PORTFOLIO OF ORIGINAL COMPOSITIONS

A thesis submitted to the University of Manchester for the degree of
Doctor of Philosophy
in the Faculty of Humanities

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CONSTANTIN POPP

SCHOOL OF ARTS, LANGUAGES AND CULTURES

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Contents of the Audio CDs and USB Flash Drive

The audio will be supplied on a USB flash drive and stereo versions on two audio CDs. The sound examples can only be found on the USB flash drive and will be referenced like "USB/compositions/piece/_examples/example.wav".

Audio CD 1

1. *stone and metal*
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3. *triptych*

USB Flash Drive

Audio and supportive files

All files are supplied in 44.1 kHz respectively 88.2 kHz, 24 bit, interleaved, wav-format. In case of the 44.1 kHz works oversampling has been used during processing and mixing.

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6. *beeps*, 44.1 kHz, including examples, stereo-version, technical rider
7. *triptych*, 44.1 kHz, including examples, stereo-version, technical rider
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Software[1]

1. PLib, SuperCollider Library, including PLib standalone application, tutorial video, technical information, extras
2. MANTIS Diffusion System, Max/MSP patch, including tutorial video, technical information

Final Word Count: 17131

[1] Each piece of software is supplied with its own readme.pdf which describes hardware requirements, the installation procedure and general instructions.

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Abstract

The PhD investigates the creation of closeness and immediacy through composition, exploring the processes of capturing, processing and composing sound materials, their spatialisation both during production and performance, and the sound materials' contexts. It is suggested that closeness can be understood spatially, temporally and in addition as being familiar with sounds and musical languages; whereas immediacy adds the meaning of being involved at some level in the shaping or decoding of the meaning of sounds of a composition. In that sense closeness and immediacy together form entry-points for the listener to make him/her become engaged in the compositional narrative.

Seven original acousmatic and mixed media works are presented in the portfolio. These are *stone and metal*, *empty rooms*, *weave/unravel*, *skalna*, *pulses*, *beeps* and *triptych*. The pieces rely on found sounds and their referential qualities, with both informing the compositional methodologies. They also borrow elements from soundscape composition, electronic music and film music. Over the development of the portfolio the inclusion of elements of other genres of music became a valuable source of inspiration and shaped the compositional methodology which lead to the development of a unique, personal style of composition.

Three of the PhD's compositions – *pulses*, *beeps* and *triptych* – investigate the musical opportunities of an acousmatic take on stems to improve the flexibility and perceived depth of spatialisation. The spatial layers of the compositions are split into parts of a soundfile. These parts can be mapped according to specific rules to the number of loudspeakers available. The portfolio pieces demonstrate that composing in spatial stems enhances spatial depth as close and distant sounds can be reproduced independently of each other on dedicated loudspeakers at the same time. The sounds of the distant loudspeakers merge with the acoustic properties of the performance space and therefore assist in making the composed spaces credible.

In addition to the compositions, one original software tools are presented in the portfolio (PLib), as well as a substantial contribution to an existing tool (MANTIS Diffusion System). They aim to facilitate the production and performance of electroacoustic music. Their application and potential is briefly discussed in the commentary.

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Acknowledgements

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I am particularly grateful for the support, advice and inspiration of my supervisor, Prof. David Berezan. In addition, the Manchester Theatre in Sound (MANTIS) composers have been a constant source of encouragement and motivation, as have my family and friends.

1 Introduction

The portfolio of compositions investigates the creation of acousmatic pieces which express a sense of closeness and immediacy. Closeness and immediacy can be understood spatially, i.e., being in physical proximity to sounds, and temporally, as in something happening right now. Whereas closeness also carries an aspect of familiarity with particular sounds (or a musical language), immediacy also refers to being able to shape sounds instantly. The aim of expressing a sense of closeness and immediacy shapes the compositional methodology heavily as it affects, among other factors, the choice of sound materials and the way sounds are treated and presented. Furthermore, from a composer's point of view, the feeling of closeness and immediacy can arise at very different stages: before and during the production and performance of a composition. The ways to achieve these feelings might differ for each stage. The portfolio, therefore, explores closeness and immediacy with regard to the process of capturing, processing and composing sound materials, their spatialisation both during production and performance, and the sound materials' contexts. This exploration will also deal with the referential and spatial aspects of sounds and their implications for the musical dramaturgy, i.e. form and narration. Or in other words, the research questions are:

- How and in which ways can acousmatic pieces express a sense of closeness and immediacy?
- How does the production and performance process, material selection, sound transformation, spatialisation, narration, form and genre affect the impression of closeness and immediacy and the creation of entry points for the listener?

The portfolio addresses these questions through the composition of seven pieces, the creation of a set of software tools and a written commentary.

Each piece refines and expands the compositional methodology of the previous composition, gently increasing the production complexity piece by piece. The development of a methodology begins with the composition of a space-informed, stereophonic acousmatic piece which focuses on space enhancing sound transformations and manual interaction with (physical) objects during recording sessions in a studio. The compositional methodology then eventually includes the use of field-recordings, multichannel audio, large-scale forms and narration.

At the same time, the composer develops (collaboratively) software tools to support and facilitate the interactive production and performance of the compositions. One is used for the sound diffusion of electroacoustic compositions (MANTIS Diffusion System Software[2]). The other one is used for the processing and improvisation of sound in realtime (PLib[3]). The portfolio will investigate how these tools inform the compositional methodology and affect closeness and immediacy.

As the composer follows the philosophy of soundscape composition where sound recordings inform the shaping of a composition[4], the compositional methodologies will be mainly inferred from

[2] USB/software/MANTIS Diffusion System Software
[3] USB/software/PLib
[4] Westerkamp, H. (2002). Linking soundscape composition and acoustic ecology. *Organised Sound*, 7(01), p.54.

the analysis of newly made sound recordings and exploratory experimentation through their sound transformations and montage, leading to processes of abstraction, simplification, orchestration and association with other sound recordings. The finding and selection of suitable sound materials is therefore critical and depends on their promise (or expectation) of expressing closeness or immediacy. The interaction of the sound selection with the development of the compositional methodology will be described in detail in the commentary.

It is hoped that in expressing closeness and immediacy engaging compositions will be created. Among other aspects of the musical language, closeness and immediacy could form entry points to a composition for both the composer and the audience, potentially allowing them to take part in the compositional narrative.

1.1 Methodology and Contents of the Commentary

The commentary describes aspects and contexts of the pieces which were important in the development of the portfolio and in answering the research questions. The pieces are presented in chronological order.

The analyses focus on aspects of the creation of each piece's particular sound materials, language, space and form while highlighting the used methodologies and the piece's unique aesthetical, poetic context. The analyses rely on elements of Smalley's theory of spectro-morphology[5] and space-form,[6] Emmerson's language grid[7] and Norman's writings about the use of everyday sounds in listening[8] and narration[9]. For the sake of clarity and simplification, the analyses will make use of these aspects wherever needed or required to describe each piece's compositional methodology, essentially following Fischman's notion of mimetic space.[10]

Depending on the piece, the following aspects will be discussed, as well:

- The development of playing techniques of materials both during recording and processing.
- The use of field-recordings, their effect of creating a sense of place and the notion of human traces.
- The development of interactive live-electronics with regard to improvisation and composition.
- Technical solutions to compose (and perform) multichannel acousmatic pieces.
- Form, the creation of large-scale pieces, the discovery of sounding pauses and moment-form-ness.

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5 Smalley, D. (1997). Spectromorphology: explaining sound-shapes. *Organised sound*, 2(2), pp.107–126.

6 Smalley (2007), pp.40.

7 Emmerson, S. (1986). The Relation of Language to Materials. In *The Language of Electroacoustic Music*. London, pp.17–39.

8 Norman, K. (2012). Listening Together, Making Place. *Organised Sound*, 17(03), pp.257–265.

9 Norman, K. (1994). Telling tales. *Contemporary Music Review*, 10(2), pp.103–109.

10 Fischman unifies Emmerson's, Smalley's and Norman's thinking in a single framework called mimetic space. See: Fischman, R. (2008). Mimetic Space – Unravelled. *Organised Sound*, 13(02). [online]. Available from: http://www.journals.cambridge.org/abstract_S1355771808000150 [Accessed 9/10/2013].

- The creation of narration and a sense of drama with regard to tension and release, the referential aspects of sound recordings and the use of pitch centres.

1.2 Multichannel Audio and Stems

The last three compositions of the portfolio explore the opportunities of an acousmatic take on stems.[11] Simply put, according to Harrison et al (2010, p. 245), stems "constitute […] discretely controllable elements […] that need to be treated discretely in a final spatialisation."[12] He mentions also that the idea of stems was originally used by mastering engineers which would provide them with more control over their final mix. The composer, however, decided to treat spatial layers of a composition as the separate elements (stems) and map them to sets of loudspeakers of a BEAST-like sound diffusion system[13] with regard to the loudspeaker's spatial function. This idea resonated with the research theme of closeness as sounds which were meant to appear close would actually be played back via loudspeakers in proximity of the listener while distant sounds would only appear on loudspeakers which would be further away from the listener. Because the stems are discretely controllable elements they can be mapped to the resources currently available. In other words: If fewer loudspeakers than stems are used for playback the stems would be mixed together (in relation to set rules[14]); on the other hand, having access to more loudspeakers the mapping options would increase. In that sense a composition mixed in stems would scale to the resources at hand while still staying performable.[15] This proved to be important as it allowed the composer to define spatial aspects of the pieces while working at various production and performance environments: During the production of the portfolio pieces the composer had access to a four channel system at home, a large diffusion system at the Novars Research Centre (greater than 24 channels), and a very large diffusion system with more than 40 channels during performance at the MANTIS festival.[16] In a way, the last three portfolio pieces are essentially tailored for the sound diffusion system of the Novars Research Centre while still being performable on smaller diffusion systems.[17]

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11 See the corresponding chapters on p. 45, 52 and 61.

12 See also: Popp, C. (2013). A Few Notes on Stem-based Composition: A Case Study. In Sound, Sight, Space, Play. De Montfort University. [online]. Available from: https://www.escholar.-manchester.ac.uk/uk-ac-man-scw:209327, p.1.

13 A system placing large quantities of loudspeakers at various distances in relation to the listener. See: Harrison, J. and Wilson, S. (2010). Rethinking the BEAST: Recent developments in multichannel composition at Birmingham ElectroAcoustic Sound Theatre. *Organised Sound*, 15(3), p.240.

14 See Appendix A: Technical Information (Surround Works) on p. 75ff for examples of these rules.

15 See also the discussion in Popp, C (2013), p. 6ff.

16 Novars Research Centre. (2011). MANTIS (Overview The University of Manchester). [online]. Available from: http://www.novars.manchester.ac.uk/mantis/overview/index.html [Accessed 28/9/2013].

17 Popp (2013), p.3.

2 *stone and metal*

2.1 Approach

stone and metal (stereo acousmatic composition, 6:14, 2010) explores how the perception of an intimate, proximate space[18] arises out of layers of recordings that have strong bonds to tactility and the listener's sense of touch. *stone and metal* also follows the musical context of *Habitat*[19] and Adrian Moore's *Junky*[20].

2.2 Materials / Playing Techniques

As the title suggests, *stone and metal* relies on stony and metallic sounds. They are derived from a circular saw blade and stones made from marble and granite. I scraped, plucked and struck the blade and stones with towels, timpani mallets, hands, fishing lines and an office chair cushion to generate gestures and textures with traces of friction, impact and energy. The playing techniques resulted from an investigation into the creation and transformation of sound through manual, gestural interaction with real-world objects.

For instance, the office chair's cushion could be used to highlight the sounds of impact and mass. When the blade was dropped from slightly above the cushion, the cushion damped the blade's resonance while adding a loud impact sound with strong low-frequency components (5'05). Similarly, dropped stones would bounce slightly or roll thanks to the cushion's subtle elasticity, creating an iterative, slowly decaying sound (6'07 − 6'11). Both sounds – the low impact sound and the iterative decay sound – were combined to form a punchy, propelling gesture which was further embellished through sounds reinforcing either the low impact or the mid / high frequency onset (4'37 – 5'47).

Rubbing stones of different materials in a variety of ways creates the impression of friction. At 0'39 the sharp edges of the stones were scraped with a towel, leading to a very gritty, rough sound. However when the stones are slowly and gently stroked with each other, a very smooth, airy sound is made (2'29 − 2'32). Because both sounds contain the characteristic resonance of the stones they refer to each other on a timbral level, however differ entirely in terms of suggested friction. This shows how different playing techniques can be used to create transformations and variety out of single objects.

The manual interaction with the objects creates instantaneous changes with strong bonds to physicality[21] and the perception of touch[22] which helps the composer to feel emotionally close to the used materials. Generating materials through various playing techniques is key to my portfolio of works in generating a rich set of source materials, especially in the works *beeps*, *triptych* and my live improvisations[23].

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[18] "The area of perspectival space closest to the listener's vantage point in a particular listening context" (Smalley 2007, p. 56).
[19] See Appendix B, p. 86.
[20] Moore, Adrian. (2000). *Junky*. Montréal: empreintes DIGITALes.
[21] See the discussion about gesture and its surrogates in Smalley (1997), p.111.
[22] See also the discussion about transmodal perception in Smalley (2007), pp.39-40.
[23] See Appendix A, p. 82.

2.3 Form

The musical evolution in *stone and metal* forms a long, composed crescendo. Textures and gestures agglomerate slowly over time, leading to an increase in density, spectral occupancy and perceived loudness. The sonogram[24] (Figure 1) gives an overview of this process when the segments indicated with the numbers 1 – 5 are compared with each other: The agglomeration and crescendo can be seen in the increased accumulation of vertical (gestures) and horizontal lines (sustained sounds) and their change in colour from dark blue (i.e., quiet) to orange/yellow (i.e., loud). Once the density and tension of the sounds cannot be increased they consolidate into a common pulse (4'39, A) which ultimately leads to the release of tension at the climax (5'46, B) and its short decay (6'00 – 6'16, C). In a way, the piece describes an evolution of textures and gestures from the granular and un-pulsed to the pulsed and iterative.

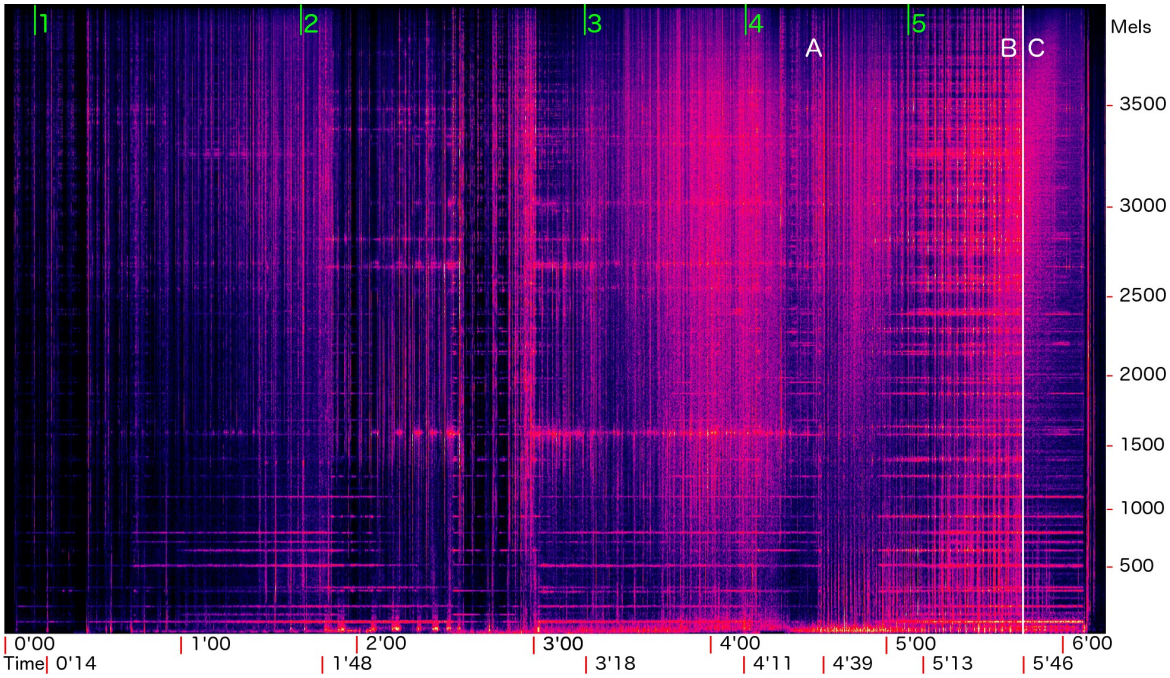

Figure 1: Sonogram of *stone and metal*.

2.4 Space

The piece generally links the musical background to distant sounds and associates the foreground with close sounds. Therefore, sound transformation was applied according to the spatial and musical function of the materials. This approach applies generally to all of my portfolio compositions.

The layering of spectrally and spatially shaped sounds creates a rich, perspectival[25] space. To generate the piece's background, the blade's long decaying resonances were exaggerated (0'54 – 0'57 or 5'47) while the opposite was done for the foreground. Time-stretching the resonances smears their transients, adding an effect that increases their perceived distance while amplifying the spectral content around 668 and 1030 Hz. This added to the sense of diffuseness and light-

[24] This sonogram and all following ones show only a mono mix of the composition for improved visibility.

[25] "The relations of spatial position, movement and scale among spectromorphologies, viewed from the listener's vantage point" (Smalley 2007, p. 56).

ness. To strengthen contrast, sustained resonances are avoided in the foreground and the materials' attacks are highlighted instead. Also, the foreground's spectral content was enhanced between 2 to 7 kHz and below 120 Hz through close-miking and multi-band compression to add presence, punch and weight. A good example of this shaping can be heard in the gestures at 0'28 and 5'32. On materials which contained little or no low frequency content the lows were removed and a spectral peak around 8 kHz and above was added to make them appear to be flying or weightless. Both strategies heightened the three dimensional contrast between the sounds, heard in gestures at 0'28 (grounded) and 1'28 (flying). The spectral shaping follows Blauert's (2010, p. 106) and Smalley's (2007, p. 47) observations of the connection between frequency content and spatial localisation. The close-miked recording of sounds in a dry studio acoustic ensures that the sounds appear not only close, but also extremely intimate.[26]

[26] See here Smalley's discussion of microphone space (Smalley 2007, p. 43).

3 *empty rooms*

3.1 Approach

The Novars studio's quiet soundscape served as the initial starting point of *empty rooms* (stereo acousmatic composition, 10:27, 2011). Because the studios are sonically highly insulated, sounds from outside of the studio are almost fully blocked and previously unheard sounds suddenly creep into the user's perception: the quiet transformer hums of the electronics in the studios become audible, as well as the muted occasional chattering of other studio users. But all those sounds occur on very low sound levels, contrasting strongly with the loud soundscapes of Manchester's dynamic city centre. In a way, both sonic states encroach on the listener's personal space equally: both force him/her into the now, pushing him/her out of the state of pure observation, either through silence, as he/she becomes aware of his/her own overloaded senses, or through overwhelming noise. *empty rooms* recreates this change in perception through a delicate blend of spaces. It harnesses the physicality and power of encroaching on the listener's personal space through interlocked recordings of unpopulated spaces, mechanised spaces[27] and overwhelming noise.

3.2 Materials

During the initial research for the piece several field-recordings of various room ambiences were captured and analysed. These recordings were taken in hallways, bathrooms and foyers from various places, such as buildings of the University of Manchester and my student dormitory. The recordings contain traces of mechanised spaces, such as the space generated by humming fans and passing air, and enacted spaces, sounds based on human activity[28] such as distant chattering.

The recordings share a few characteristics:

- They lend themselves to textures due to a lack of gestures within the soundscape.
- The soundscapes generally appear very distant and quiet and
- thus expose the field-recorder's and microphones's amplifier noise which appears to be closer.
- The soundscape's implied room acoustics change considerably from one recording to the next.

These observations informed the compositional concept heavily. The lack of gestures was addressed through appropriating the few proximate sounds found in the soundscapes which were by-products of the recording process and the composer's sudden movement while recording. The general lack of foreground sounds, however, matched the idea of the composition as their absence highlights the empty, mechanic or unpopulated character of the soundscapes. Additional close-up recordings of a fridge and turntable, both fitting the piece's timbres and sound selection, provide contrast with the distant, reverberant soundscapes. The hiss present in the recordings suggested

[27] "A source-bonded space produced by sound-emitting machines, mechanisms and technologically based systems, independently of human activity." (Smalley 2007, p. 55).
[28] Smalley (2007), p.55.

the use of noise as part of the piece's language and informed the selection of sound transformation. To shape the noise, distortion based on bit-rate reduction and clipping were employed to increase the grittiness and aggressiveness, whereas convolution and high-shelf filters were used to hide or smooth the hiss's presence. The distortion in particular created sounds with prominent, proximate high-frequency content which seemingly encroach on the listener's space (e.g. 4:28) and populate the musical foreground. They also masked any noise present in the background recordings. The notion of analysing source recordings to extract a suitable compositional language resonates with the idea of discovery common in soundscape composition[29] and is key to all the works in the portfolio.[30]

3.3 Language / Form

The section from 0'00 to 2'14 introduces the main compositional language (Figure 2). The piece comes into being from filtered noise and some of the piece's materials and spaces are gradually revealed. This is done via slowly fading in more and more sonic detail and high-frequency content: generated and filtered pink noise is gradually replaced with time-stretched clicks, the hum of a turntable recording (0'00 – 0'47, A) and distorted (0'47 onwards, B), time-stretched ambient recordings (1'18 onwards). The ambient recordings and time-stretching slowly add distance, while the distortion adds closeness, tension and masks the hiss of the ambient recordings.

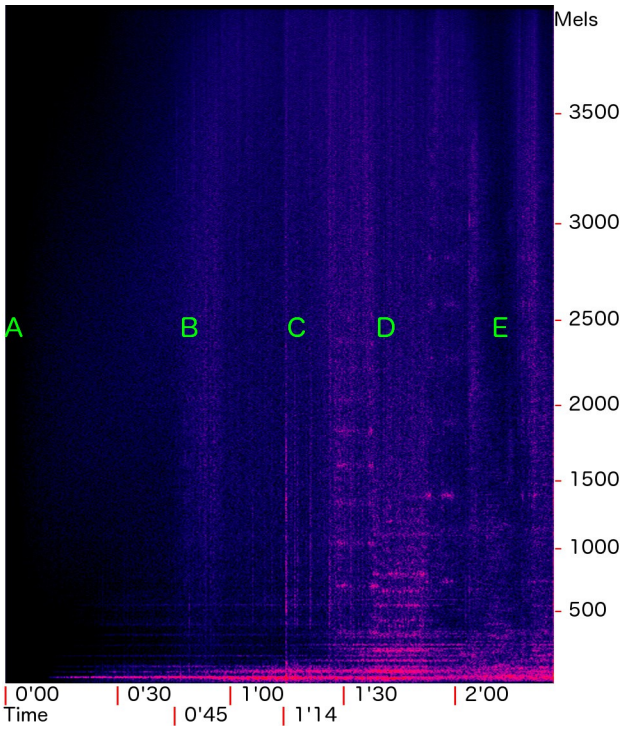

Figure 2: Sonogram *empty rooms*, 0'00 - 2'15.

At 1'32 (D) the foreground (distorted noise) and background spaces (time-stretched ambient recordings) are finally fully revealed. The slow fade-in of textures and singular gestures resulting from discontinuities, or jump-cuts (1'14, C), establishes a reliance on textures to propel the piece, while sparse, dramatic gestures serve as surprising elements to keep the gradual change interesting. This combination also leads the listener to expect a rather evolutionary piece with unexpected discontinuities. The proximate sound of moving clothes at 2'00 – 2'05, primed at 0'45, ends this moment gesturally and initiates a brief moment of very distant, stretched, blurry ambient recordings and an absence of proximate space (2'06 − 2'14, E). The gradual change of spaces and textures continues throughout the piece – it essentially oscillates between moments where either close, loud and gritty or blurry, quiet and distant sounds predominate (see the overall change in colour from bright / loud (bright purple / yellow), to dark / quiet (black, blue), in Figure 3).

