in a painted mirror by a high-pass filter running through the distortion/wave-shaping iZotope’s logic plug-in Thrash2.

Pink and white noise is run through various chaotic processes (of the composer’s design), complex wave shaping or both. The noises the sounds at the extremes of complexity, whilst the oscillators and recordings exist in the simplest form possible.

Terren’s As Rendered was an attempt to create a notional, chimeric ecological soundscape using traditional classical instruments and a chaotic computer-synthesis framework. Inspired by Brian Eno’s thought experiment of learning a field recording “exactly as one would a piece of music” (Toop, 1995 p. 129), the work is loosely structured yet highly determinate, using Terren’s own field recordings and noise improvisations as semiotic material. As Rendered cautiously embraces an element of fantasy in the representation of a plausible acoustic ecology, in which the medium of its transmission obfuscates its realistic qualities.

Using field recordings and noise improvisations as loose material for acoustic instruments to play, there is inevitably a distortion brought about by this transmedial process, and this distortion undeniably has a degree of complexity across time akin to the dialogue surrounding mid-20th century developments in chaos theory.

In As Rendered Terren uses a laptop generating a chimeric, slightly fantastical soundscape as a supplement to the soundscape created by the acoustic instruments. This sound is synthesised in Max for Live in five morphologically distinct components. The process for generating the sounds was primarily inspired by the functional iterative synthesis as described by Agostino Di Scipio (Di Scipio 2002).

Vickery’s nature forms II used a number of approaches to sonification/resynthesis to produce “copies” of the field recording of bird sounds and a rusty gate, that were to different degrees timbrally varied but morphologically similar: the self-devised software Sinereader, which uses additive synthesis to resonify spectrogram images (Vickery 2014); Ring Modulation synthesis, where the strongest sinusoidal component detected each 40ms of the recording was then ring-modulated according to the currently detected spectral brightness of the recording; Subtractive synthesis using frequency and amplitude data detected in the recording to bandpass filter white-noise; and “spectral freezing” of components of the field recording to create spectrally derived chords from features of the recording. Similar methods were used to process the live signals from the three performers for example shaping “coloured noise” (Eimert 1955) into the sonic structure of the field recording using subtractive synthesis. The final work uses the source recording and its resynthesised copies as a means of generating structure based upon timbrally distinct sections (Fig. 11).

A less interventionist approach was taken in Vickery’s small waves, which combines components of the field recording of bullfrogs spectrally frozen, using Eric Lyon’s thresher object to highlight amplitudinally prominent frequencies, with the source recording.

![Figure 11](image-url)

**Figure 11.** Visual representation (inverted) of temporally proportional alignment of multiple resynthesis (a.-d.) and notation (e. – f) versions of the recording in nature forms II (excerpt): a. field recording spectrogram; b. ring modulation resynthesis spectrogram; c. subtractive synthesis spectrogram; d. spectral “freeze” sonogram/scoring; e. percussion score; and f. instrumental score.

This approach draws on the concepts underpinning Peter Ablinger’s “Phonorealism” works in the Quadraten series (Ablinger 2011), in which spectral analysis data from recordings is “reconstituted in various media:
instrumental ensembles, white noise, or computer-controlled player piano” (Barrett 2007). Spatial depth was emulated by separating sonic features in different frequency bands into multiple channels with a series of frequency tracking patches developed by the composer in MaxMSP. As no actual spatial data was derived from the stereo field recording, the channels were then to spatialised according to their frequency (azimuth) and amplitude (distance) in the object ambipanning.

Figure 12. Manual frequency tracking by annotating the spectrogram with multiple function objects to automate the centre frequency of bandpass filters.

A number approaches to frequency tracking were explored: manual frequency tracking, by annotating the spectrogram with multiple function objects and then retrieving the data by inputting the position of the audiofile as reported by snapshot to control the centre frequency of bandpass filters (Fig. 12); Automated frequency tracking controlling the bandpass filters’ centre frequency via frequencies derived from spectral analysis conducted using the sigmund object; and “ecological niche” tracking drawing on Krause’ theory which asserts that “animal and insect vocalisations tend to occupy small bands of frequencies leaving “spectral niches” (bands of little or no energy) into which the vocalisations (fundamental and formants) of other animals, birds or insects can fit.” (Wrightson 2000 p. 11). This theory would suggest that band passing at particular frequencies will tend to capture divergent features of the sonic environment, Audacity’s Plot Spectrum function (Mazzoni and Dannenberg 2002) (Fig. 13.) was used to determine the niche frequency bands in the recording and then bandpass filters were applied separately to each band.