[29] As Westerkamp (2002, p. 54) puts it: "aesthetic values will emerge from the recorded soundscape or from some of its elements".
[30] See also p. 32 and 39.

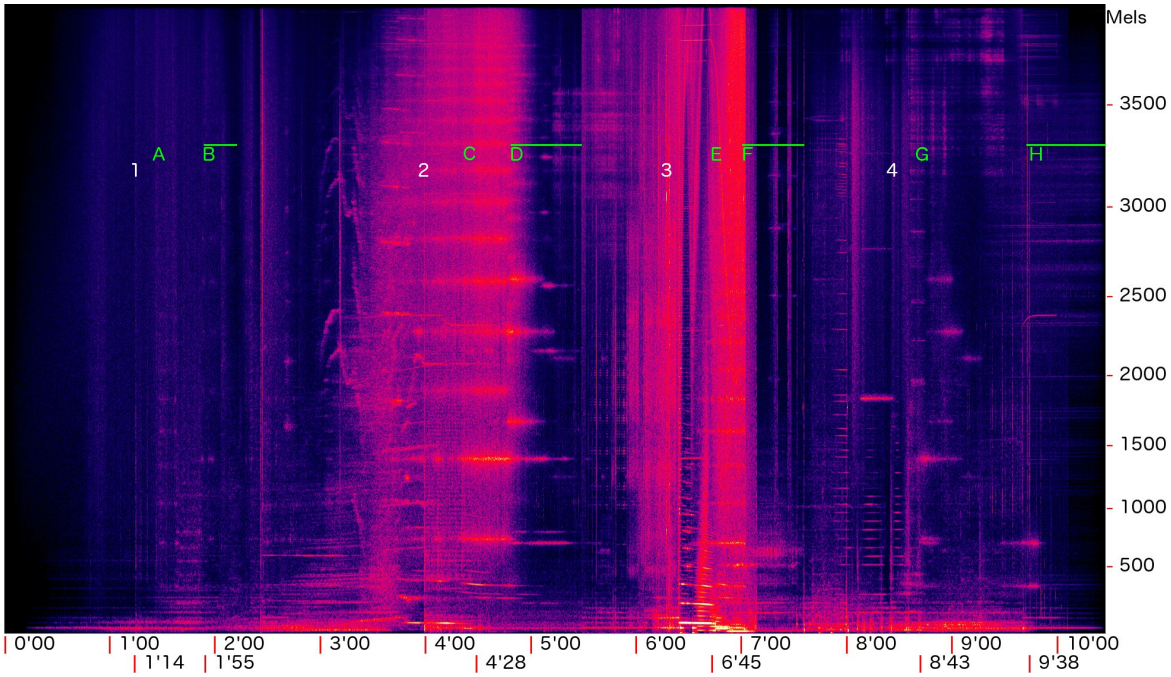

Figure 3: Sonogram *empty rooms* (full).

The blending and intensity of the sounds evolve over time, becoming more insistent and/or more defined. The jump-cuts (Figure 3, numbers 1 – 4) ultimately lead to powerful, overwhelming local climaxes (A, C, E and G). While the distortion disappears after the main climax at around 6'45 (C), the piece settles on combinations of less blurry and more referential, untransformed sounds. This combination resolves the tension built-up before the climax and gives the piece a sense of arrival in a mechanised space, departing from the synthetic sounds of the beginning. With regard to the piece's initial starting point, the processes of reduction taking place at H, as well as B, D and F, come close to recreating the feeling of gradual isolation from the outside mentioned in the introduction.

3.4 Human traces

The sounds of the recordist caused by his movement (or lack thereof) leave a trace (and their lack) of human activity. This idea resonates with the notion of isolation and empty spaces in the piece. In a way, the absence of humans is achieved through exactly the opposite: through mostly avoiding crowd-like sounds and presenting a trace of a human, who seems to be observing the soundscapes or causing a change in tension, release and space at crucial moments.[31] Because crowd-like sounds appear only at a singular moment (8'42 – 9'02) and very subtly, contrasting the prominent sounds of the recordist, the sensation of the emptiness or solitude of the piece's space is reinforced.

[31] See: 00'45, 02'00, 02'45, 03'07, 05'24, 06'04, 07'18, 08'02, 09'42.

Also making the sounds of the recording process become part of the piece evokes a sense of intimacy and immediacy.[32] Due to the source-bonding[33] of the sounds, the listener can imagine taking part in or observing the recording process.[34] This idea of engaging the listener with the piece through sounds referring to the recording process and also lending a human trace to the pieces becomes crucial to my portfolio, as also shown in the analysis of *pulses* and *beeps*. It is hoped that this idea serves as an entry point for the listener's imagination to engage with the piece.[35]

[32] See also Norman's analysis of Michel Redolfi's *Desert Tracks*. Norman (1994), p.106.

[33] “The natural tendency to relate sounds to supposed sources and causes [...]” (Smalley 1997, p.110).

[34] This strategy is similar to the one Radiolab follows. They include the sounds of radio-making such as test sounds ("test, one, two, three..") or the direction of the interviewee for immediacy. The show *Rodney Versus Death* (Radiolab 2013) is a good example of this (see timecode 1'03-1'14). However, at the time of composing empty rooms, the composer was unaware of their approach.

[35] See also the discussion about entry-points on page 63.

4 Excursus: PLib

4.1 Introduction

The PLib is a SuperCollider-based modular environment for the production and improvisation of electroacoustic music. It has been used in my portfolio compositions as well as in my performance practise[36] due to the PLib's gestural sound shaping qualities. The PLib directly resonates with the research themes of “closeness” and “immediacy”, here in terms of allowing the composer immediate gestural control over sounds. In a way, the materials used during composition are performed sounds captured in recordings either through interaction with the sound materials themselves (see *stone and metal*) or through realtime sound processing / generation (see *weave/unravel*).

4.2 Approach

The PLib borrows the design paradigm of an electric guitarist's / bassist's pedal board and simulates it in software.[37] Each pedal on the board features sound shaping or sound generating capabilities which are tweaked by the user through knobs or other external controls (Figure 4). With these controls the user explores musical ideas quickly and intuitively. Although a pedal alone might be musically limited, the collection of pedals forms a complex network with various degrees of versatility. My implementation in SuperCollider is made to behave in a similar way (Figure 5). Similarly to an effect pedal, a sound transforming or generating algorithm is represented through a box, i.e., a window (A) with controls (B), inputs (C) and outputs (D). The boxes can be connected with each other[38] and their musical potential explored through an interaction with the graphical user interface or an external controller connected via MIDI or OSC.[39] The external controller provides tactile control over the algorithm's parameters (which can be mapped easily via the “Mp” button, (E)).

[36] A full list of performances can be found in Appendix A, p. 82.

[37] For alternative approaches to the design paradigm to live-electronics see: Zadel, M. (2006). Laptop Performance: Techniques, Tools, and a New Interface Design. In *Proceedings of the International Computer Music Conference*. pp.643–648.

[38] I.e. via connecting the output signal of one pedal/window to the input of another pedal/window. In the PLib this is done via the window's drop-down menu (C).

[39] See the screencast USB/software/PLib/_tutorial videos/plib screencast improvisation.mp4

Figure 4: Photo of Mauricio Pauly's pedalboard. (Photo used with permission).

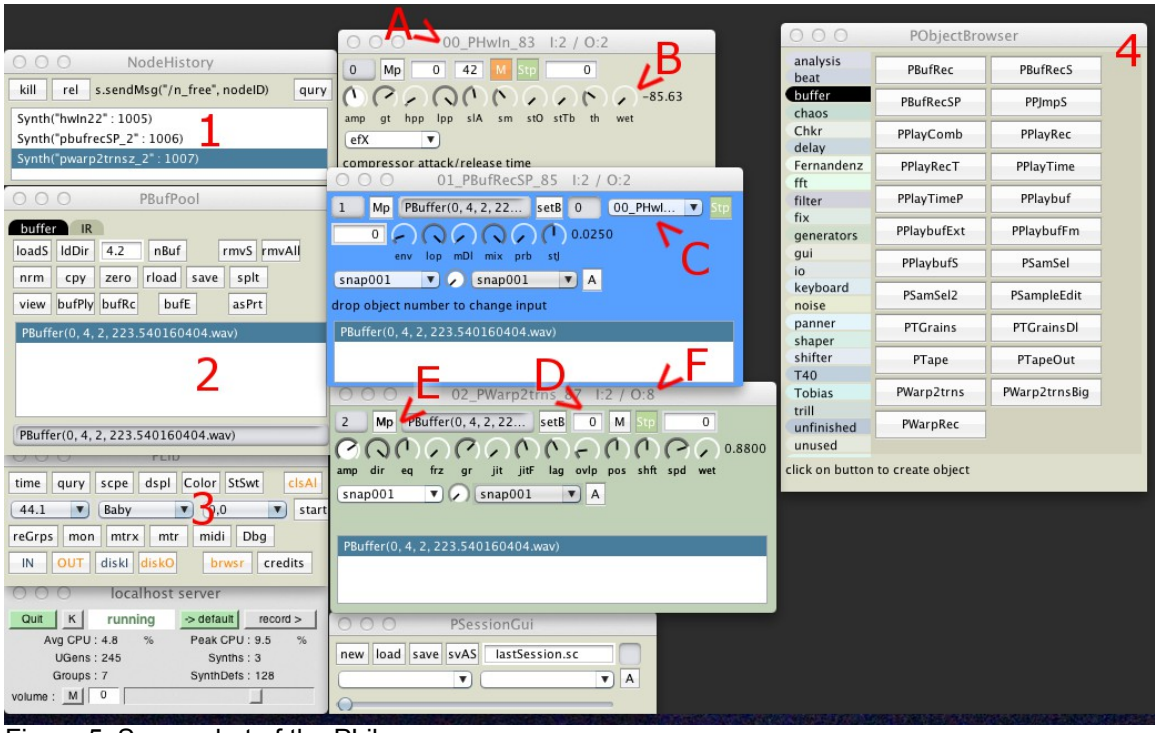

Figure 5: Screenshot of the PLib.

However, the PLib goes beyond a simple pedal board implementation.[40] The algorithms are not simply effects which embellish the performer's instrument-playing, but rather complicated algorithms purposely built to perform relatively specific musical functions, giving the electronics their

[40] Also because it is not a guitarist's pedal board: It is a computer program running on a laptop. For an analysis of the specifics of the laptop as an instrument see: Paine, G. (2009). Gesture and Morphology in Laptop Performance. In R. T. Dean, ed. *The Oxford Handbook of Computer Music*. Oxford University Press, pp.299–329.

own voice.[41] Furthermore, the algorithms support multichannel audio simply and in various configurations (F).[42] The PLib also contains utility windows which give an overview over currently active algorithms (1), a collection of soundfiles in memory (2), general options and shortcuts to algorithms (3), as well as a browser showing the library's available algorithms (4). Unlike guitar effects the algorithms can be easily duplicated, altered and exchanged with no costs and without dragging virtual wires, offering a dynamic environment. However, this dynamism implies that the current configuration – the patch – may be changed constantly to accommodate always changing needs. This dynamism has a few implications[43] which will be addressed in two archetypal workflows below. One is meant for composition, the other for improvisation.

4.3 Workflow

4.3.1 Composition

The compositional workflow is based on the transformation and creation of soundfiles. In my case, a soundfile serves usually as the starting point for the tasks at hand. This soundfile will be imported into the environment and transformed through algorithms. The output of the algorithms will then be captured in a new soundfile which in turn will be transformed or imported in a DAW to make the soundfile a compositional building block. Generally I tend to change the algorithms dramatically during the initial development of a piece and constrain myself to a set of found combinations once the piece's logic is defined.[44] At this later stage, the inner workings of the algorithms will not change, but only their actual number and combination on the day: on one day one ring-modulator is needed; another day might require three ring-modulators and a grain-player. The notion of a definitive patch may not occur as the patch always changes to accommodate the requirements of the day. Due to this dynamism, parameters are mapped to external controllers only temporarily and if unavoidable.[45]

4.3.2 Live-Performance

The live-performance workflow differs from the compositional workflow in terms of dynamism and starting point. Instead of a soundfile, a live-input such as a traditional instrument or object, serves as the starting point (which might be recorded into memory if required by certain algorithms). During the preparation of a performance a number of algorithms will be created, changed or selected after a few experiments. Once an interesting selection is found it will be fixed in a definite patch to allow the performer to rehearse the selection. As the interaction via a computer mouse is too slow to keep up with the virtuosity of traditional musicians, the performer will

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41 As in a separate instrument within an ensemble with musicians. See the discussion on *weave/unravel*, p.30.

42 See Popp (2013), p.9. The number of input and output channels of an algorithm can be changed with a simple text command.

43 Perkis, T. (2009). Some Notes on My Electronic Improvisation Practice. In R. T. Dean, ed. *The Oxford Handbook of Computer Music*. Oxford University Press, p.162.

44 In other words: The composer selects sound processes from the PLib's browser and connects / adapts the processes to each other depending on what he/she needs at that precise moment. Optionally, new processes can be added to the browser and instantiated thereafter.

45 Because controller mappings are stored in the PLib for a specific patch only, an always changing patch also means that controller mappings will have to be continuously adapted. The mapping of parameters to MIDI/OSC controllers might therefore not be feasible.

have to think of a suitable mapping of parameters to an external controller. This mapping will also have to stay fixed to become memorable. As there are normally more parameters than controls on a controller, the selection of parameters will have to be well thought-out which in turn defines the versatility and musical potential of the patch.

Having to choose the selection of parameters and transformation methods in advance[46] may seem counter-intuitive and frightening within an improvisation setting as the musical context is usually created while performing and may vary tremendously from rehearsals to performances. It may therefore seem advisable to keep dynamism within the patch as much as possible. But because interacting with a software environment takes so much time (when using a mouse) and hogs the performer's focus, the performer's response time would be too slow compared to performers using traditional instruments.[47] Imagine: he/she would have to think which algorithm works best for the moment, find the algorithm in a browser and load it, move the mouse to the needed parameters and then start playing. By the time the performer could finally respond, the other performers might have (and usually have) moved on and the found solution may no longer be adequate. Therefore, imposing the notion of a fixed instrument on a patch with clear fixed musical functions and limitations, which can be played via an external, multi-parametric controller and rehearsed, learned and taken care of, offers the benefit of reducing the performer's response time[48] and increasing virtuosity.

[46] See also the discussion on "live soundscape composition" in, Eigenfeldt, A. (2007). Real-time Composition or Computer Improvisation? A composer's search for intelligent tools in interactive computer music. www.ems-network.org/IMG/pdf_EigenfeldtEMS07.pdf. [online]. Available from: http://www.sfu.ca/~eigenfel/RealTimeComposition.pdf [Accessed 12/10/2013], p.5.

[47] Zadel (2006), p.646, and Perkis (2009), pp.161-163.

[48] Live-coding might allow greater dynamism here as it does not necessarily depend on an instrument model. For example, see Thor Magnussen's ixi-lang: Thor, Magnussen. (2011). Play with ixi lang version 3. [online]. Available from: http://vimeo.com/31811717 [Accessed 11/08/2013].

5 weave/unravel

weave/unravel[49] (multichannel mixed-media improvisation, approx. 17'00, 2011 – 2013) is a slow evolving electroacoustic improvisation based on a few set rules[50] between Hervé Perez[51] on soprano saxophone and shakuhachi and Constantin Popp on live-electronics. The duo aims to project the implied spaces[52] of the instruments into the concert hall, as well as exploring and highlighting their sonic potential via the use of live-electronics. To achieve this, Perez's instruments will be amplified, extended, abstracted and spatialised (see p. 26). The electronics focus on realtime sound transformation and sound synthesis to keep the electronics linked to the moment of time and space when the performance with Perez is taking place. This approach avoids pre-recorded sounds, i.e. sounds recorded in a studio prior to a performance, wherever possible or reasonable. A recording of a performance, which stems from a living room concert in Sheffield on February 11, 2013, will be used as an example of the collaboration. The recording has been slightly shorted and mastered to make it suitable for home listening.[53]

5.1 Perez's Process

Perez's setup consists of two instruments which are played mostly in a non-idiomatic way and a set of microphones for amplification and input of the live-electronics, sharing loudspeakers for amplification with the live-electronics. Adding pitched components as necessary, he relies on unpitched, peripheral sounds of the instruments such as multiphonics (15'51 − 15'54) and sounds of the instrument's sound making process, for example breath sounds (0'02 − 0'04). Traditional playing techniques producing idiomatic sounds play a minor role and are reserved for special moments such as climaxes (7'52) and usually give way to sounds with strong noise[54] components (8'10 − 8'14). All of Perez's sounds are constantly amplified via two to four microphones which are routed to the frontal loudspeakers of an immersive sound system. The sound system can be anything from a quadrophonic ring of loudspeakers to a large sound diffusion system. Unless at climaxes, the direct sound of the instruments will mostly be fully masked by the amplification as the peripheral sounds tend to be relatively quiet. The microphones therefore work as a magnifying glass, highlighting the sound's different colours and work as a spatialisation device (see p. 29). The combination of extended techniques, amplification, live-processing and avoidance of pitched melodies

[49] Weave/Unravel. WeaveUnravel's stream on SoundCloud - Hear the world's sounds. *SoundCloud*. [online]. Available from: https://soundcloud.com/weaveunravel [Accessed 23/10/2013].
[50] See the improvisation score on USB/compositions/3 – weave-unravel/weave-unravel score.pdf.
[51] Perez, H. (2013). Hervé perez's stream on SoundCloud - Hear the world's sounds. *SoundCloud*. [online]. Available from: https://soundcloud.com/herveperez [Accessed 12/10/2013].
[52] The pitch space, enacted space, the inner space taken up by the tubes of the instruments.
[53] See USB/compositions/3 – weave-unravel/weave_unravel 2013-02-11.wav.
[54] As in sounds having aperiodic waveforms. The word noise is seen here as signal. See the process of noisification described in: Collis, A. (2008). Sounds of the system: the emancipation of noise in the music of Carsten Nicolai. *Organised Sound*, 13(01), p.32.

transform the instruments in a way that they appear to be abstracted[55] like a found sound is abstracted through acousmatic techniques.

5.2 Language

5.2.1 Approaches to Sound Transformations

The live-processing (schematic overview[56] in Figure 6), consisting of various samplers (pink + green)[57], sine banks (brown)[58], a band-pass filter array (yellow),[59] multi-tap delays (blue) and reverb (purple),[60] performs four main functions in relation to Perez's sounds:

- control of pitch directly or indirectly,
- abstraction of materials by cutting the links to the source and removing or imposing pitch from/on materials,
- spatialisation of sounds,
- creating a unique voice for the electronics.

[55] The word abstracted is meant to describe the transformation of a traditional instrument into a new sound source. For example, the extended techniques transform a saxophone, usually seen as an instrument of jazz playing scales, riffs and melodies, into a noise generator (in the shape of a saxophone) where each key filters the noise. The saxophone is therefore abstracted as it is removed from its original context through unusual playing techniques. See Emmerson (2007), p. 129.

[56] Please note that the routing between the processes is not necessarily static throughout the performance as it may be changed depending on the musical context. The figure merely illustrates one state of the patch at one moment in time.

[57] Two of them are based on granular synthesis, the other one on wavetable synthesis.

[58] The sine-banks are tuned to an inharmonic set of frequencies published in: Hero, B. (1998). FREQUENCIES OF THE ORGANS OF THE BODY AND PLANETS. [online]. Available from: http://www.greatdreams.com/hertz.htm [Accessed 12/8/2013]. These frequencies will be handled as a sound object and subject to sound transformation processes during the performance.

[59] The band-pass filters are tuned to the overtone series of f#.

[60] The delays and reverb's function is to sustain notes, blur or multiply the input in a cloud-like fashion.

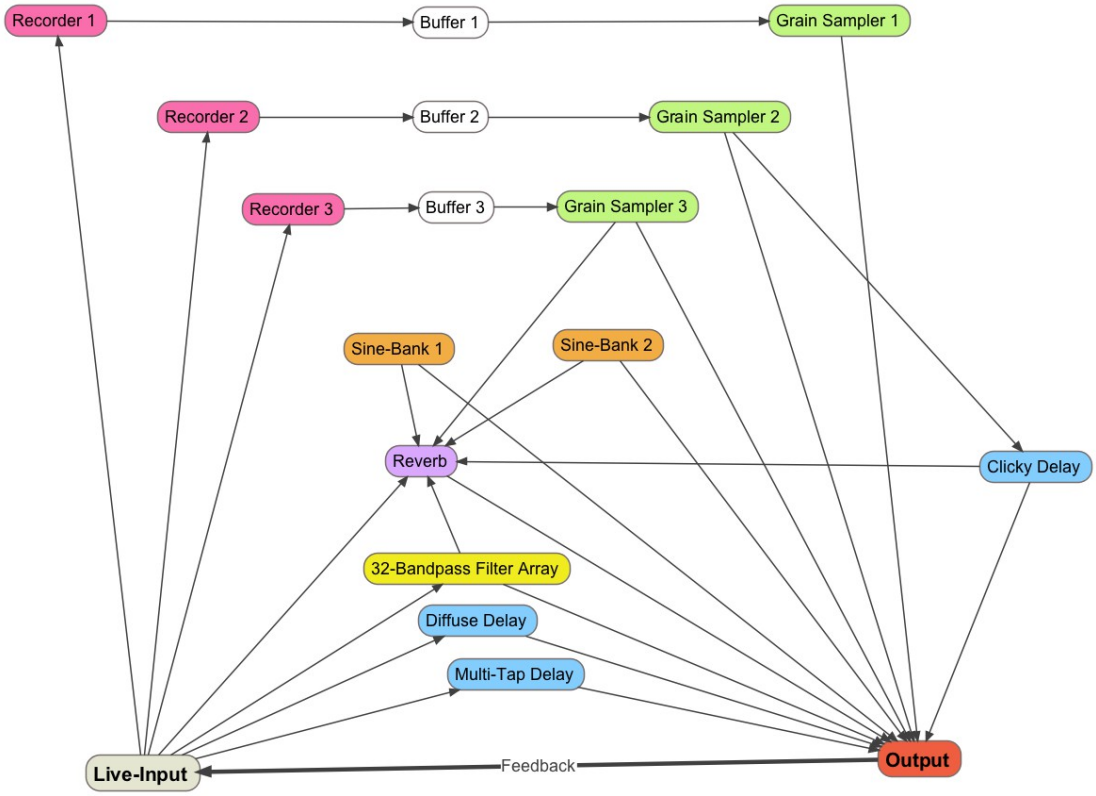

Figure 6: Schematic overview of the sound processing for *weave/unravel*.

Some of the processes control pitch directly or indirectly and mirror Perez's pool of materials in the electronics. Because of their resonant behaviour and interaction between the microphones and loudspeakers, the bandpass filters force feedback to occur according to their internal tuning (Figure 7, number 2). Which specific tone will appear depends mostly on the output level and amount of resonance of the particular bandpass filter. The sine generators offer less direct control over pitch (4 or at 12'12-13'48). Although they are tuned to a set of predefined frequencies they can be shaped via two MIDI controllers in a crude way (due to the controller's coarse resolution and lack of specific markings).[61] Whereas the bandpass filters and sine banks generate pitched sounds (2, 4), the samplers, the unrealistic reverb and delays generate both, depending on the parameter settings and Perez's input (1, 3, 5).

[61] This is intentional as to keep the musical language fixed on timbres and colours.

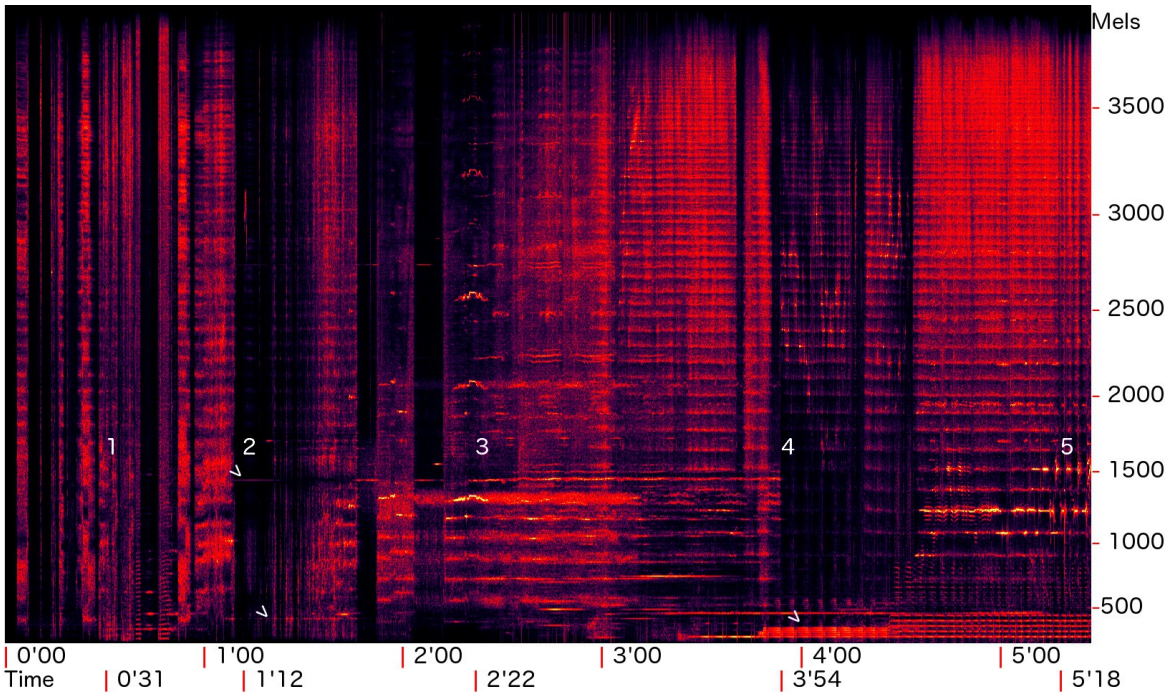

Figure 7: Sonogram *weave/unravel* (0'00 - 5'20).

The electronics help Perez to abstract his sounds. The extent of abstraction depends on the nature of the transformation process and their settings. In the background at 8'47 to 8'58, a fragment of Perez's playing is frozen in time. The reference to the saxophone emerges relatively clearly. However, in the foreground, the noisy glissandi of the wavetable sample bear no (timbral) resemblance to the saxophone although they are fed by it. Perez's sound is fully abstracted here. In the segment from 0'56 to 1'09, the grain size approaches zero and the grain samplers increasingly distort the perception of pitch while increasingly removing the reference to the saxophone. Furthermore, abstraction is increased through spatialisation.

5.2.2 Space

Each performer in the collaboration has their own ways to project their sounds in space. Firstly, the close-up microphones give Perez an instantaneous method to project his sounds in space. They pick up the spatial layout of the keys and sounding holes (0'02 − 0'17). Perez exaggerates this spatial layout even further through moving the instruments momentarily closer to one of the microphones. The close connection between Perez's gestural, spatial input (and his sound material) and its result in the loudspeakers justifies the acousmatic dislocation of the instrument[62] and harnesses the opportunities this brings to the musical language. In a way, not only are the sounds of the instrument amplified by the microphone-loudspeaker combination, but also its movement. Secondly, the live-processing also transforms Perez's sounds spatially. The spatial effect may be the intended result of a sound transformation, such as adding reverb to the (more or less transformed) live-input (16'00 − end), or is a by-product of a particular process such as time-stretching of a recorded segment (4'31 − 4'50).[63] The spatial effects caused by the sound transformations dif-

[62] See the discussion on acousmatic dislocation in Emmerson (2007), p.94 and p.129.

[63] The granular synthesis increases the apparent source width of Perez's sound image in this example and blends with otherwise unprocessed sounds, creating a very wide, larger-than-life shakuhachi.

fer in their implied distance (compare 0'27 − 00'45 with 2'21 − 3'01). In fact, they are chosen exactly because of their differences as they give Popp a direct and predictable control over the layering of spaces. Because the performers know the ways to articulate space with their instruments their spatial potential becomes part of the improvisation's musical language (see, for example, 8'16 onwards).

5.2.3 Identities

All of the processes can be used in a way that lends the electronics their own voice or identity. This is important so that the electronics do not simply act as a vehicle for the instrument but have a distinctive and independent role.[64] The grain samplers, delays and spatialisation transform Perez's instrument into a hyper-instrument if the connection to the source material stays intact (0'36 – 0'38). However, once this connection is lost through more radical transformation[65] or through sounds of clearly electronic origin, the electronics emanate their own, dedicated identity and become the voice of the electronics performer (Figure 8, number 3). Consequently, via processing and amplification, the performers gain the ability to base the musical language on the generation and dissolution of their own sonic identities – a fact which is alluded to in the duo's name weave/unravel. The musical exploration of the performers' sonic identities (and their spatialisation) justifies the spatial dislocation of the performers' sound.[66]

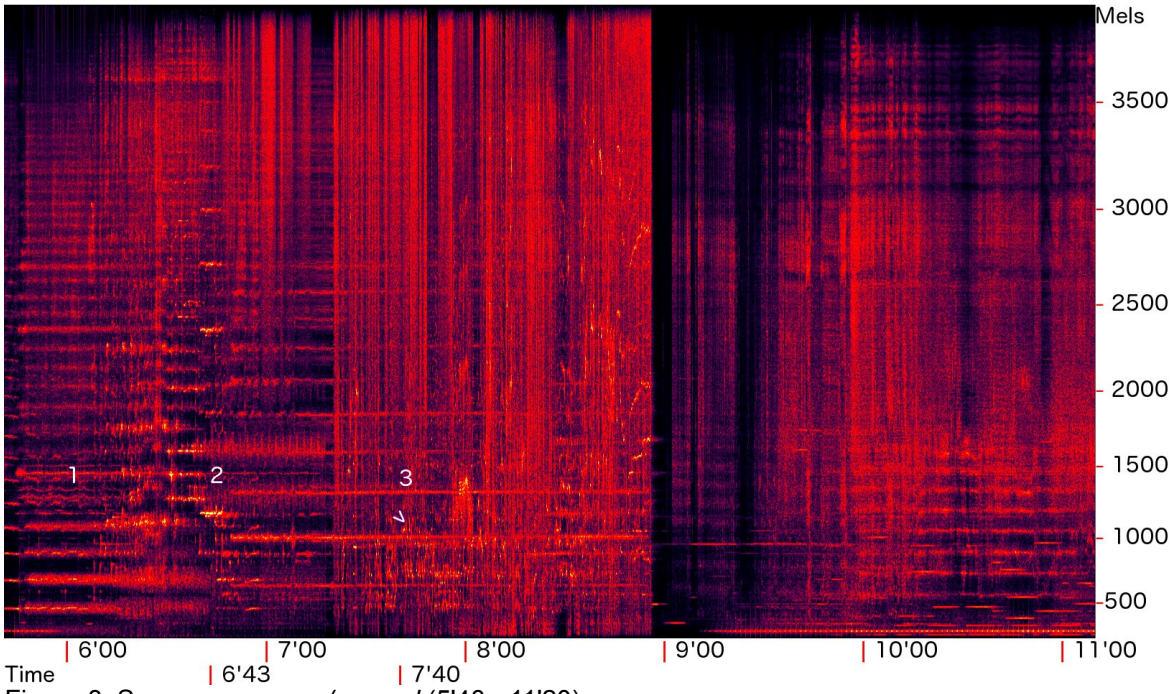

Figure 8: Sonogram *weave/unravel* (5'40 - 11'20).

5.3 Electroacoustic improvisation

Both performers inform each other's playing in response to the sounds they generate via close listening. The responses are associations to suggested sound materials in terms of timbre, rhythm,

64 See Eigenfeldt's criticism of interactive computer music in: Eigenfeldt, A. (2007), p.4.
65 As is the case with the wavetable synthesiser or at small grain lengths of the grain sampler.
66 Also, the sine-tone generators create a sound of clearly electronic origin and do not depend on the live-input. They therefore lend the electronics their own identity, too. See 4'46, 11'32 or 14'30.

energy, noise or pitch content. For example, in segment 1'47 − 2'04 Perez imitates the pitch and general envelope of the feedback tones of the electronics through playing harmonics on the saxophone. Similarly, the freezing in time of a short fragment (Figure 8, number 1) which suggests an increase in intensity and pulsating content, leads Perez to perform fast paced glissandi which in turn animate Popp to react with the noise-like glissandi of the wavetable sampler (2, 3). Those associations flow back and forth between two equal players as they both react to (or ignore) the partner's cues equally and exhibit their own identity if desired.

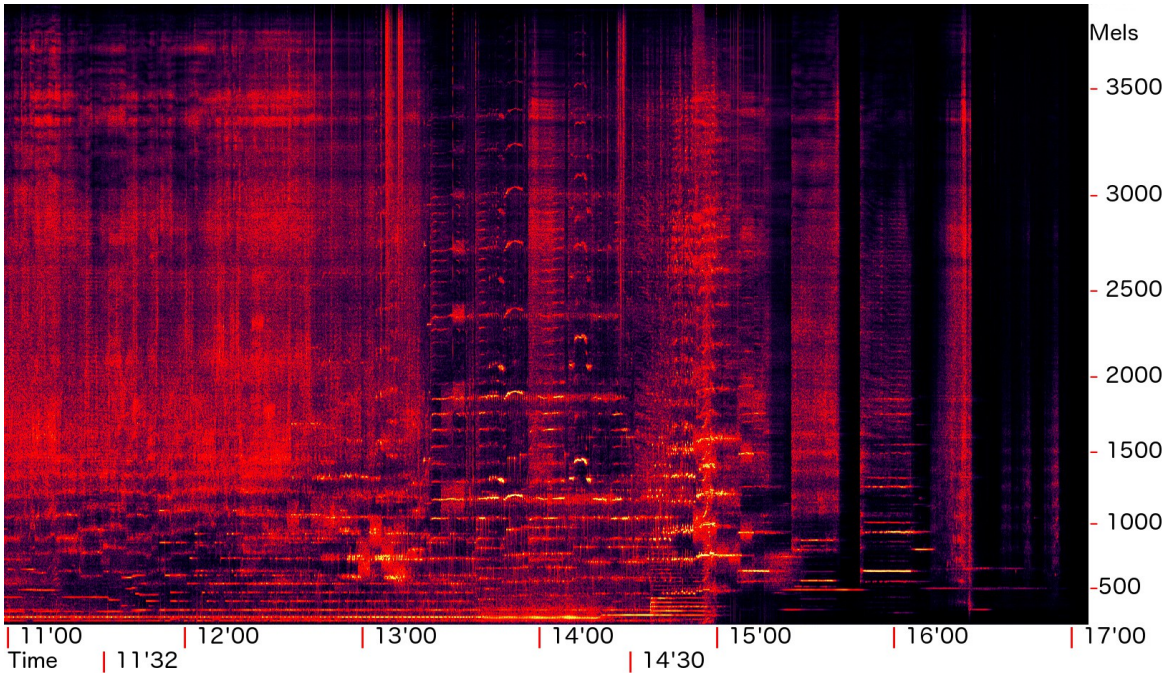

Figure 9: Sonogram of *weave/unravel* (11'00 - 17'00).

6 *skalna*

6.1 Approach

skalna (four channel acousmatic composition, 9'26, 2012) centres around field-recordings captured in and around an abandoned mining site[67] found in Łódź, Poland. It also extends my methodology of composing space through the use of quadrophonic recordings and the way how recordings inform the development of the composition.

6.2 Materials / Language / Form

One of the outdoor recordings is central to the musical concept of *skalna* (Figure 10).[68] It contains singular gestures derived from stones bouncing onto a structure of reinforced concrete (1), which interject environmental sounds (2). The recording ends with the sound of a passing aeroplane (3), obscuring the previously heard sounds. Once the aeroplane has passed, the ambient sounds come slowly back into focus (4). The combination of environmental sounds interjected by sonic gestures and their eventual masking through a loud background sound forms the piece's basic structural model.

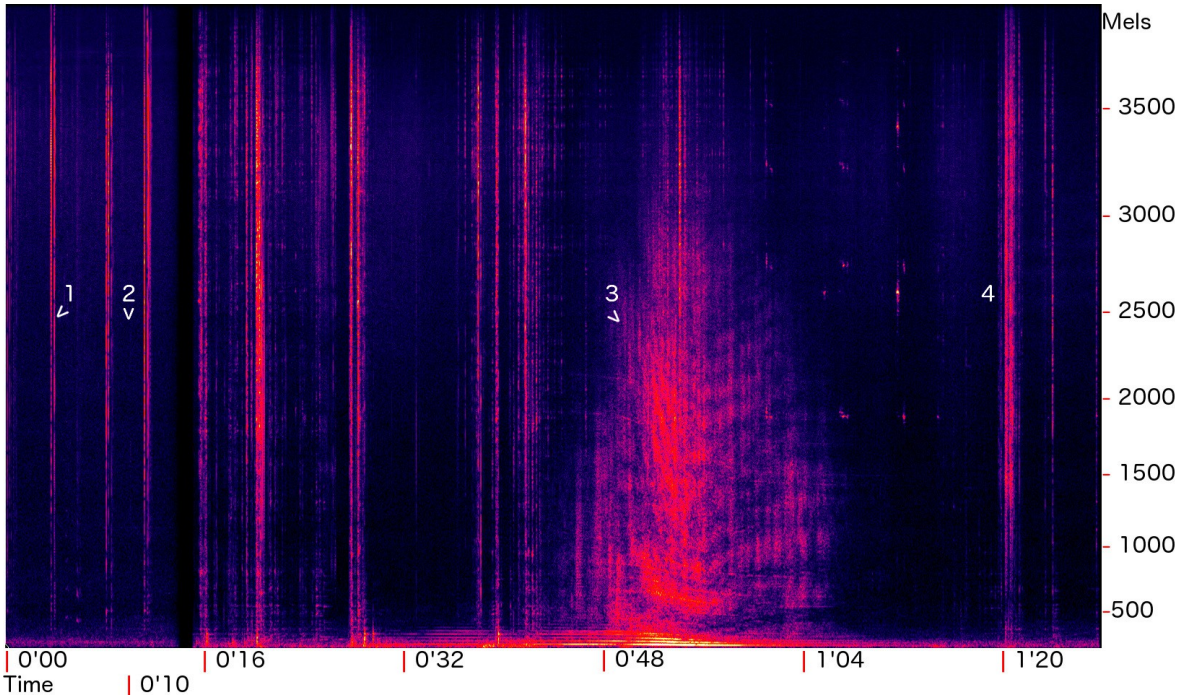

Figure 10: Sonogram of skalna - ex01 - stones and plane.wav.

The piece applies this structural model to the formal development of the materials. The introductory section 0'00-1'46 can be considered as a variation of this archetype (Figure 11, A). Supplemental recordings re-create the main recording such that it slowly introduces the listener to the sound world. The sounds of the stones are replaced by softer close-miked studio recordings of gently struck stones. The environmental sounds are exchanged with more pronounced recordings

[67] Coordinates: approx. +51°46'35.96", +19°32'56.40".
[68] See USB/compositions/4 skalna/_examples/skalna - ex01 - stones and plane.wav.

which highlight aspects such as human traces (1), wind (2) or the vastness of the open space (3). The contrasting pitched sounds remotely allude to the idea of the passing aeroplane (4), bringing contrasting sounds into focus such as a change in harmony and (a vast enclosed) space (5). The pitched sounds are derived from a contrasting source recording of softly resonating, wooden-like sounds placed in a large hall.[69]

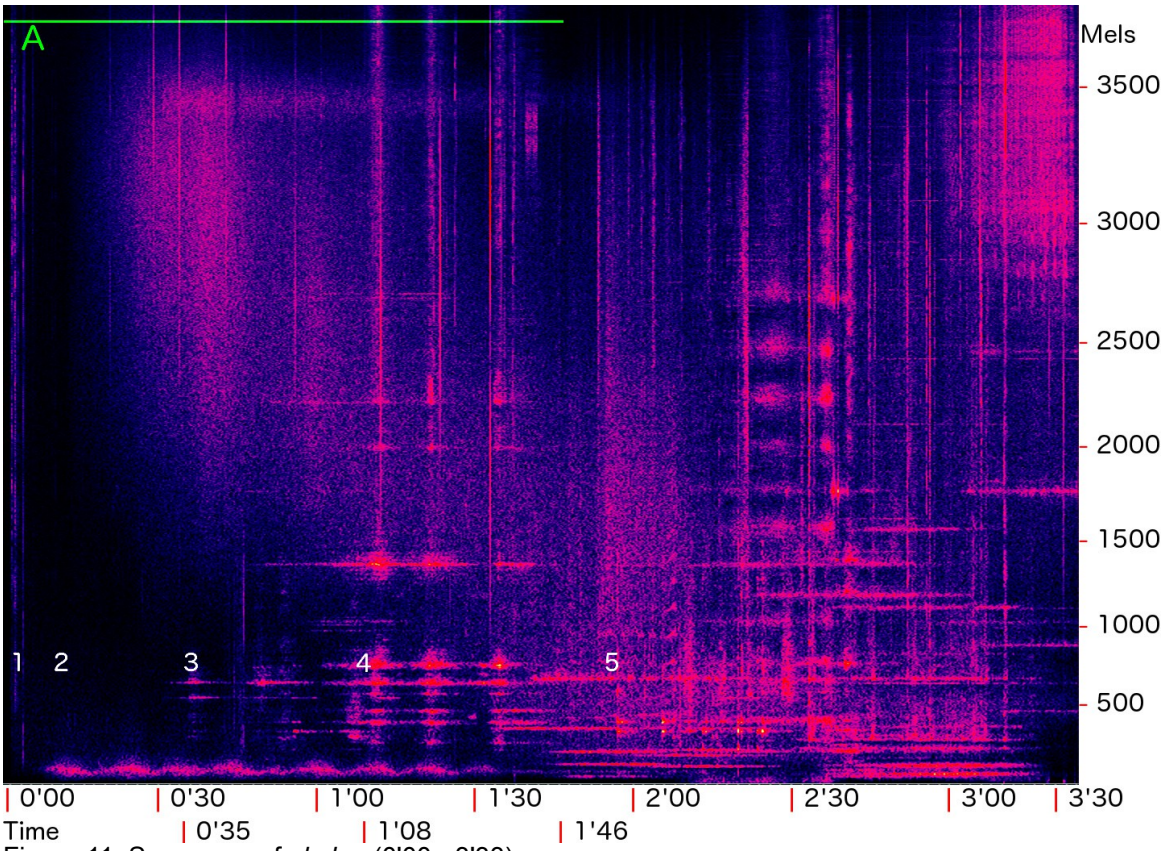

Figure 11: Sonogram of *skalna* (0'00 - 3'33).

The process of replacement and embellishment of the main model repeats several times throughout the piece. Each iteration becomes more dramatic through the evolution of pitched sounds and increasingly voluminous stone-based gestures (Figure 12, numbers 1 – 4). Granular synthesis, distorted resonant bandpass filters, time-stretching and complex layering of sounds are key to increasing the density and volume of the sounds (5) or imposing/reinforcing (6) the pitched content. The gestures set off eventually (B) dense textures based on the recordings of stone, metal and wood, which embellish the main recording (A). The main recording's sound of the passing aeroplane is taken as the climax of the piece (C). To reinforce the dramatic effect and the change in focus, the aeroplane sound is not only strongly transformed to remove reference to the original sound source, but also laboriously supplemented through additional textures based on transformed stone, metal and wooden source recordings. Through the concentration on spectro-morphological discourse during the climax (D), the piece can gently change its focus back to the environmental / referential sounds (E) to end with an emphasis on the outdoors sounds (F).

[69] See USB/compositions/4 skalna/_examples/skalna – ex02 – wood.wav.

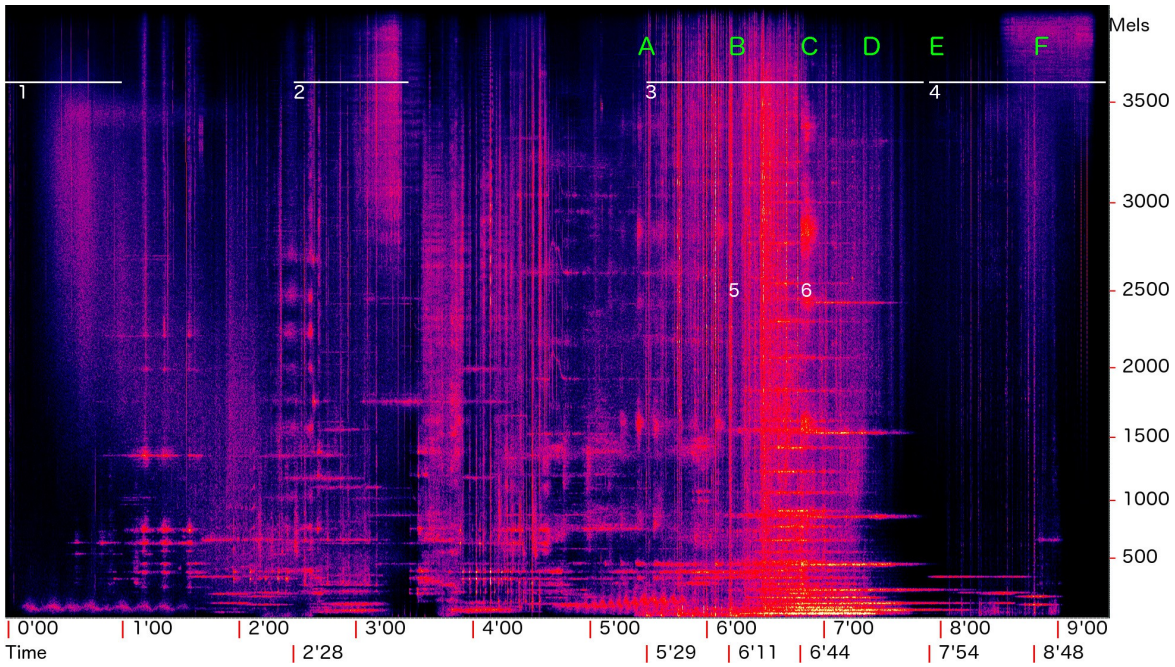

Figure 12: Sonogram of *skalna* (full).

6.3 Space and Multichannel Audio

Composing in multichannel had a significant effect on my compositional workflow. It affected the capturing, editing and transformation of the soundfiles substantially. As a consequence I had to replace and adapt the tools I had previously used. Because the solutions are key to the subsequent portfolio pieces, they will be briefly discussed below.

6.3.1 Capturing

After a series of experiments and recording sessions, I eventually came up with the idea to extend a spaced pair of DPA 4060s[70] by adding another spaced pair.[71] This resulted in a IRT-cross-like setup where the inner pair is mapped to the frontal speakers and the outer pair to the rear speakers (as indicated with the letters LS - L - R – RS in Figure 13). That way, the recorded prospective space[72] warps evenly around the listener (in high resolution): For example, standing in front of the railroad tracks and recording and reproducing a passing train like this would make its sound fly around the listener. With regard to the soundscapes in *skalna*, I shaped or bended this microphone setup further so as to maximise envelopment, spatial separation, width and even distribution of sounds. The result can be heard in segment 3'11 – 3'24 of *skalna.* The ease with which the capturing of space can be adjusted through simple microphone placements persuaded me not to use an ambisonics microphone.