These frequency tracking processes are similar to conventional Audio Expansion, however the complexity and the uniform spread of amplitudes from increasingly distant sources that are common in most field recordings, render poor results from conventional expansion. Perhaps unsurprisingly then, the manual method for frequency tracking proved to be the most effective of those explored.

It could be argued that manual designation of the band pass frequencies adds a ‘human’ layer to the process in contradiction to the eco-structural aims of deriving all data from the environment itself. However, the process is no less of an intervention than choosing sonic features to be emulated by acoustic instruments and indeed, in this case, was achieved through similar means: visual detection of features from a spectrogram. The approach is perhaps analogous to the ‘Cocktail Party Effect’ (Pollack and Pickett 1957) a feature of the human auditory perception in which conscious auditory attention allows for pre-semantic attenuation of signals in a complex environment.

Figure 13. Audacity’s “Plot Spectrum” function.

3.3 STRUCTURAL CONSIDERATIONS

Gillies’ Shelter aims to render the complex environmental phenomena of rainfall in a manner to an audience, essentially through two alternate resonifications.

In a window in Sicily, the intention is to portray the field recording like a three-dimensional shape that is viewed from six different perspectives. Each recording is from the same area in Palermo, Sicily, and in each recording one can hear distant echoes of the sounds that are the feature of other recordings; an announcing voice in a speaker rings distantly in one and in close proximity in another, different parts of a marketplace and different ‘characters’ can be heard as they loudly shout over one another, with each recording offering a new perspective on the space by attending to another individual source of sound. It is arranged in ten ‘moments’, all of which overlap, and range in duration from just over a minute to just under twelve.

In this way the field recordings attempt to allow one to listen to what is purely fascinating about the sonic situations in one place, but have a sort of ‘prismatic’ structure and the possibility for a narrative mode of listening across the piece; the listener can assemble a low-resolution image in their head of a larger location, rather than hearing one continuous field recording through the whole piece.

In this way the fact that the recordings are from Palermo is not as important as the way they are recorded; the unique location of the recording only offers the possibility for specific listeners to emotionally connect to the sounds in specific ways. The technique of changing ‘perspective’ offers a formal option that is incredibly difficult to effectively achieve with more abstract sounds.

In a painted mirror of nothing, the field recording is an extension of the noise; it is processed with similar wave shaping and faint elements of voices and sounds peer out of something more chaotic. The work is also all sourced from a single field recording sourced from the

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We have argued that although the opportunity for data derived either from manual processing and spatialisation of the performance using instruments of sonic features of the recording and live audio recording, the “human” sonification works is represented through the “fixed medium” of an on one hand and visual representations (spectrograms of the original data must remain in series”.

derived from natural sound sources” and that “structural based musical composition”: that “structures must be termed the “pr...happens in this work). As Rendered does not have an explicitly identifiable form. In sonifying environmental sound, Terren aimed to create an ecology whereby the sounds were wholly unpredictable at a micro level, but at a macro level were rather predictable and prosaic. The work starts and finishes without any fanfare—like a field recording, in which the recording device is turned on, then after twelve minutes, turned off (or with a short fade-out, as happens in this work).

nature forms II and small waves explore the notion of eco-structuralism, maintaining what Opie and Brown (2006) term the “primary rules” of “environmentally-based musical composition”: that “structures must be derived from natural sound sources” and that “structural data must remain in series”. In both works the structure of the original field recording is conserved through simultaneous reference to multiple aligned recordings on one hand and visual representations (spectrograms and scores) on the other. The structural data in these works is represented through the “fixed medium” of an audio recording, the “human” sonification by acoustic instruments of sonic features of the recording and live processing and spatialisation of the performance using data derived either from manual annotation or realtime analysis.

4. CONCLUSION
We have argued that although the opportunity for composers and performers to engage with the extra-musical sounds of field recordings existed from the advent of sound recording, this sonic world was ideologically antithetical to Modernism and for the most part remained unexplored until the advent of the anti-doctrinaire Postmodernist period.

It was also argued that technological developments, not least the changes wrought by recording on the act of listening, significantly set the stage for the exploration of field recordings that has occurred since the 1970s. The processes employed by the composers that are described in this paper constitute a set of possible approaches to engaging with field recordings in an eco-structural manner through machine and performative means. They provide a range of methodologies for interaction and manipulation field recordings through spectral analysis, processing and synchronisation of visual and sonic elements of the work.

As investigation into means of interacting with ‘extra-musical’ sound proceeds, it can be expected that interaction and engagement with field-recording will continue to deepen.

5. REFERENCES