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[70] DPA Microphones. (2013). 4060 Omnidirectional, Hi-Sens. [online]. Available from: http://www.dpamicrophones.com/en/products.aspx?c=Item&category=128&item=24035 [Accessed 18/10/2013].

[71] As the DPA's have a small footprint and their windshields are easily affordable, the DPA's form ideal partners for field-recordings. The microphones were then connected to an Edirol R44 (Figure 20).

[72] "[…] the frontal image, which extends laterally to create panoramic space" (Smalley 2007, p. 56).

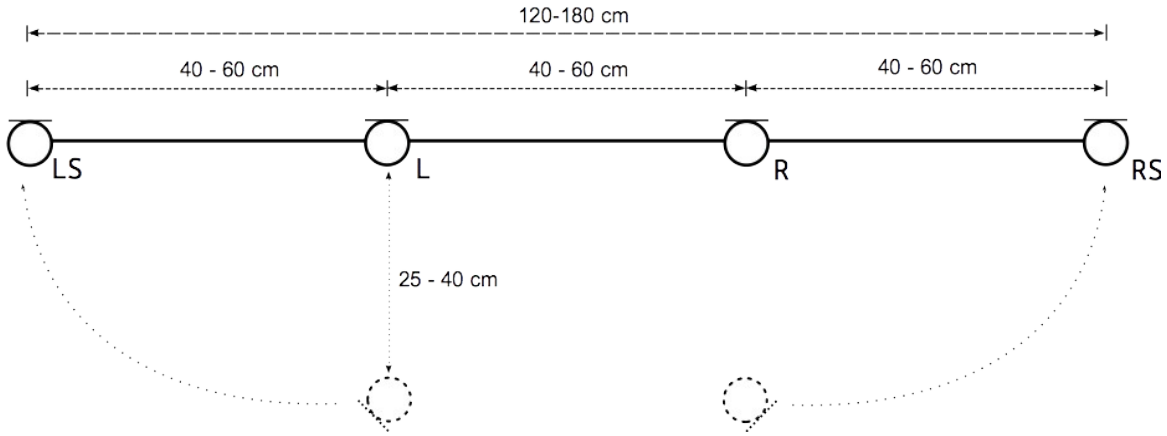

Figure 13: Symbolic representation of the warped IRT-cross. The circles represent microphones. The dashed circles represent original position of the surround microphones.

Figure 14: Photo of the complete recording set-up. Tentpoles had been used to attach the microphones.

6.3.2 Editing, Processing

With regard to software, I searched for tools which allowed the direct editing and transformation of multichannel images[73]. Cockos's Reaper[74] is my ideal choice as the main compositional platform due to the way it handles multichannel audio (and its affordability). Multichannel plugins were also needed to transform the audio without having to use multiple instances of the same plu-

[73] For a more detailed description of the technical aspects of my multichannel composition techniques see Popp (2013).

[74] Cockos Incorporated. REAPER | Audio Production Without Limits. [online]. Available from: http://reaper.fm/ [Accessed 8/10/2013].

gin to shape all the channels of the source soundfile at once. The plugins of Voxengo, in particular HarmoniEq[75] and Tube Amp[76], and MeldaProduction[77] suit my purpose.[78] Additionally, I adapted my effects written in Reaktor[79] and SuperCollider (PLib[80]) to support multichannel processing, as well.

However, because not all source recordings were made in multichannel and not all applications I used supported multichannel operation, files had to be split and/or conformed back to four channels. Stereo files can be converted into multichannel images through multichannel transformation in which the transformation's parameters differ for all channels slightly. That way, the audio would not need to be panned across the loudspeakers, solving the problems induced by panning, i.e. strong correlation between the channels.[81] Alternatively the source files had to be processed in two steps: firstly the front channels, secondly the rear ones, possibly with slight differences in the settings to increase width or de-correlation.

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75 Voxengo. Harmonically-enhanced audio equalizer plugin (AU, VST) - Voxengo HarmoniEQ - Voxengo. [online]. Available from: http://www.voxengo.com/product/harmonieq/ [Accessed 8/10/2013].

76 Voxengo. Audio tube/valve overdrive plugin (AU, VST) - Voxengo Tube Amp - Voxengo. [online]. Available from: http://www.voxengo.com/product/tubeamp/ [Accessed 8/10/2013].

77 MeldaProduction, professional audio processing software. [online]. Available from: http://www.meldaproduction.com/ [Accessed 22/1/2014].

78 The plugins made by Flux:: could have been another solution but were not affordable for me. See: Flux:: Flux:: sound and picture development. [online]. Available from: http://www.flux-home.com/ [Accessed 28/9/2013].

79 Native Instruments. Komplete : Synths & Samplers : Reaktor 5 | Products. [online]. Available from: http://www.native-instruments.com/en/products/komplete/synths-samplers/reaktor-5/ [Accessed 28/9/2013].

80 See p. 22.

81 Kendall, G.S. (1995). The decorrelation of audio signals and its impact on spatial imagery. *Computer Music Journal*, 19(4), pp.71–87. See also the discussion about multichannel audio in: Kendall, G.S. (2010). Spatial Perception and Cognition in Multichannel Audio for Electroacoustic Music. *Organised Sound*, 15(03), pp.228–238.

7 *pulses*

7.1 Approach

pulses (8-channel acousmatic composition, 20'04, 2012) refines my skills in multichannel composition and the orchestration of recorded and re-created soundscapes within a large-scale work. To achieve this I searched for suitable materials, a structure which facilitated the production of a large-scale work and a spatial format going beyond four channels. The research led me to two sets of field-recordings I made in England and Germany, to a form based on contrasting moments and to stems based on spatial layers.

7.2 Source Materials / Themes

Two sets of field-recordings provided a rich starting point for soundscape exploration. The first set focuses on the soundscape around a traffic light in Göttingen, Germany,[82] and the second set on the soundscape of Hadrian's Wall, UK.[83] Both sets contrast each other strongly in their spatial aspects and morphology. The traffic light soundscape is loud, rather hectic and dense with little spatial transparency (Figure 15).[84] Its recording contains in proximate space pulsating clicks[85] and in distal space[86] traces of human agency, e.g., voices, sounds of cars. However, the Hadrian's Wall

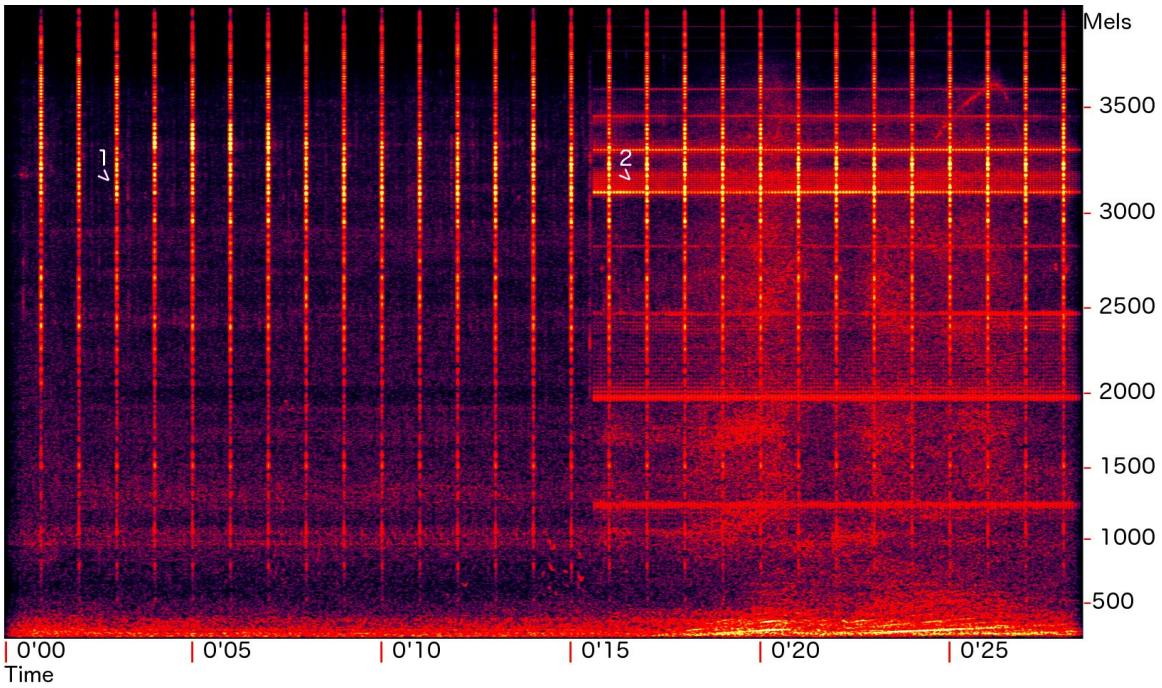

Figure 15: Sonogram of a traffic light in Göttingen.

soundscape is rather calm (Figure 16), with high spatial depth, a sense of openness, vastness, including the agency of animals (sheep and an occasional chirping bird, 1) and a human trace (the

[82] Coordinates: +51°32'11.94", +9°55'41.91".
[83] Coordinates: approx. +54°59'12.84", -2°28'55.38"
[84] USB/compositions/5 pulses/_examples/pulses - ex 01 - goettingen light.wav.
[85] The frequency of the pulses depends on the state of the traffic light (Figure 15): slow for red (1), fast for green (2).
[86] "I use the term 'proximate' to designate space nearest to the listener, and 'distal' for space furthest from the listener." (Smalley 2007, p. 36).

sound recordist, 2).[87] Also, it contains many noise sources: the noise generated by the microphones and the recorder's preamps, the noise of the environment generated by the trees and slow passing cars in the distance, as well as – in one of the recordings – a quite gritty noise created by a loose connection between the recorder and the external microphone.[88]

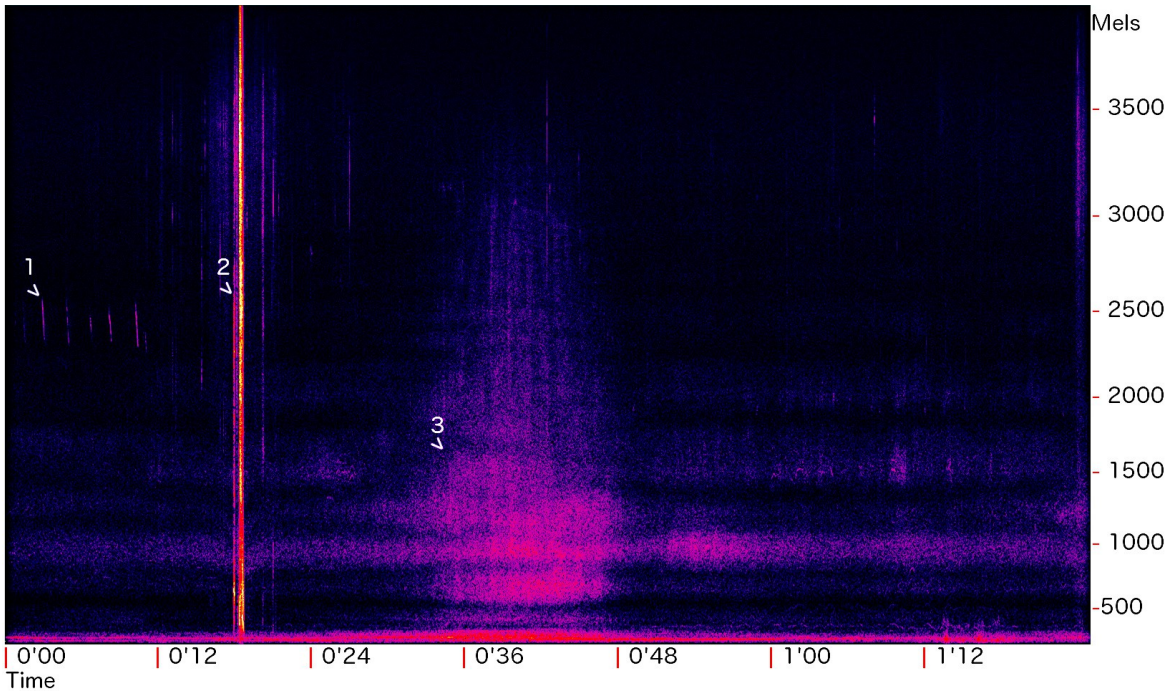

Figure 16: Sonogram of the Hadrian's Wall.

This analysis suggested a theme or main focus point for each recording set. The traffic light brought to mind the idea of clicks and pulses at various speeds (here referred to as the click-theme), whereas Hadrian's Wall implied an emphasis on different kinds of (environmental) noise and vastness of space (here referred to as the open-space theme). Both themes resulted in two archetypal sections to establish their contrast for the listener.[89]

While trying out different transformation methods to establish a connection between the two themes, a third theme, referenced as pcm-sampling-effect, emerged out of the idea of pulse code modulation. Unlike normal sampling where a sampled value is held until the next value is measured[90], the variation imposes an attack and decay envelope onto each value. Depending on the sampling rate, different coloured clicks (1) or the source recordings with strong artefacts, i.e. aliasing[91] (2), appear (Figure 17).[92] By adjusting the sampling rate the click theme can be connected with the open-space theme. Due to a bug in my PLib, I accidentally fed the output of the pcm-samping-effect to its input, causing unexpected and dynamic sawtooth-wave-like sounds to arise. Those sawtooth-waves eventually formed the third theme – synthetic, pitched sounds – to contrast with the field-recordings.

87 USB/compositions/5 pulses/_examples/pulses - ex 02 - hadrians wall horizon.wav.
88 USB/compositions/5 pulses/_examples/pulses - ex 03 - landscape and broken connector.wav.
89 See p. 39 and 40.
90 See Smith, S.W. (1997). *The scientist and engineer's guide to digital signal processing*. San Diego, Calif.: California Technical Pub, p.36.
91 See Smith (1997), p.40.
92 USB/compositions/5 pulses/_examples/pulses - ex 04 - hadrians wall – pcm.wav

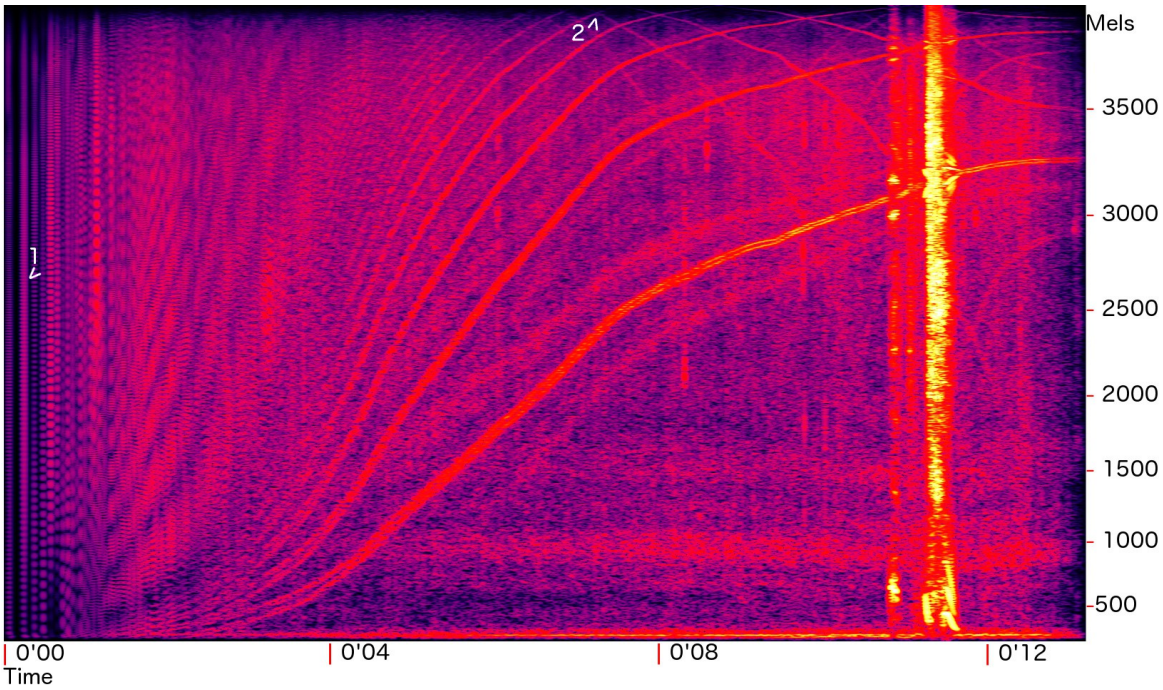

Figure 17: Sonogram of pulses - ex 04 - hadrians wall – pcm.wav.

7.3 Methodology: Abstraction, Simplification, Orchestration and Association

The process of abstraction, simplification, orchestration and association is key to the development of the materials. These processes will be described through the analysis of three sections of *pulses* and in relation to Simon Emmerson's language grid.

7.3.1 Abstraction / Extraction

The musical core concept of the first Traffic Light section (3'22 – 5'10) is extracted from the traffic light field-recording and can be seen as an example of abstracted syntax. Rather than reconstructing the field-recording in a literal way, the section focuses on the recording's musical qualities. Synthetic, pulsating clicks mimic the traffic light's timbre, contrast in spectral content and pulsating quality, albeit in an exaggerated way.[93] The pulses are faster and slower, the timbre brighter and darker. Furthermore, the approach to the spatialisation of clicks stems from the context of the field-recording: at night, when the traffic is quieter, more traffic lights at an intersection become audible to the listener. They form spatially distributed complex rhythms which change depending on the listener's vantage point. The spatial and rhythmical effect of the listener's movement is simulated in the piece in an aestheticised way. Whereas each of the slow, dark clicks appears in a specific, highly contrasting spatial position, the fast, high pitched clicks sound continuously during their movement to articulate their whole trajectory. The pace of the clicks is chosen so as to highlight their spatial trajectory. Because the section's focus lies in the play with space, pulsating rhythms and pitch the discourse is aural. As the synthetic versions of the clicks focus on specific aspects of the source materials, they, compared to the source recording, become simplified and their musical aspects are highlighted.

[93] Compare 3'41 – 3'43 with USB/compositions/5 pulses/_examples/pulses - ex 01 - goettingen light.wav.

7.3.2 Simplification

Simplified reconstruction through the focus on specific aspects of the source materials is (also) key to the first Landscape section (5'39 - 7'43), which focuses on the Hadrian's Wall recordings. The ambient noise of the trees and the distant, slowly passing cars are reconstructed in a simplified way via filtering pink noise and recreating the source's slow evolving spectral-temporal envelope.[94] The harsh noise and erratic, unexpected behaviour of the loose microphone-preamp connection is imitated via a distorted compressor with fast attack and release times and a high compression ratio, which heavily exaggerates the subtle fluctuations in signal level (and the floating point errors) of extremely quiet pink noise.[95] Again, simplification helps to shift the focus on to the aural aspects of the sounds, rather than their connection to the source. In the piece, the simplified, synthetic versions form a transition between a real-world landscape implied by the original recordings and an imaginary, unreal one[96]; i.e., a transition from mimetic to mainly aural discourse. The complex combination of simplified and quoted real-world sounds recreate the composer's impression of the original soundscape's vastness via an exaggerated perspective, as sounds are made both closer and more distant through synthesis and sound transformations (reverb/spatialisation).

7.3.3 Orchestration

Both sections also brought another process to light: the notion of orchestrated field-recordings which shall be discussed with regard to the second Traffic Light section (16'00 – 18'03). Contrary to the first Traffic Light section, here the original source recording has been used, albeit in various transformations: At 16'10 the recording appears like a clock-like ticking, together with its sounds of cars and traces of humans, or at 16'39, where it is transformed via a distorted comb-filter, making it sound similar to a level crossing signal. Rather than mimicking the traffic light clicks, supplemental and synthetic sounds (e-bass-like and church-bell-like sounds) highlight the source recording's pulses and mood. Their pulse fit the traffic light's pulse at a slower rate – the two pulses of the traffic light become multiples of the synthetic sound's pulse. Because the traffic light's pulses are much faster, they develop a dramatic aspect and increase tension (compare 16'49 with 17'00). In that sense, both layers – the traffic light and its ambience and the synthesised sounds – comment on and influence each other. Since the source recordings and their transformations still refer to the real-world while being embedded in the piece's evolutionary development, the discourse here is both mimetic and aural; however the syntax is abstracted.

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94 Compare 5'43 – 6'02 with USB/compositions/5 pulses/_examples/pulses - ex 02 - hadrians wall horizon.wav at 0'30 – 0'50.

95 Compare 6'22 – 6'37 with USB/compositions/5 pulses/_examples/pulses - ex 03 - landscape and broken connector.wav. Compare also the section 12'37 – 12'47 with USB/compositions/5 pulses/_examples/pulses - ex 05 - broken connector crescendo.wav.

96 With regard to the definition of imaginary landscapes see: Wishart, T. (1986). Sound Symbols and Landscapes. In *The Language of Electroacoustic Music*, pp.48.

7.3.4 Association

Since the themes repeat in different contexts and merge eventually (Table 1), a complicated network of material relationships is created (Figure 18)[97]. These relationships are used throughout the piece to create transitions and links between the themes, forming coherence despite the heterogeneous source materials. For example, the watery noise from 0'25 onwards relates to the seashore-wave-like motion and timbre of the beginning of the Landscape 1 section (5'39). This association with water is reinforced through the indirect (10'32) and direct (15'27) allusion to rain-drops via resonant clicks. Those clicks themselves, however, refer to the other clicks of the piece, e.g., the beginning (0'00 – 0'24) or in the Traffic Light sections (3'02 – 5'10, 16'00 – 18'13). The second Traffic Light section inherits the seashore-waves association through the context of rain-like and passing car sounds as they share the morphology of the seashore-like trajectory of noise sounds in the Landscape 1 section. These associative links, as described in the example, are numerous in *pulses*.

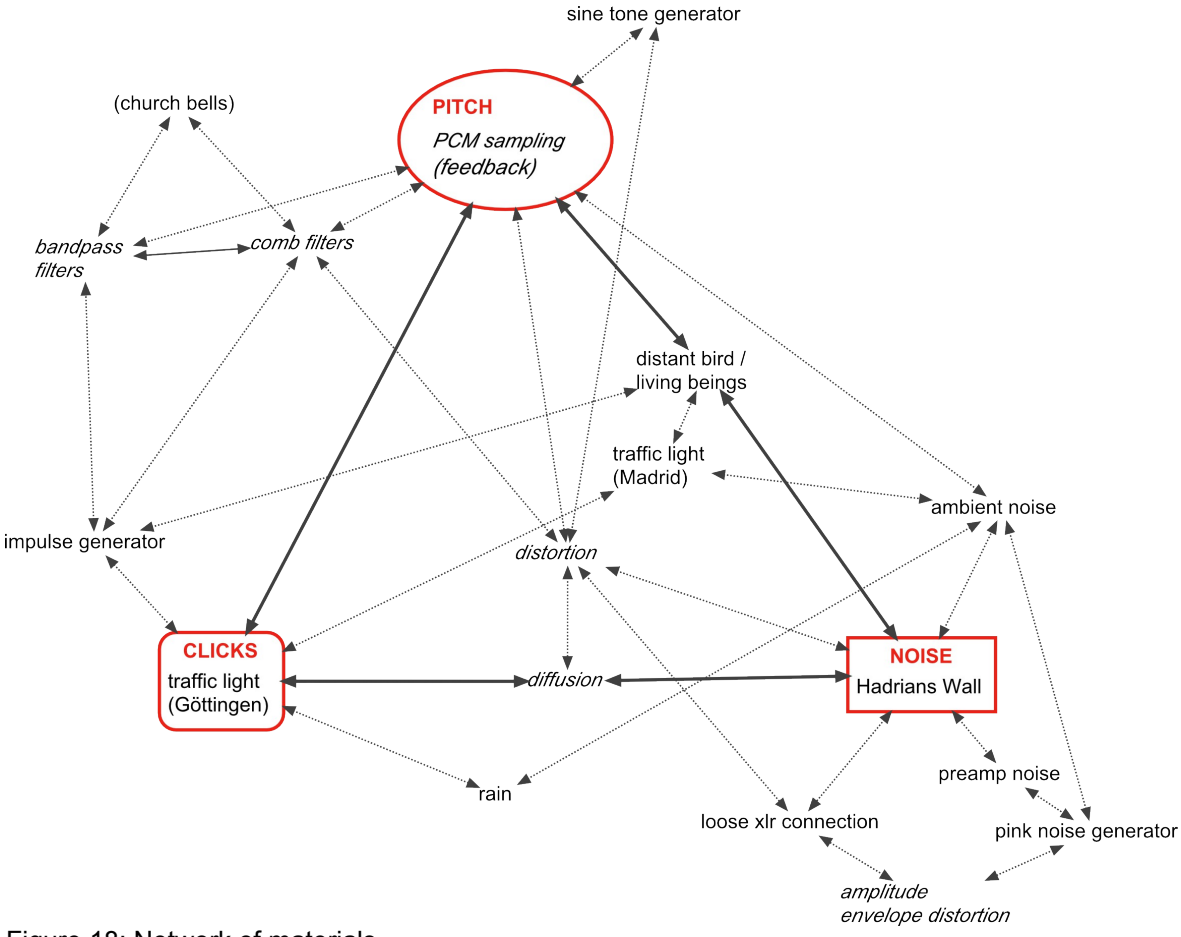

Figure 18: Network of materials.

[97] The sounds indicated in the Figure include the main morphological aspects (in red), as well as the abstracted and abstract sounds, sound transformations/processes (in italics) and supplemental materials. Some sounds, such as tree or wind noise, appear subsumed in a group descriptor, e.g., ambient noise.

7.4 Form

timeframe	part	moment	section name	aspect / theme	type
00’00-00’25	1	A	Pcm 1	click + pitch	synthetic
00’25-03’02		B	Watery Noise / Clicks	click + noise	
03’02-05’10			Traffic Light 1	click + pulse + pitch	
05’10-05’39		C	Pause 1	click + pulse + pitch	
05’39-07’43	2	D	Landscape 1 / Loose Connector	noise	concrete
07’43-10’32			Bird	pitch + noise	
10’32-11’22		E	Pause 2	click + decay	synthetic
11’22-14’00	3	F	Pcm 2 / Loose Connector	pitch + noise	synthetic
14’00-16’00	4	G	Rain / Landscape 2	click + decay + noise + pitch	synthetic + concrete
16’00-18’13			Traffic Light 2	click + pulse + noise + pitch	
18’13-20’04		H	Landscape 3	click + noise	

Table 1: Overview of *pulses*'s sections, themes and sound types.

The oscillation between real-world and synthetic sounds (Table 1) as well as the change in spectral occupancy and distribution, and also loudness, ensures that the sections contrast each other clearly (Figure 19. For example, section Traffic Light 1 culminates (4'54) after a strong emphasis on base frequencies and high sound level in the Pause 1 section (C), which features rather dark, spectrally thin and very quiet sounds. The subsequent section (D) starts with a slow broadband pink noise crescendo, aims for a relatively loud beginning then continues relatively quietly. The crescendo is embedded in an environment of ambient sounds (5'39). Whereas the previous section was rather abstract, real-world sounds dominate the new section (at least in its beginning). Similarly, the dense spectral occupancy and high sound level of the Pcm 2 section (F) contrasts heavily the quiet, slow decaying clicks in the Pause 2 section (E). The Pause 2 section works as a transition from the real-world materials in D to the synthetic materials in F. These contrasts (and transitions) in sound typology and dynamics continue throughout the piece.

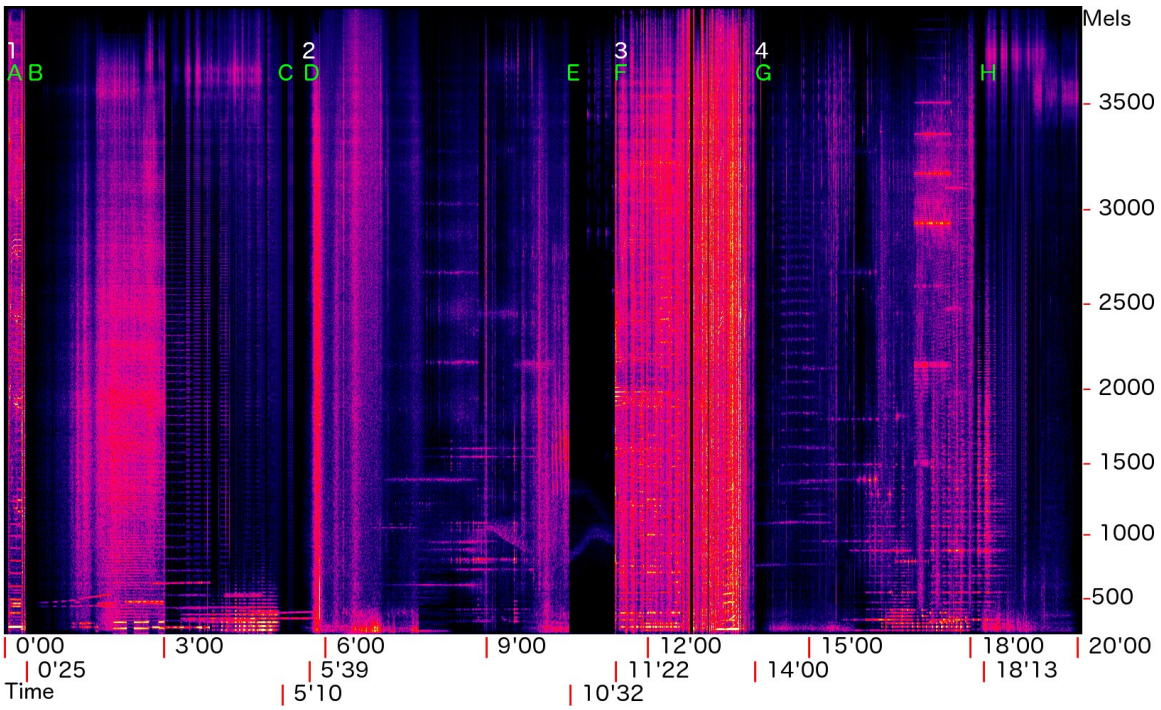

Figure 19: Sonogram of *pulses*.

The sound structures therefore move around Emmerson's language grid (Table 2). It should be noted that the beginnings of each part either feature prominent (but not necessarily solely) synthetic (part 1 & 3) or real-world sounds (part 2), or both (part 4). Also, each section might start with an aural discourse and become more mimetic as the section evolves, or vice versa. This process of transition between the aural and the mimetic is employed heavily throughout the piece, for example in part 4.

				discourse		syntax	
				aural	*mimetic*	*abstracted*	
00'00-00'25	1	A	Pcm 1	x		x	exposition
00'25-03'02		B	Watery Noise / Clicks	x	x	x	
03'02-05'10			Traffic Light 1	x		x	
05'10-05'39		C	Pause 1	x		x	
05'39-07'43	2	D	Landscape 1 / Loose Connection		x	x	synthesis / development
07'43-10'32			Bird	x	x	x	
10'32-11'22		E	Pause 2	x		x	
11'22-14'00	3	F	Pcm 2 / Loose Connection	x		x	
14'00-16'00	4	G	Rain / Landscape 2	x	x	x	development / recapitulation
16'00-18'13			Traffic Light 2	x	x	x	
18'13-20'04		H	Landscape 3	x →	x	x	coda

Table 2: Structural overview of *pulses* with reference to the language grid.

The function of the Pause sections shall be discussed in more detail, now.

7.4.1 The Pauses

The concept of sounding pauses refers to the idea of short sections with little activity, giving the listener a rest while the piece keeps playing. It was borrowed from Michael Obst's *espace sonores*.[98] In *espace sonores* short, static moments with mimetic discourse and (virtually) no musical evolution appear between large sections which use purely synthesised sounds. Those short segments give the listener the chance to reconnect to the piece, providing a relaxation from the synthetic materials while avoiding silence between each section. A similar method is used in *pulses*. The activity in the short segments is also reduced, but they concentrate instead on synthesised materials, relying on aural discourse. However their effect is comparable: they equally give the listener time to regain his/her attention, but also improve the contrasts between the sections.

The use of sounding pauses implies neither purely smooth nor disjunct transitions. In the Pause 1 section, the background sounds rise slowly and fade into silence while the pink noise gradually fades in. The noise works as a release of tension, as it washes the previous section away like a wave at the seashore, and it prepares the environmental sounds of the next section. From the material perspective the pink noise is surprising, but from the perspective of tension and release it follows quite logical. Depending on the focus, this transition from the Pause 1 section to the Landscape 1 section might be both smooth and disjunct. The Pause 2 section works in a similar way. It further strengthens the effect of (quasi-) silence and increases the focus on synthetic sounds. While the sound type of the subsequent section is prepared, i.e., synthetic sounds, their overall loudness is not, eventually startling the listener. This is intentional for dramaturgical reasons: the composer felt that the listener's attention might drift away from the piece at the end of the (slow) Bird section and therefore composed an increase in tension by making use of the startling effect.

To avoid a stereotyped formal progression in the shape of a section – pause – section – pause sequence, the pauses become more integrated in their later sections. The sound materials at the end of the Pcm 2 section become merged with the sound materials of the Rain section (14'00 – 16'00) which prepare the church-bell-like materials of the Traffic Light 2 section. The Rain section functions both as a relaxation from the loud and tense sounds of the Pcm 2 section, while bridging the path and tension to the Traffic Light 2 section.

7.4.2 Moment-form-ness

The overall formal development of *pulses* exhibits moment-form-like aspects. According to Kramer (1988, p. 483), a moment form is based on a succession of "self-contained, (quasi-) independent sections" with their own particular character. "Usual introductory, rising, transitional and fading-away stages are not delineated in a development curve encompassing the entire duration

[98] I heard the acousmatic version in a concert at the HfM Weimar 2005. As far as I know, the acousmatic version is only available from Obst himself. However he has orchestrated the piece into a orchestral version, which is available here: Obst, M. (2005). *Espaces sonores. Für Bläserquintett und kleines Orchester*. Brühl: Verlag Neue Musik.

of the work".[99] Because some of the sections have their own character and manner that they evolve or contrast with each other, the idea of a succession of moments having their own evolution emerges. However, since the section's materials reappear and their contexts are merged (see above), the moments become less self-contained, as well as their transitional stages might have been delineated via the concept of pauses. The concept of moments was useful for the composer insofar as it guaranteed sufficient contrasts to keep the flow of tension and release intact.

7.5 Space/Stems

pulses extends the compositional methodologies of multichannel audio developed in *skalna* with the concept of spatial stems to increase the effect of spatial depth (or perspective).[100] The loudspeaker setup is split in two quadrophonic rings with increasing diameters and distance to the listener (Figure 20).[101] Each ring performs its own function. Whereas the smaller ring is used to playback sounds appearing in the proximity of the listener, the larger ring reinforces the perception of distant sounds due to its distance to the listener. It therefore adds the dimension of actual distance to sound spatialisation as opposed to virtual distance suggested by room simulation methods such as reverb. For example, at 14'09 the sound of rain drops come gradually closer to the listener via a crossfade between the reverberated sound through the larger ring and a drier version in the smaller ring. Similarly at 7'51, distorted close sounds on the smaller ring give a sensation of physical closeness which is reinforced through the contrast of the reverberated (distant) sounds of the larger ring. Because the sounds of the larger ring blend more with the natural reverberation of the performance hall, the credibility of the reverb employed increases. This distal to proximate trajectory repeats at various places in the piece (0'29, 5'30, etc.), as well as the complex layering of proximate and distal spaces (10'51, 18'58, etc.). Because of the spatial contrast, the effect of being close to sound is reinforced, creating a sense of the vastness of the composed space at times. The nature of the stems makes sure that the piece stays performable even when only one ring of loudspeakers is available.[102]

[99] Stockhausen, K.-H. (1963). Momentform: Neue Beziehungen zwischen Aufführungsdauer, Werkdauer und Moment. In *Texte zur Musik*. Cologne: DuMont Schauberg, pp.198–199.

[100] For a more technical description of stem-based composition see: Popp (2013), p.8.

[101] The rear loudspeakers of the inner ring are placed in a 5.1 fashion to improve lateral sound projection at the cost of smoothness of circular motion around the listener (Dow 2004, p. 4). The distant loudspeakers, facing the walls, fill the gaps between the close loudspeakers due to their diffuse character.

[102] See also Popp (2013), p.5.

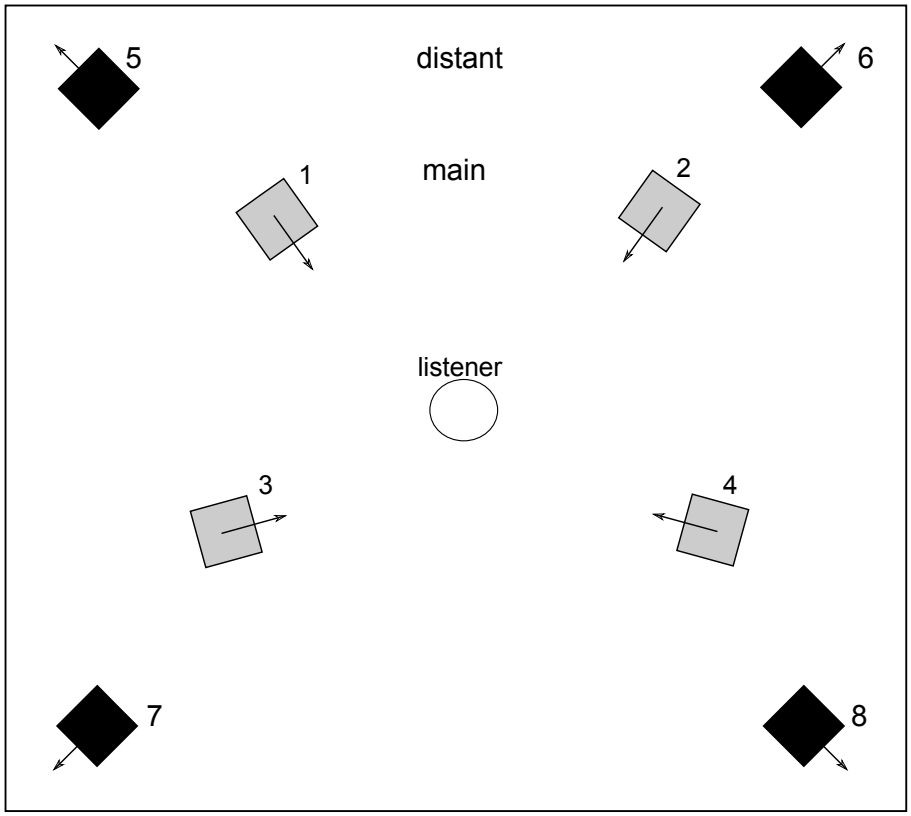

Figure 20: Loudspeaker layout for *pulses*.

7.6 The Recordist

With regard to human traces, the inclusion of the sound recordist's sneeze is important (5'52). It is included in the piece, not only because it fits the gesture initiated by the pink noise crescendo, but also because it changes the listener's spatial perception. Since the sneeze appears on all close loudspeakers, combined with a rather wide and diffuse apparent source width, the listener is given the impression that s(he) is hearing the landscape through a technical medium (combination of microphones, headphones or loudspeakers) while it is being recorded. This impression is further suggested through the strong attenuation of the noise that occurs when wind blows at microphones, and the sounds of the recordist's movement. The impression creates a sense of immediacy to the piece and, in a way, feels like a shared private moment between the listener and the recordist. Interestingly, this perception fades when the sneeze appears in the distance a second time (8'57), creating a more imaginary impression through the amalgamation of spaces that arises out of the layering of the material's inherent spaces.

8 *beeps*

8.1 Approach

beeps (14-channel acousmatic composition, 14'49, 2013) investigates how a sense of drama or tragedy can be communicated to the listener. It explores the dramatic effect of gestures and draws heavily on the compositional methodologies developed in the portfolio. The compositional aims resulted from repeated listening to shows produced at Radiolab.[103] Their shows are tuned for strong emotional impact on the listener via the use of sound design, music and story telling.[104] *beeps* strives to create a similar emotional effect in the realm of electroacoustics, but without imitating Françis Dhomont's *Sous le regard d'un solei noir*[105] or Michel Chion's *Requiem*[106]. Everyday sounds and their transformations were key, alluding to a sense of narration through their referential qualities.[107]

8.2 Materials / Methodology

One recording of a microwave supplied the main musical material and idea for the development of the piece (Figure 21).[108] The recording contains a variety of gestures created by the interaction with a microwave and builds complex links to the parameters pitch and space. The gestures served as a starting point and archetype of the gestural interplay of heterogeneous sound types, especially the connection between the sounds of the closing / opening of the microwave (1, 2) and the sounds of beeps (3, compare with 0'48 – 0'51 of *beeps*). The recording's reference to pitch space[109] resulted from the hum present in the recording: the hum being part of the ambient sounds (A) and the sound the microwave makes when it is engaged (B). Both sounds are used as the tonal context for other sounds.[110] The recording's reference to space suggests the concept of dense spatial layering: the internal space of the inside of the microwave (colouration of the sounds recorded inside the microwave) and the delicate mix of external spaces, as in the room where the microwave is placed (reverberation of the sounds) and the outside world outside of the room (traffic noises, D, and human traces from outside the room).

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[103] Radiolab. Podcasts - Radiolab. [online]. Available from: http://www.radiolab.org/series/podcasts/ [Accessed 22/10/2013].

[104] See the section around the "pointing arrow": Abumrad, J. (2012). The Terrors & Occasional Virtues of Not Knowing What You're Doing. [online]. Available from: http://transom.org/?p=28787 [Accessed 21/8/2013].

[105] Dhomont, F. (1996). *Sous le regard d'un solei noir*. Montréal: empreintes DIGITALes.

[106] Chion, M. (2007). *Requiem*. Brussels: Sub Rosa.

[107] See also the discussion on narration in p. 57.

[108] See USB/compositions/6 beeps/_examples/beeps ex 01 - mw0460 original idea.wav

[109] (Tonal) pitch space is a “subdivision of spectral space into incremental steps that are deployed in intervallic combination” (Smalley 2007, p. 56).

[110] See the hum at beginning of part 2 (4'21) or the bandpass-filtered hum of the microwave around 1'53 (pitched background sounds).

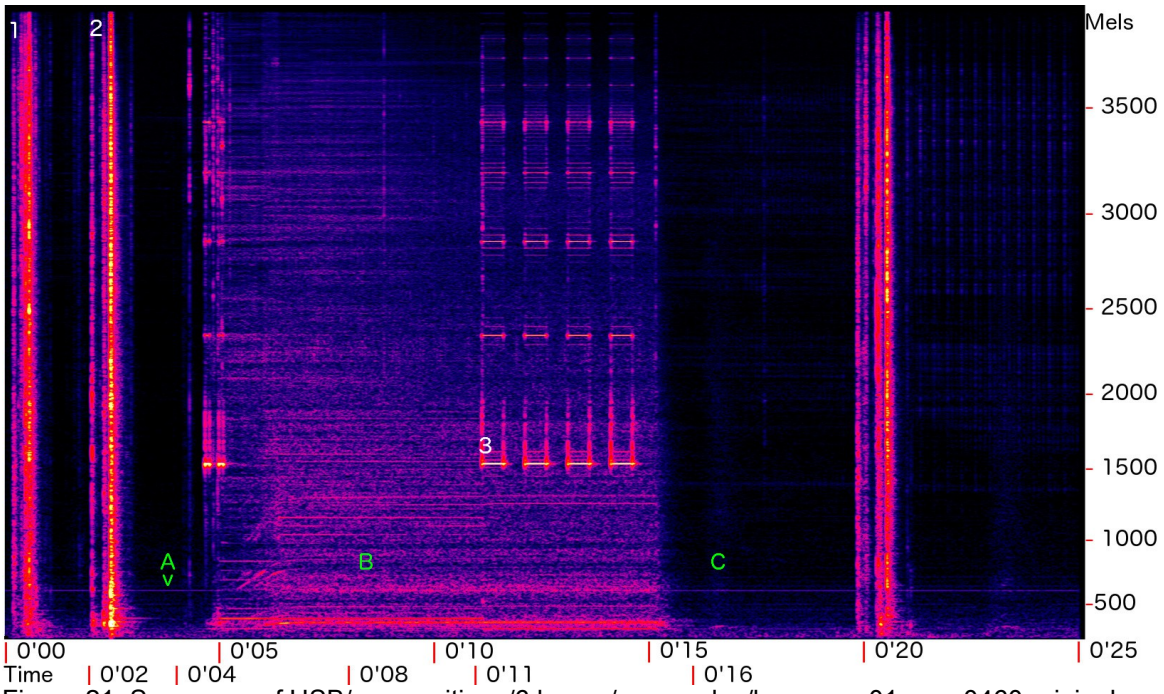

Figure 21: Sonogram of USB/compositions/6 beeps/_examples/beeps ex 01 - mw0460 original idea.wav

The musical ideas present in the recordings prompted the capture of supplemental recordings.[111] This broadened the amount of control the composer could exert over gestures, pitch space and space/spatialisation. The original gestures were embellished by additional recordings of the microwave (and other objects) using playing techniques[112] found in *stone and metal*. The range of the microwave's beeps was extended by field-recordings from objects such as elevator controls and entry gates which contained their own beep-like sounds and new musical inspiration. The spatial layers present in the source recording prompted the recording of the microwave with different microphone types (spaced pair using omni-directional and cardioid microphones) and in different room acoustics (dry, small room vs. medium-size reverberant room) to increase control over the composition of perspective using the microwave's sounds.

Abstraction and simplified resynthesis helped to reduce the background noise present in the field-recordings and offered new options of transition. For example at 1'15 – 1'40, the hiss in a recording of the dripping of an electronic shower was reduced to highlight its musical qualities. One strong frequency of the dripping was selected and a pulse with similar pace was synthesised (1'45 – 1'50, A & B in Figure 23 on p. 53). Due to their similar morphologies, the beeping sounds could be linked to the dripping sound. The dripping's simplified version created therefore a transition between the two originally rather unrelated recordings. The method of simplified resynthesis has been used at other moments in the piece as well (high pitched beeps at 2'30 (C) and their synthesised version at 2'54 (D)).

With regard to narration, the referential aspects of beeping objects helped to avoid the use of a narrator's voice normally present in melodramas or radio programmes. If the listener follows the

[111] E.g. plastic fridge drawers, a metallic dish drainer, a fridge's evaporator coil.
[112] E.g., slamming, brushing, pressing, plucking.

sound's reference to his/her everyday experience, the beeps are part of a process of communication between agents and objects.[113] For example, the beep of an entry gate signals the user the permission or denial of entry (7'51 – 8'04 single beep vs. several, fast-paced beeps). Or the anacrusis of the time at a radio announcement syncs the listener's perception of time.[114] Because the listener has the option of not paying attention to the sound's cause, the sense of narration created by the beeps tends to be rather subtle and less referential while the musical qualities of the sounds stand out more. A stronger sense of narration is actually achieved in the way the gestures are transformed and presented in the musical context, as will be described below with regard to the evolution of a conflict.

8.3 Form / Language

The piece roughly follows an A-B-A'-Coda form (Figure 22). While part one (0'00 – 4'18, A) introduces the listener to the piece's language and the idea of a conflict, part two (4'18 – 8'12, B) focuses on the development of the beep and the slow escalation of the conflict. Part three (8'12 – 13'30, AB') – a hybrid between A and B – then expands this escalation, which eventually leads to a cathartic resolution (10'45 – 13'30, 1). The coda (13'30 – 14'48, Coda) then dwells on softening the beeps and attack-based gestures to gradually end the piece, implying a resolved conflict.

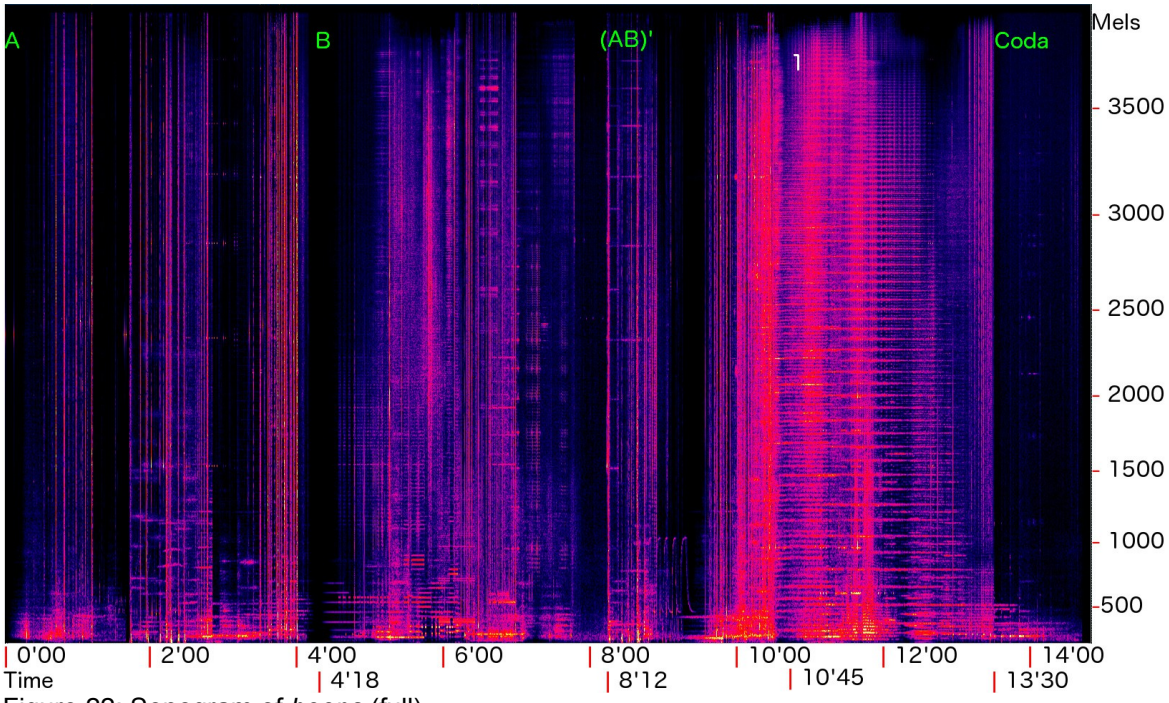

Figure 22: Sonogram of *beeps* (full).

[113] See Emmerson's discussion on “Narrative” and “Landscape and the Live” in Emmerson (1999, p. 139) or Wishart's analysis on “Music and Myth” in Wishart (1986, p. 55-56).

[114] Compare USB/compositions/6 beeps/_examples/beeps ex 02 - radio station time announcement.wav and the recording's abstraction at 8'12 – 8'23.

The sound of the beep is key to the introduction and transition of spaces and gestures, especially in the introductory section from 0'00 – 1'40 (Figure 23). For example, through the gradual increase of distance and reverberation (1, 3) and slow reveal of additional recordings (2), the beeps delineate the evolution of space.[115] They begin in a dry, reverb-less environment (1), get slowly and increasingly reverberated, making a small room acoustic apparent (3), and eventually are replaced with a field-recording of distant beeps in a large space with people (0'44, 6). The connection of the beeps to the metallic/plastic gestures is equally slowly revealed: They at first do not relate directly to each other (3, 4), but eventually form a strong bond through repeated combination (5, 7, 8). The connection works because of a sense of implied pulse between the beeps and the metallic/plastic sounds (0'48 – 0'52, 1'00 – 1'03) and a (subtle) cause-and-effect bond based on the change of pitch (4). It is worth mentioning that the timbre (and association) of the beeps evolves heavily throughout the introductory segment. First, they are synthesised (1), then replaced by a field-recording as part of the microwave context (5) and the entry gate recording (6) and then changed back again to a synthesised version (at higher pitch, 7 & 8). This evolution is a good example of how simplified resynthesis of field-recordings can be used to create transitions and connections between different spaces, materials and contexts.

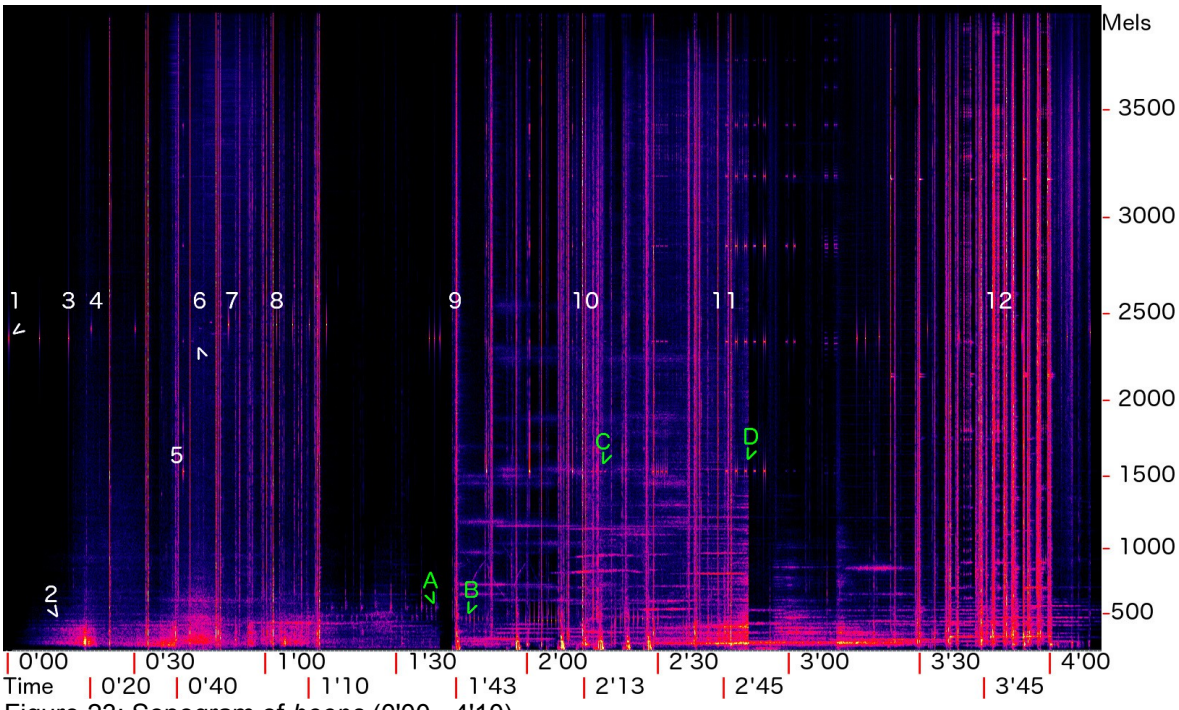

Figure 23: Sonogram of *beeps* (0'00 - 4'10).

The segments from 0'45 – 1'19, 1'43 – 2'00, 3'36 – 4'02, 6'34 – 7'00 and 9'49 – 10'32 suggest the evolution of a conflict audible in the development of the metallic gestures and their connection to beeping sounds. While the segment at 00'45 introduces the metallic gestures (7) and their bond to the beeps, the metallic gestures's physicality and emotional force becomes increasingly reinforced in 1'43 – 4'02 (and in later segments): over time, the attacks of various sound types are placed in the same context and become more and more interwoven, brighter and weighty (8 – 12),

[115] At 0'20 – 0'24 the specific spatial layering of the original source recording appears in the piece in an embellished way. The beeps are more distant and slightly more reverberated, whereas the metallic gestures appear both very close and distant while the sound of the traffic comes into focus every now and then.

while harsher sounds become increasingly prominent or accelerate (1-3 in Figure 24), especially in later sections (compare 0'45 with 3'45, 6'31, 8'32, 9'56). A combination of sound transformations helped to increase these impressions – in particular minute editing, compression, transient shaping, ring-modulation and granular synthesis. Furthermore, the gesture's development is mirrored in the background, as its spectral colour slowly changes from dark, quiet and calm (0'45) to very bright, loud and insistent (9'42 – 10'32, 2 & 3). Tension and dissonance progressively accumulate as the piece unfolds to reinforce the impression of conflict and a sense of drama.

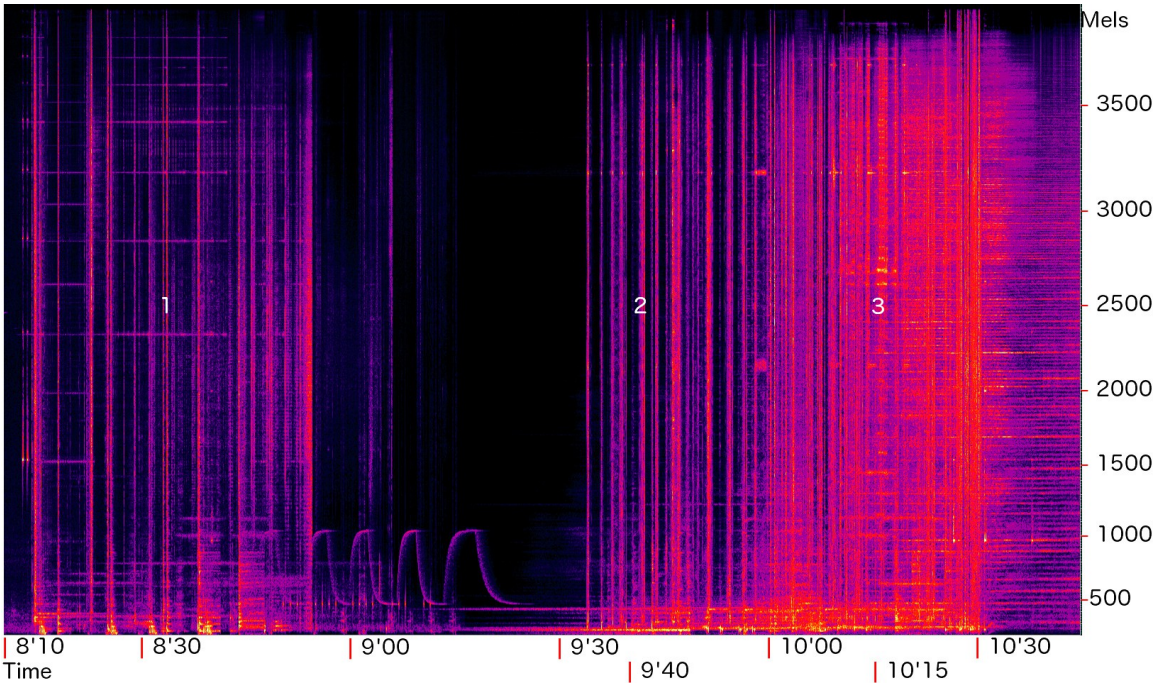

Figure 24: Sonogram of *beeps* (8'10 - 10'40).

The conflict finally resolves in a cathartic segment (10'45 – 13'30) and coda (13'30 – 14'48), which reinforces the sense of drama as well, as it refers to that tension's dissipation (Figure 25). This impression stems from the slow tonal resolution of accumulated tension (1 – 2), accompanied by a simple call-and-response pattern: the close beeps (1) are answered by more distant, and an octave lower beeps (2). The whole piece decelerates while the beeps' durations are sustained (compare 1 with 2, 3) and the attack-based gestures disappear (10'32 – 13'24) for some time, to be eventually softened in the coda (4).[116]

[116] The attack-based gestures' complexity is reduced and their timbre changed.

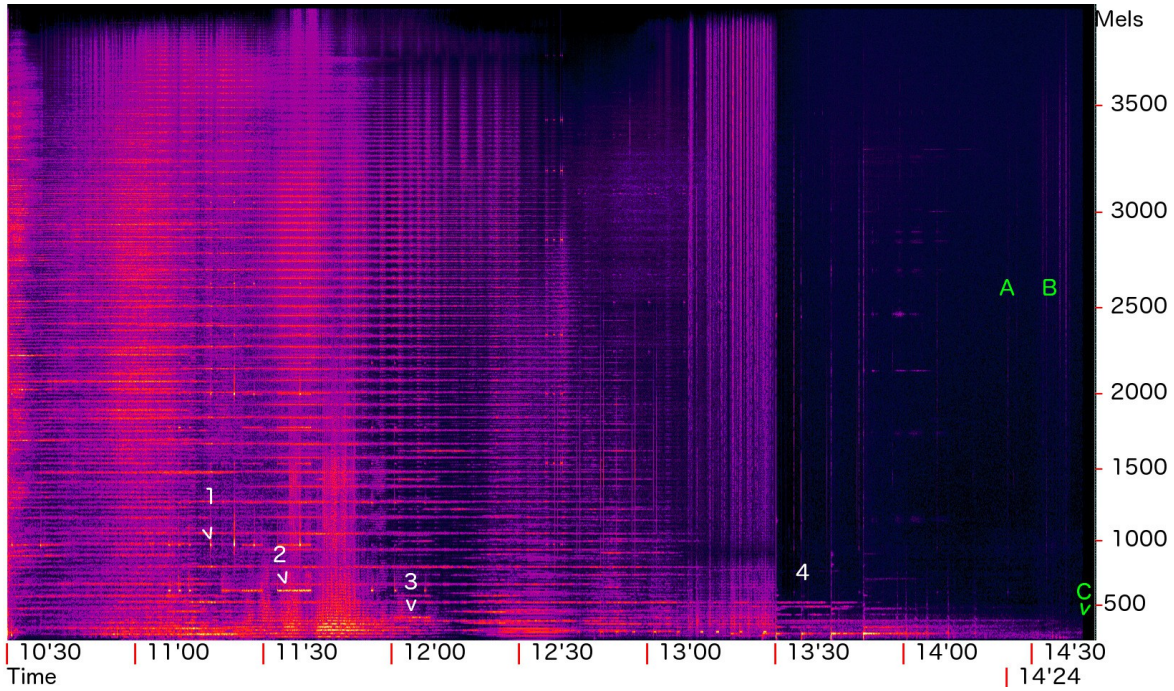

Figure 25: Sonogram of *beeps* (10'30 - 14'48).

8.4 The Recordist (II)

As in *pulses*, the sound recordist is also present in *beeps*. While the piece arrives slowly at a field-recording of an empty, quiet space (Figure 31, A), it ends abruptly when the field-recording stops. The sound of clothes and steps (14'32, B) suggest an agent who turns off the recording device with which the piece seemed to have been recorded (C). The noise of the field-recorder's preamp and the recordist himself is important to make itself (or the medium) known to the listener and to differentiate between the noise of the performance hall and the noise (or silence) of the piece. By following the referential ties of the sounds of the recording process, the listener could imagine that at that moment he/she hears the piece from the perspective of an outside recordist who happened to record the evolution of a conflict. The recordist however doubles the listener's role – he /she is observing from the outside. In a way, the inclusion of the recordist serves as an entry point to the piece, once the listener identifies himself / herself with the recordist, creating an allusion to intimacy/immediacy via a collective observation of someone else's private moment.

8.5 Space / Stems

As previously mentioned, the sound materials were recorded and transformed in several ways to increase spatial depth (Table 3). Recording the materials at various distances, in reverberant and dry spaces with a spaced pair of microphones created a plethora of spatial layers. The spatial aspects of these layers were exaggerated even more through synthesis and transformation to expand the spatial palette further. Synthesis and omission of the original attack and decay, with regard to the beeps, removed the links to the recording's original room acoustics. Artificial reverberation via convolution reverb using two different impulse responses added further distance to the synthesised or recorded materials. Extreme time-stretching, especially in combination with reverberation, increased the perceived distance and room size tremendously, too. The resulting sounds

were then placed according to their implied distance on three quadrophonic rings of loudspeakers with increasing diameter plus an added stereo pair in close proximity to the listener.

distance	type	detail	stems
close	(re-) synthesis	based on field-recordings	close / solo ring
	stereo recording technique	spaced pair — cardioid	
	stereo recording technique	spaced pair — omni-directional	main ring
	reverberation / field-recording	small room ambience	distant ring
	reverberation	church ambience	very distant ring
far	extreme time stretching	paulstretch	

Table 3: Link between distance, sound processing / recording and distribution to stems.

To facilitate the production process, the piece was composed firstly in stereo and then transformed into a multichannel, stem-based version (4 stems, 3 in quadrophonic rings, 1 as a stereo soloist, Figure 26).[117] This had the advantage that compositional decisions could be made quickly as the definition of the multichannel aspects had been deferred to a later stage. For example, splitting or conforming sound images to multichannel takes time and extra effort which could impair the development of compositional ideas. While the composer waits for the computer to have completed, say, the channel splitting and merging, the composer's train of thought could be interrupted, possibly making him/her forget his/her current ideas. With regard to the sheer number of stems, deferring the multichannel aspects meant a huge time saving at the first compositional stage as the amount of signal to be sent to each stem had to be defined for every sound (Figure 27, note the seven lanes of automation envelopes per track (Volume, 3 curves for the stems, 3 for panning))! However, when the piece was transformed into a multichannel version, the sounds were already “finished" and therefore needed to be panned[118] to conform them to the quadrophonic rings. Panning was preferred over other multichannel transformation as the sounds had to be changed a lot for decorrelation to appear. These extra strong transformations however would have affected compositional decisions and were therefore avoided. This is, however, problematic as panning induces correlation between the channels, making the overall sound image less robust due to the precedence effect,[119] especially compared to the multichannel sound images of *pulses.* On the positive side, the depth and credibility of the spaces caused by the stem-based approach still outweighs the concerns in image stability.

[117] See also the technical descriptions on p. 77.

[118] For the sake of simplicity and compatibility to the stems format a custom-designed quadrophonic panner was made and used by the composer. Because the panner ran within the DAW and was accessible to the composer other spatialisation methods were not used. For a discussion for approaches to spatialisation see also: Peters (2010), pp.41-50.

[119] Kendall (1995), p.71.

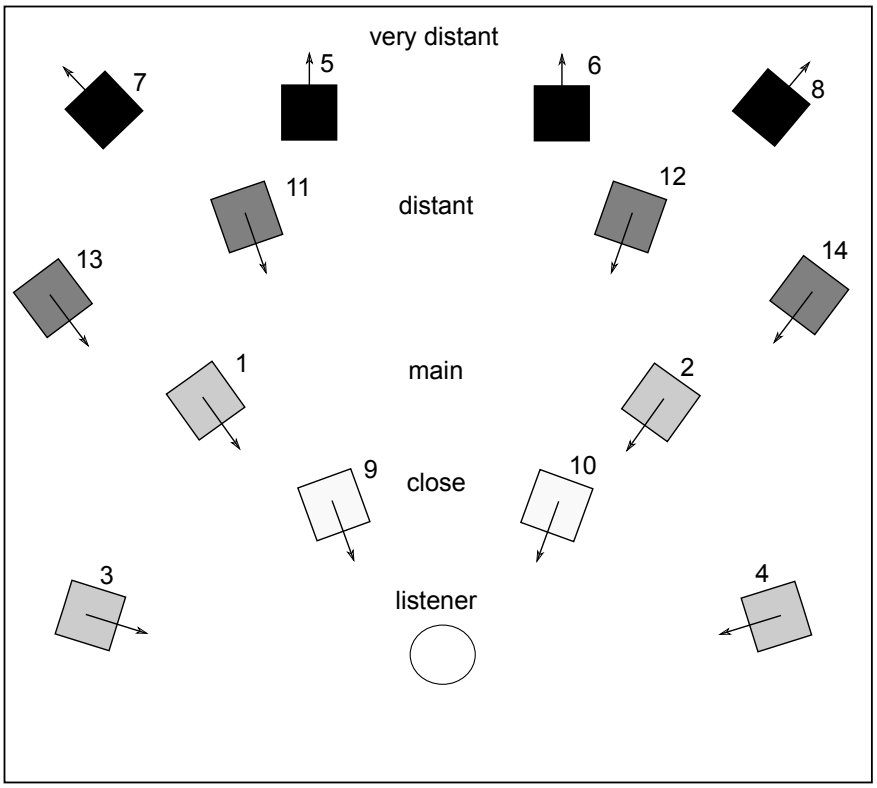

Figure 26: Overview of the mapping of stems to loudspeakers (orchestral version).

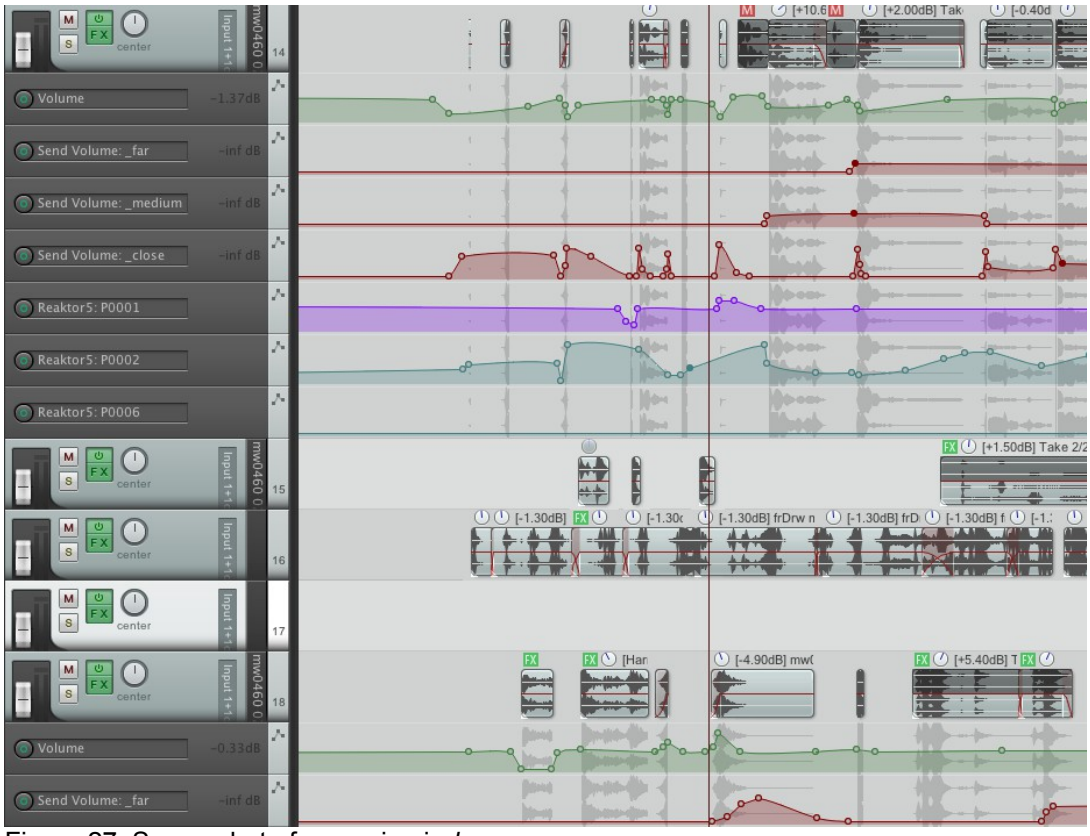

Figure 27: Screenshot of a session in *beeps*.

8.6 Pitch Centres

Throughout the portfolio, pitch centres helped to shape the ebb and flow of the pieces' tension. The methodologies associated with pitch centres are shared among the pieces of the portfolio and I will use *beeps* to explain them, in particular with reference to how pitch centres are extracted, created, used and applied to form continuity and contrasts between various materials.

A combination of various sound transformations shapes the emergence of pitch centres. Pitch-shifting downwards highlighted the pitched quality of the beeps of the microwave[120], while gentle frequency-shifting of bandpass-filters created related but slightly opposing pitch centres (see 1'46 – 2'14 in *beeps*). The root pitch of a sound can be reinforced through a comb-filter resonating on the same root (7'30 – 7'42, harmonic sounds in the background) or blurred if the roots do not match as the comb-filter can strengthen the inharmonic components of the original sound (12'46, bright inharmonic sound in the background). Layering opposing pitch centres with strong inharmonic content can also blur each sound's root (12'26). Extreme time-stretching of the metallic/plastic attack and decay gestures (via paulstretch[121]) creates a natural evolution from noisy to pitched spectra (9'29 – 9'49, the stretched attack gesture had been reversed here, creating an evolution from pitched to noisy).

Overlapping harmonic segments and constant pitch centres are key to the forming of harmonic successions. For example, in 1'43 – 2'18 and 2'52 – 3'18 each harmonic segment overlaps with the next. They fade in and out gradually, both in amplitude and spectral occupancy, to make the partials of the previous segment relate to the next one. This effect reduces harmonic distance between shared timbres, causing a gentle harmonic flow. Additional sounds might ease the harmonic distance or work as glue between different timbres. For example, the glissando in the background at 1'46 matches the direction of change in timbre (low to high, dark to bright, and vice versa). The beeps at 2'47 – 2'52 bridge the harmonic discontinuity and bind the following harmonic succession via their constant pitch centre. Both techniques – the overlap with spectral thinning and constant pitch centre – are reminiscent of instrumental music's theory: the overlap works in a (albeit remotely) similar way as voice leading[122] does, the constant pitch centre functions like a pedal point.[123]

The harmonic flow of *beeps* is linked to the progression of tension and release. For example, the segment from 2'43 to 2'53 sheds light onto harmonic discontinuities as its pitch centres are quite distant, causing a jump in the harmonic succession. The contrast in dynamics and pitch, as well as the use of gestures reinforce the jump to create a strong contrast, build up and release of tension (see Figure 23, D). The section feels coherent due to the sound's shared timbral family and the connecting beeps. The segment from 10'14 – 11'30 forms an example of tension and release through resolving dissonance between opposing pitch centres. The pitch centres around 10'14 and 11'30 diverge from and dissolve into each other in minor (10'14) or major (10'42)

[120] USB/compositions/6 beeps/_examples/beeps ex 03 - microwave - pitch shift example.wav.
[121] Paul, N.O. (2011). paulnasca/paulstretch_cpp. *GitHub*. [online]. Available from: https://github.com/paulnasca/paulstretch_cpp [Accessed 28/1/2014].
[122] See Schoenberg, A. (1969). *Structural Functions of Harmony*. W. W. Norton, p.39. The reduced harmonic distance between different spectra alludes to the idea of the “law of the shortest way” which is part of the concept of voice leading.
[123] Schoenberg (1969), p.209.

seconds created by the combination of foreground and background sounds. The accumulations and resolutions are both underscored by the context: the two families of beeping sounds sound in unison at the climax, whereas the sound families created by the metallic/plastic gestures sound in discord prior to the climax.

9 triptych

9.1 Approach

After *beeps* I revisited narrative concepts in music and searched for an approach to stem-based compositions which facilitates the use of four stems but also reduces production time. I found a suitable solution in the metaphorical use of field-recordings and applying aspects of film sound. In that sense, *triptych* (16 channel acousmatic composition, 15'04, 2013) is my personal take on the idea of the cinema for the ear.[124] Some of the field-recordings contain voices and therefore leave direct human traces in the piece. The field-recordings' anecdotal aspects are exploited to also create a sense of narration.

9.2 Materials/Form

triptych, as the title suggests, is made up of three parts. Each part acts as a movement and explores a specific theme and emotion. While the first movement describes a sense of arrival and place, the second focuses on the notion of force and tension leading to a sense of departure and loss. The sense of departure and loss is explored in detail in the third movement. Referential sounds and their metaphorical implications are key to communicating those themes to the listener.[125]

Movement one (0'00 – 02'13, Figure 28) introduces the listener to the piece's sound world and musical language. The piece's language generally consists of an amalgamation of distinct spaces heard simultaneously. The amalgamation stems from a delicate layering of recordings containing their own reference to space: The foreground is made up of dry, close-miked abrasive sounds (1), which are embedded in indoor and outdoor field-recordings (3, 8) and strongly reverberated pitched, sustained (orchestral-like) sounds (2). The piece's language also incorporates causal relationships between onsets, continuations and terminations (5, 6, 7). Because the overall evolution of sounds happens at a slow pace and while no conflicting contrast appears, the listener has time to enter the piece.

[124] "Musical use of sound in a cinema-like manner; that is, that the perceived sound sources contribute to the appreciation of a work". See: ElectroAcoustic Resource Site (EARS). Index: Cinéma Pour l'Oreille (Cinema For The Ears) (Genres and Categories [G&C]). [online]. Available from: http://www.ears.dmu.ac.uk/spip.php?rubrique411 [Accessed 6/10/2013].

[125] The notion of narration based on referential sounds assumes that the listener chooses to follow the sound's metaphorical links. See: Wishart (1996), pp.163-176.

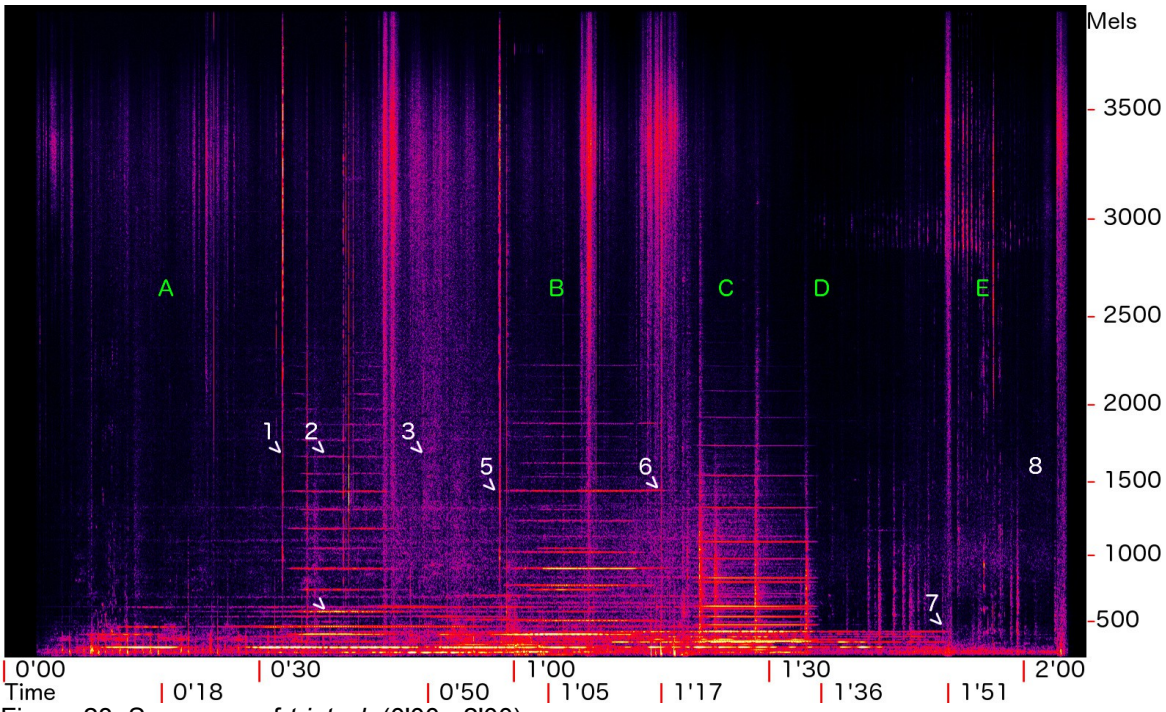

Figure 28: Sonogram of *triptych* (0'00 - 2'00).

Movement one also establishes a sense of arrival, leading to a notion of place. Both impressions are achieved through sounds referring to the real world[126], orchestral music and their slow evolution. As the synthetic swells of pitched sounds become increasingly orchestra-like[127] (B) and the space suggested by the field-recordings changes from enclosed spaces (A) to an open space (C), the piece gradually arrives at a mystic place[128] (D) named by a recorded voice as near "Salford Quays" (E). This sense of arrival at a place is further reinforced as the piece halts in a solo outdoor field-recording as the swells and harmonic sounds stop (7), allowing the voices present in the field-recording room to be heard (relatively) clearly.

Movement two (2'13 – 9'01, Figure 29), however, takes movement one's materials and puts them into a more animated context, outlining the notion of (physical) force and tension. The materials are transformed in such a way as to highlight their pulsating (1), abrasive (2, 4, 5) or orchestra-like (3) character. The materials are placed in a strongly causal relationship with bursts of clicks acting as prominent triggers of change (A). The non-linear increase in intensity and harshness both in volume and repetitive behaviour creates a force between intervening onsets over time and the static, inescapable pulse (B, compare the onsets and pitched sounds at 3'15 with 4'10, 5'07 and 6'15). The pulse becomes increasingly erratic towards the end of the movement, culminating

[126] Sound of a revolving door (0'07), voice (0'10, 0'35, 1'55), indoor (0'06, 0'35) and outdoor ambience (1'21).

[127] The timbre of the swells at 0'36 or 1'02 sound similar to orchestral (film) music due to their similarity in spectro-morphology. (See Smalley's discussion of second-order surrogacy in Smalley (1997), p.112). This impression is further helped through mimicking typical reverberation found in orchestral music, i.e. acoustics of large performance halls. Compare the swell at 1'02 with the beginning of Hans Zimmer's *Radical Notion*, on: Zimmer, H. (2010). *Inception*. Burbank: Reprise Records.

[128] According to Norman (2012, p. 259), a sense of place is created by emplacing a body by "its perceptual activity and its physical movement[...]". Listening to field-recordings could trigger a similar behaviour: The listener could imagine being at the place described by the field-recordings via observing their spatial / environmental cues.

in nervous textures and marking a transition from ordered to erratic pulses (C, compare 6'46 with 7'48). The erratic pulses are then reinforced while new materials referring to the notion of travelling (airport security announcement) are introduced and the overall spectral contour becomes airy (D). This airiness results from a previous concentration on sustained sounds with strong low-frequency components (6) and their sudden absence (7), with additional noisy, brighter sounds.[129] The erratic pulses, the travel-like sounds and airiness introduce the notion of departure which is explored in movement three.

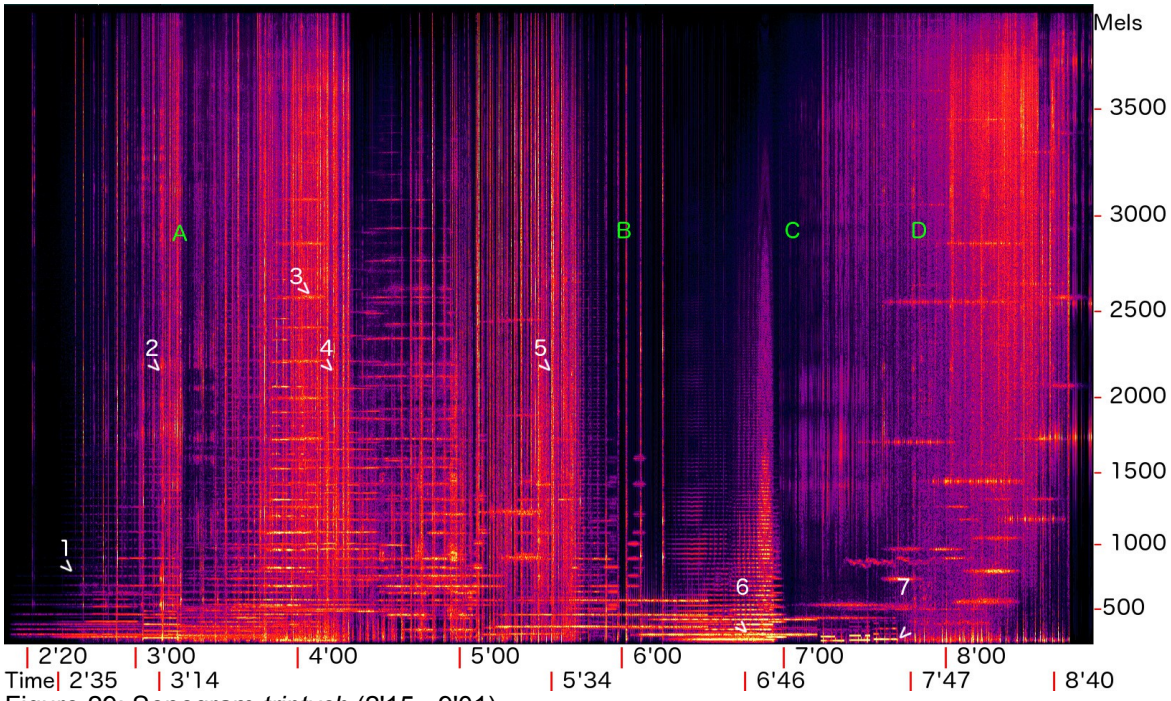

Figure 29: Sonogram *triptych* (2'15 - 9'01).

Movement three (9'01 – 15'04, Figure 30) explores the notion of departure and loss through associating the main referential (field-) recordings from movements one and two[130] with sounds referring to the notion of travelling and a sigh-like motif. The sigh-like character (1) results from a falling pitch envelope (i.e., glissando) superimposed onto (faster) orchestral, brass-like swells. It refers to the aestheticised version of a person sighing (i.e. “Seufzermotiv”).[131] To highlight the sighs, the swells are juxtaposed with sounds featuring static pitches which eventually roughly approximate the sound of train horns (2).[132] Both sound types become more intense throughout the movement (3, 4, 5), ultimately leading to an overwhelming and engulfing climax which fuses the swells from movement two with the sigh and horns of movement three (6).

[129] This moment in the piece reminds me of Smalley's description of implied planes and levitation in Smalley (2007), p.46.

[130] In particular the orchestral swells, the voice and revolving door recordings, as well as the abrasive sounds.

[131] See: Godøy, R.I. and Leman, M. (2009). *Musical Gestures: Sound, Movement, and Meaning*. Routledge, p.82. For an example of the Seufzermotiv in classical music hear the beginning of Mozarts's *Lacrimosa* of his *Requiem* (approx. 00'00 − 00'25).

[132] Compare 10'05 with Brannan, A. TRAIN FOG HORN LONG WYOMMING. [online]. Available from: http://www.freesound.org/people/andybrannan/sounds/145622/ [Accessed 24/1/2014].

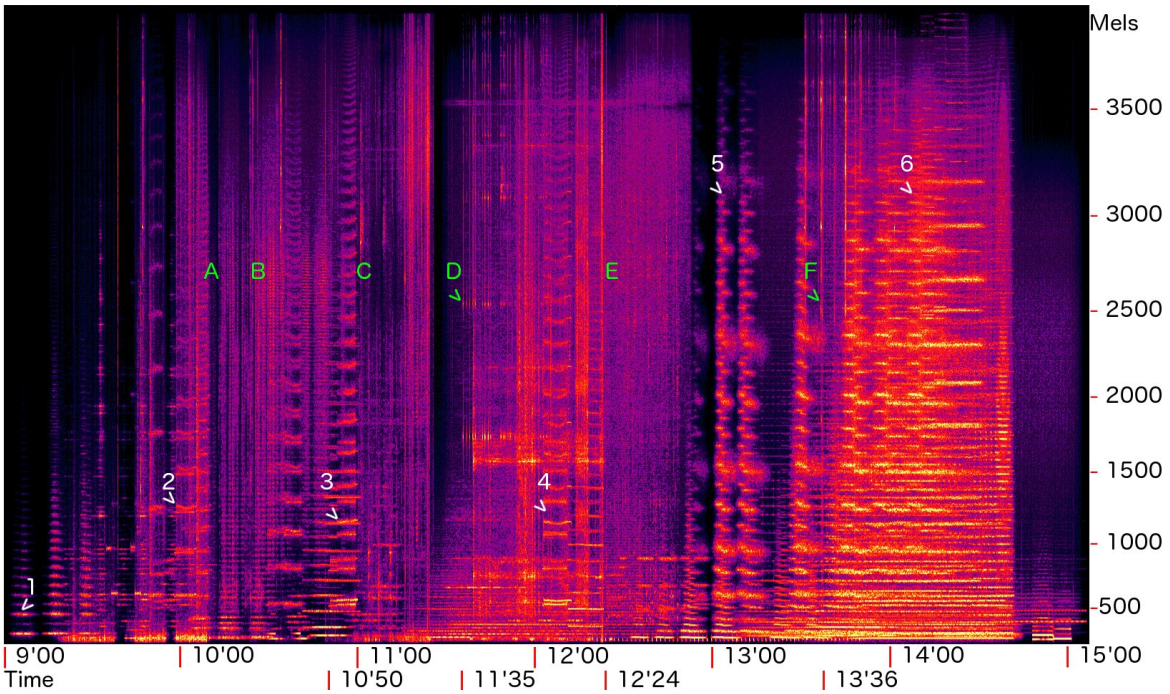

Figure 30: Sonogram of *triptych* (9'00 - 15'04).

Referential sounds referring to the real world and to the contexts of the piece are here key to circumscribing the notion of travel and the sense of departure. The airport announcement from movement Two reoccurs (A), this time appearing in a more musical, stylised performance, and is supported by additional travel-themed recordings. These additions are sounds like trains passing over a railroad junction (B), the train-like horns mentioned above (3) and a "boarding an aeroplane" announcement (E). They set a context of departure which becomes apparent around 10'48-11'13 through the transformed quotation of movement One's sense of place (C) as it is placed out of context in terms of colour and mood (compare 11'02-11'13 with the section starting at 10'37 and 11'24). Because the quotation appears transformed, it can be heard not as going back to the place, but rather as a memory of that place and, therefore, the sense of departure is suggested. The sense of departure is further reinforced through the reoccurrence of the nervous texture from movement Two (D) and its intensified context at 11'38 which leads to the "boarding" announcement (E) and ultimately the cathartic culmination of sigh-like sounds and orchestra-like swells at the piece's climax (6). Similarly, the abrasive sounds from movement Two appear singular rather than in masses (F), further strengthening the idea of loss.

9.3 A movie without images?

triptych borrows the idea and function of amalgamating discordant spaces from science fiction films like *Iron Man 2*[133]. For example, in the beginning of *Iron Man 2* (0'00 – 1'10, Netflix edition) orchestral music accompanies a succession of mediatic spaces[134] (on-the-air-sounds[135]) in the form

[133] Favreau, J. and Branagh, K. (2010). *Iron Man 2*.

[134] “An amalgam of spaces associated with communications and mass media, as represented in sound by radio and the telephone, and sonic aspects of film and television.” (Smalley 2007, p. 39)

[135] “[...] [S]ounds in a scene that are supposedly transmitted electronically as on-the-air — transmitted by radio, telephone, amplification […] — sounds that consequently are not subject to "natural" mechanical laws of sound propagation.”. (Chion et al. 1994, p. 76).

of televised public addresses. Both elements sound in their own specific room acoustics (large concert hall vs stadium-like and living-room spaces): they are not contained in each other, they just sound at the same time. Similarly in *triptych's* beginning (0'00 – 1'51), the orchestra-like swells, housed in large concert hall acoustics, accompany the field-recordings of, for example, a revolving door and its associated spaces, as well as close-miked metallic sounds. As the orchestral music of *Iron Man 2* sets the mood for the scene(s), so do the orchestra-like swells in *triptych*, as they colour the un-pitched, inharmonic field- and studio-recordings through a (film music-like) flow of pitches ordered in a chord progression.[136] In that sense, the orchestral character of the orchestra-like sounds is important as it alludes to the sense of drama common to orchestral music in films. By referring to the sonic language of films through the amalgamation of spaces, as well as their functions, an expectation of narration and drama is achieved which in turn helps the referential sounds to unfold their narrational, anecdotal impact.[137] The musical language and anecdotal aspects of the sounds together form a rhetorical framework for narration.[138]

9.4 Stems

triptych's materials are placed on the stems according to their distance and dramatic function. For example, the orchestral sounds generally appear on more medium distant loudspeakers to mimic the distance from which orchestral music is generally heard in films (see 0'58 or Figure 31). However, to increase their dramatic effect during singular moments, they gradually move to closer stems to be more overwhelming and to encroach on the listener's personal space (12'00 – 12'24 or 14'00-14'40). Because the layers generally do not move to keep the idea of amalgamation of discordant spaces intact, the singular movement of layers attains a dramatic quality.

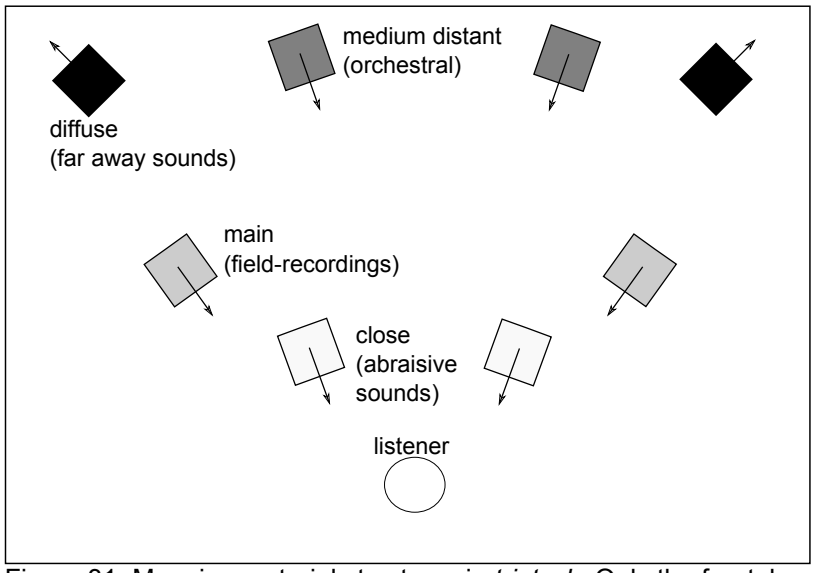

Figure 31: Mapping materials to stems in *triptych*. Only the frontal loudspeakers are indicated.

[136] See the description of a film score's function in Oppenheim (1998), pp. 5-6.
[137] See the discussion of triptych's themes of arrival, departure and loss, especially with regard to place on p. 58 and 60.
[138] See also Andean (2013), p. 2: “The narrative properties of a work, rather than stalling at the local level as singular symbols, are often used to construct a rhetorical framework for the piece, […] supporting [...] the musical layer of the work [in many cases].”

With regard to the production of *triptych* in the DAW (see Figure 32), each material category was assigned to a group track which corresponded to a specific stem. For example, the group track TonesClose (A) contains dry, synthesised materials which will be reproduced on the close loudspeaker stem. The group track TONES (B) on the other hand feature synthesised materials, which will be reverberated and performed on the medium distant loudspeaker stem. Additionally, all the materials were conformed to comply to or produced in four channels. Together with both approaches, the composer spatialised the materials purely by routing and assigning materials to tracks, sparsely adding crossfades between tracks for dramatic effect (see above). Compared to the workflow of beeps (see page 52), triptych's workflow felt much quicker and simple to control, making the production of four stems a comparatively quick undertaking.[139]

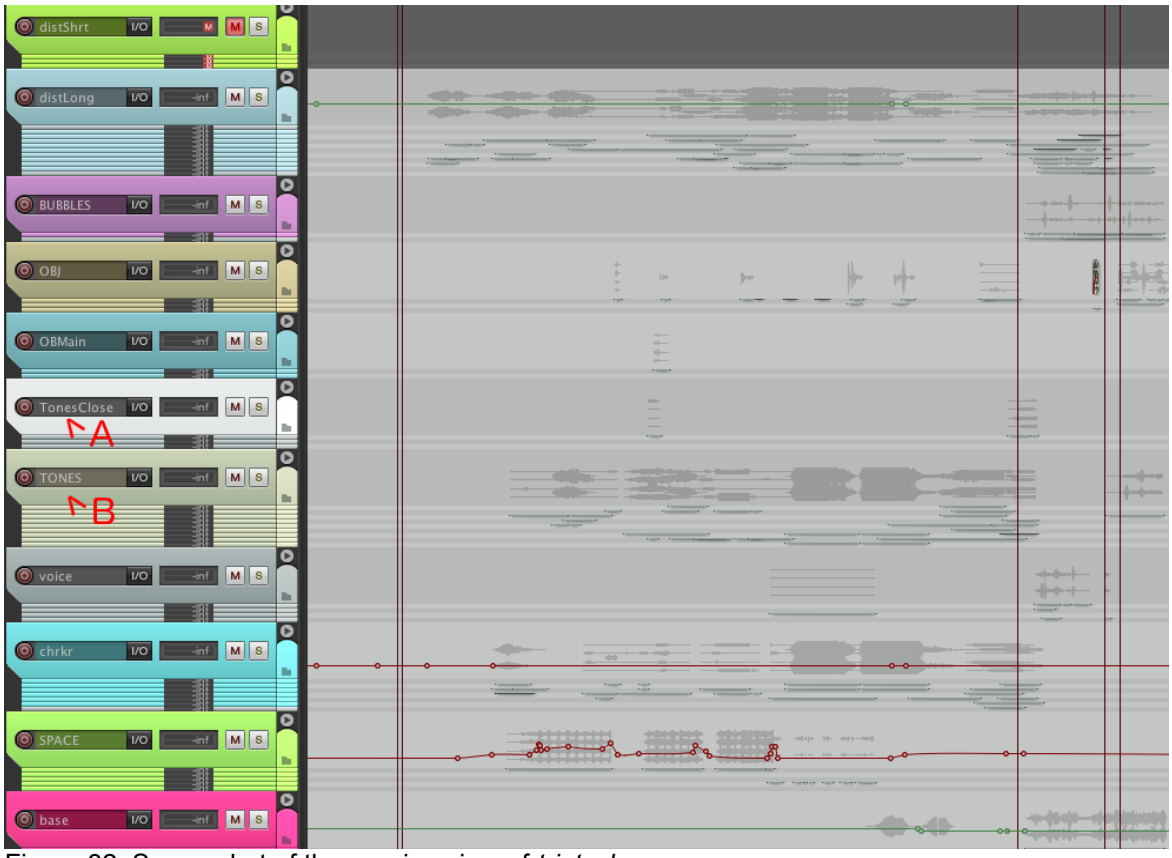

Figure 32: Screenshot of the session view of *triptych*.

[139] Compare the screenshot of the session of *triptych* with *beeps*'s session on p. 54.

10 Conclusion

The portfolio of works explored closeness and immediacy with regard to the process of capturing, processing and composing sound materials, their spatialisation both during production and performance, and the sound materials' contexts. Closeness and immediacy formed entry-points for the listener who (possibly) becomes or takes part in the compositional narrative.

Placing sounds both in proximity to and at a distance from the listener became a strong theme throughout the portfolio as a way to express closeness. Spatial contrast among the sounds in terms of distance gave rise to the experience of closeness as close sounds could be perceived as such because they appeared relatively closer than other, more distant sounds. The commentary discussed various strategies for elaborating the spatial close-distant theme. While stereophonic and multichannel recording techniques provided the starting point for composing space through various microphone placement strategies, sound transformation aided spatialisation to reinforce or exaggerate spatial contrast (*stone and metal*, *empty rooms* and *beeps*). From *pulses* onwards the separation of space into stems increased the detail and complexity of the composition and performance of space further (*pulses* and *triptych*). Especially in the multichannel compositions, a high level of immersion and envelopment encouraged the listener to imagine being part of the composed environment as the sounds moved around or surrounded him/her and put him/her into the centre of the sound's trajectories.

Referential sounds, especially sounds leaving a human trace, were key to expressing closeness, immediacy and narration. As shown in *empty rooms*, *skalna*, *pulses* and *triptych*, by including sounds created by the recordist during the recording process, the recordist can be placed into the piece[140], linking him/her to the piece's narrative[141]: it is the recordist who is observing the events presented and they happen to him because he has been there when the events have happened. In that sense, the recordist appears as a narrator who takes part in the story and its (authentic) telling.[142] Incorporating the recordist into the pieces also gives the listener the option to identify himself/herself with the recordist. That way, the listener can imagine hearing the sounds in the raw, un-edited way the recordist might have heard them and could feel as if he/she is observing the production process – an impression which is reinforced through the use of immersion in the stem-based pieces (*pulses* and *beeps*). Consequently a sense of temporal closeness and immediacy is evoked, too.

Furthermore, referential sounds form a trace of narration which benefit the impression of closeness and accessibility. According to Andean (2013, p. 5), the narrative aspects of acousmatic works facilitate listening, i.e. form entry-points for the listener, especially for beginners, as they are invited to imagine meaning out of the suspected causes of the sounds and their relationships. Decoding meaning from sounds relies on the listener's own experience of the world and through this decoding he becomes part of or possibly close to the narrative.[143] The success of this process also

[140] Obviously this depends on the degree of how familiar the listener is with those sounds and is able or willing to decode their cause.
[141] See also Michel Redolfi's *Desert Tracks* and Norman's analysis in Norman (1994), p.106.
[142] Norman (1994), pp.105-109.
[143] Norman (1994), p.107.

depends on the extent to which the listener is familiar with (close to) the sounds and/or musical language.

To facilitate the decoding of the music, the composer made use of everyday sounds, e.g. sounds of nature and human activity (beeping sounds or security announcements), and structural building blocks of music, such as pitched sounds, causal relationships between the materials, form inspired by traditional forms such as song forms[144] (*beeps, triptych*), as well as borrowing elements of various musical genres. For example, *triptych* makes use of elements of orchestral film music to connote the presented soundscapes (see p. 60). Or *empty rooms* appropriates the use of distortion and bit-rate reduction found in electronic music to create gritty, encroaching soundscapes (see 4'00 onwards, p. 19, compare with Alva Noto's *Xerrox Tek Part 1* on the album *Xerrox Vol. 2*).[145] In that sense, the inclusion of musical ideas from other genres equally form entry-points as the listener might recognise these borrowed ideas from the music he/she is familiar with (or generally listens to).[146] Furthermore, extracting musical information from recordings helps to make sounds behave in a way the listener is familiar with and which make him feel at home: The slow, pendulum-like noise-crescendos in *pulses* behave like passing cars or the seashore (5'39 or 14'00 onwards). Even though the sound source itself might be unknown, it behaves like something known.[147]

On a side note: Borrowing elements from other genres of music also creates the side-effect of expanding the genre of acousmatic music. As Ramsay (2011) notes, there are, for example, multiple crossover points between Intelligent Dance Music and acousmatic music due to technical similarities such as the production tools or music analysis methods. According to him, these crossover points can be used to augment compositional and pedagogic practise, as well as afford “a potential compositional refuge” between genres of music. Over the development of the portfolio the inclusion of elements of other genres became a valuable source of inspiration and shaped the compositional methodology as shown in the analysis, for example, of *beeps* (p. 47) and *triptych* (p. 60).

Lastly, the development of the software tools enhanced the feeling of closeness and immediacy that the composer had while working with the compositions. The PLib fostered the interactive exploration and shaping of (multichannel) sounds in realtime, allowing the composer to work with sound intuitively and quickly. Its interactive potential for performances was investigated in *weave/unravel*. The Mantis Diffusion System (Figure 33), meanwhile, helped to adapt the composed pieces to a variety of listening situations by offering elaborate control over routing, loudness, timbre and envelopment. For example, the built-in equaliser (A) and routing capabilities (B) assist in correcting differences in the production and performance environments, as well as reinforcing spatial separation or union of the spatial layers/stems and ensuring a high level of immersion.

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144 Randel, D.M. (2003). *The Harvard Dictionary of Music*. Harvard University Press, p. 101.
145 Noto, A. (2008). *Xerrox Vol. 2*. Chemnitz: Raster-Noton.
146 Ramsay, B., 2011. Tools, Techniques and Composition: Bridging Acousmatic and IDM by Ben Ramsay. [online]. Available from: http://cec.sonus.ca/econtact/14_4/ramsay_acousmatic-idm.html [Accessed 06/30/2013].
147 See Smalley's concept of surrogacy in Smalley (1997), pp.111-113.

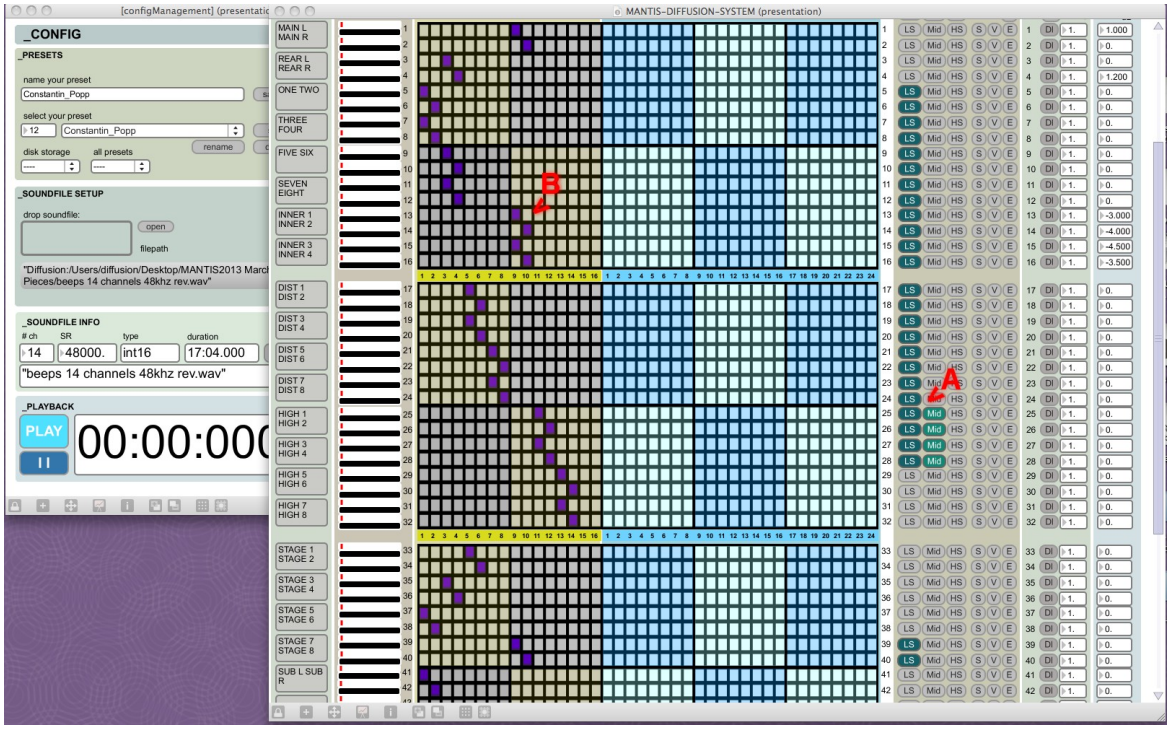

Figure 33: Screenshot of *beeps* in the MANTIS Diffusion System.

To sum up, the pieces composed in the portfolio fuse Andean's and Smalley's observations of what acousmatic music can be: concentrating "on space and spatial experience as aesthetically central"[148], and using "recorded sound as compositional material [...] for both its musical and [...] narrative properties".[149] While the spatial experience is fundamental for all portfolio pieces, each piece balances the musical and narrative thinking behind the sounds differently. While *stone and metal*, *skalna* and *pulses* focus more on the musical qualities of soundscapes, *empty rooms*, *beeps* and *triptych* pay stronger attention to the symbolic qualities of the sounds. The concept of closeness and immediacy was (and will stay) a rich source of inspiration for the portfolio (and the composer).

[148] Smalley (2007), p.35.
[149] Andean (2013), p.1.

11 Bibliography

Abumrad, J. (2012). The Terrors & Occasional Virtues of Not Knowing What You're Doing. [online]. Available from: http://transom.org/?p=28787 [Accessed August 21, 2013].

Adkins, M. (2008a). Towards a beautiful land: Compositional strategies and influences in Five Panels (no.1). [online]. Available from: http://eprints.hud.ac.uk/4264/1/Towards_a_beautiful_land.pdf [Accessed June 30, 2013].

Adkins, M. (2008b). Towards a beautiful land: Compositional strategies and influences in Five Panels (no.5). [online]. Available from: http://eprints.hud.ac.uk/4267/1/2_Towards_a_beautiful_land_copy.doc [Accessed June 30, 2013].

Andean, J. (2013). Approaches to Narrative in Acousmatic Music. In From Tape to Typedef. University of Sheffield.

Baalman, M.A.J. (2010). Spatial Composition Techniques and Sound Spatialisation Technologies. *Organised Sound*, 15(03), pp.209–218.

Barreiro, D.L. (2010). Considerations on the Handling of Space in Multichannel Electroacoustic Works. *Organised Sound*, 15(03), pp.290–296.

Bayle, F. (2007). Space, and more. *Organised Sound*, 12(03). [online]. Available from: http://www.journals.cambridge.org/abstract_S1355771807001872 [Accessed June 30, 2013].

Berezan, D. (2002). *Portfolio of Original Compositions*. University of Birmingham.

Berezan, D. et al. (2008). IN FLUX- A NEW APPROACH TO SOUND DIFFUSION PERFORMANCE PRACTICE FOR FIXED MEDIA MUSIC. In *Proceedings of the International Computer Music Conference, Belfast, UK*. [online]. Available from: http://classes.berklee.edu/mbierylo/ICMC08/defevent/papers/cr1038.pdf [Accessed June 30, 2013].

Blackburn, M. (2011). The Visual Sound-Shapes of Spectromorphology: an illustrative guide to composition. *Organised Sound*, 16(1), pp.5–13.

Blauert, J. (2010). Hearing Of Music In Three Spatial Dimensions. In W. Auhagen, B. Gätjen, & K. W. Niemöller, eds. *Systemische Musikwissenschaft. Festschrift Jobst Peter Fricke zum 65. Geburtstag*. Köln, pp. 103–112. [online]. Available from: http://www.uni-koeln.de/phil-fak/muwi/fricke/103blauert.pdf [Accessed August 13, 2013].

Blauert, J. (1997). *Spatial Hearing: The Psychophysics of Human Sound Localization*. MIT Press.

Brannan, A. *TRAIN FOG HORN LONG WYOMMING*. [online]. Available from: http://www.freesound.org/people/andybrannan/sounds/145622/ [Accessed January 24, 2014].

Casserley, L. (1998). A digital signal processing instrument for improvised music. *Journal of Electroacoustic Music*, 11, pp.25–29.

Chion, M., Gorbman, C. and Murch, W. (1994). *Audio-vision: sound on screen*. New York: Columbia University Press.

Christopher Burns. Designing for Emergent Behavior: a John Cage realization. [online]. Available from: http://hdl.handle.net/2027/spo.bbp2372.2004.043 [Accessed June 30, 2013].

Cockos Incorporated. (2013). REAPER | Audio Production Without Limits. [online]. Available from: http://reaper.fm/ [Accessed October 8, 2013].

Collins, N. et al. (2004). Live coding in laptop performance. *Organised Sound*, 8(03). [online]. Available from: http://www.journals.cambridge.org/abstract_S135577180300030X [Accessed June 30, 2013].

Collins, N. (2006). *Handmade electronic music: the art of hardware hacking*. New York: Routledge.

Collis, A. (2008). Sounds of the system: the emancipation of noise in the music of Carsten Nicolai. *Organised Sound*, 13(01). [online]. Available from: http://www.journals.cambridge.org/abstract_S1355771808000058 [Accessed July 3, 2013].

Dack, J. (2002). Abstract and Concrete. *Journal of Electroacoustic Music*, 14.

Dack, J. (2008). Music in space, space in music. *Society for the Promotion of New Music: New Notes*, (6), pp.2–4.

Dean, R.T. (2009). *The Oxford Handbook of Computer Music*. Oxford University Press.

Dow, R. (2004). Multi-channel sound in spatially rich acousmatic composition. In *Proceedings of the 4th International Conference 'Understanding and creating music*. [online]. Available from: http://decoy.iki.fi/dsound/ambisonic/motherlode/source/rdow-multichannelsound.pdf [Accessed June 30, 2013].

DPA Microphones. (2013a). 4060 Omnidirectional, Hi-Sens. [online]. Available from: http://www.dpamicrophones.com/en/products.aspx?c=Item&category=128&item=24035 [Accessed October 18, 2013].

DPA Microphones. (2013b). Coincident Arrays vs. Spaced Arrays. [online]. Available from: http://www.dpamicrophones.com/en/Microphone-University/Surround%20Techniques/Coincident%20and%20Spaced%20Arrays.aspx [Accessed October 18, 2013].

DPA Microphones. (2013c). DPA Microphones :: Surround techniques. [online]. Available from: http://www.dpamicrophones.com/en/Mic-University/Surround%20Techniques.aspx [Accessed June 30, 2013].

Drummond, J. (2009). Understanding Interactive Systems. *Organised Sound*, 14(02), p.124.

Eigenfeldt, A. (2007). Real-time Composition or Computer Improvisation? A composer's search for intelligent tools in interactive computer music. *www. ems-network. org/IMG/pdf_EigenfeldtEMS07. pdf (4 January 2009)*. [online]. Available from: http://www.sfu.ca/~eigenfel/RealTimeComposition.pdf [Accessed October 12, 2013].

ElectroAcoustic Resource Site (EARS). Index: Cinéma Pour l'Oreille (Cinema For The Ears) (Genres and Categories [G&C]). [online]. Available from: http://www.ears.dmu.ac.uk/spip.php?rubrique411 [Accessed October 6, 2013a].

ElectroAcoustic Resource Site (EARS). Index: Electronica (Genres and Categories [G&C]). [online]. Available from: http://www.ears.dmu.ac.uk/spip.php?rubrique127 [Accessed November 4, 2013b].

ElectroAcoustic Resource Site (EARS). Index: Mixed Work (Genres and Categories [G&C]). [online]. Available from: http://www.ears.dmu.ac.uk/spip.php?rubrique142 [Accessed November 4, 2013c].

ElectroAcoustic Resource Site (EARS). Index: Soundscape Composition (Genres and Categories [G&C]). [online]. Available from: http://www.ears.dmu.ac.uk/spip.php?rubrique154 [Accessed November 4, 2013d].

Emmerson, S. (1986). The Relation of Language to Materials. In *The Language of Electroacoustic Music*. London, pp.17–39.

Emmerson, S. (1994a). 'Live' versus 'real-time'. *Contemporary Music Review*, 10(2), pp.95–101.

Emmerson, S. (1994b). 'Local/field': towards a typology of live electroacoustic music. In *International Computer Music Conference (1994)*. pp.31–34.

Emmerson, S. (1998). Acoustic/electroacoustic: The relationship with instruments. *Journal of New Music Research*, 27(1-2), pp.146–164.

Emmerson, S. (1999). Aural landscape: musical space. *Organised Sound*, 3(2), pp.135–140.

Emmerson, S. (2007). *Living electronic music*. Aldershot, Hants, England; Burlington, VT: Ashgate. [online]. Available from: http://site.ebrary.com/id/10211348 [Accessed August 7, 2013].

Fischman, R. (2008). Mimetic Space – Unravelled. *Organised Sound*, 13(02). [online]. Available from: http://www.journals.cambridge.org/abstract_S1355771808000150 [Accessed October 9, 2013].

Fluid Mastering. (2011). Fluid Mastering: Mastering from Stems: what it means, and how to do it. [online]. Available from: http://www.fluidmastering.com/mastering-from-stems.htm [Accessed September 28, 2013].

Geier, M., Ahrens, J. and Spors, S. (2010). Object-based Audio Reproduction and the Audio Scene Description Format. *Organised Sound*, 15(03), pp.219–227.

Glogau, H.-U. (1989). *Der Konzertsaal: zur Struktur alter und neuer Konzerthäuser*. G. Olms.

Godøy, R.I. and Leman, M. (2009). *Musical Gestures: Sound, Movement, and Meaning*. Routledge.

Gorne, A.V. (2002). L'interprétation spatiale, Essai de formalisation méthodologique. *Démeter*. [online]. Available from: http://demeter.revue.univ-lille3.fr/interpretation/vandegorne.pdf [Accessed June 30, 2013].

Grossmann, R. (2008). The tip of the iceberg: laptop music and the information-technological transformation of music. *Organised Sound*, 13(01). [online]. Available from: http://www.journals.cambridge.org/abstract_S1355771808000022 [Accessed June 30, 2013].

Hall, E.T. (1969). *The hidden dimension man's use of space in public and private*. London: Bodley Head.

Harrison, J. (1998). Sound, space, sculpture: some thoughts on the 'what','how'and 'why'of sound diffusion. *Organised Sound*, 3(02), pp.117–127.

Harrison, J. (1999). CEC — eContact! 3.2 - Imaginary Space by Jonty Harrison. [online]. Available from: http://cec.sonus.ca/econtact/ACMA/ACMConference.htm [Accessed July 3, 2013].

Harrison, J. (2011). The Final Frontier? Spatial Strategies in Acousmatic Composition and Performance. In *Toronto Electroacoustic Symposium*. [online]. Available from: http://cec.sonus.ca/econtact/14_4/harrison_spatialstrategies.html.

Harrison, J. and Wilson, S. (2010). Rethinking the BEAST: Recent developments in multichannel composition at Birmingham ElectroAcoustic Sound Theatre. *Organised Sound*, 15(3), pp.239–250.

Hero, B. (1998). FREQUENCIES OF THE ORGANS OF THE BODY AND PLANETS. [online]. Available from: http://www.greatdreams.com/hertz.htm [Accessed August 12, 2013].

Hewitt, S. et al. (2010). HELO: The Laptop Ensemble as an Incubator for Individual Laptop Performance Practices. In *Proceedings of the International Computer Music Conference*. New York. [online]. Available from: http://eprints.hud.ac.uk/7397/1/TremblayHelo.pdf [Accessed June 30, 2013].

Ixi audio. (2011). *Play with ixi lang version 3*. [online]. Available from: http://vimeo.com/31811717 [Accessed August 11, 2013].

Jones, R. et al. (2009). A force-sensitive surface for intimate control. In *Proceedings of the International Conference on New Interfaces for Musical Expression (NIME)*. pp.236–241. [online]. Available from: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.157.8879&rep=rep1&type=pdf [Accessed June 30, 2013].

Kendall, G.S. (1995). The decorrelation of audio signals and its impact on spatial imagery. *Computer Music Journal*, 19(4), pp.71–87.

Kendall, G. (2008). THE ARTISTIC PLAY OF SPATIAL ORGANIZATION: SPATIAL ATTRIBUTES, SCENE ANALYSIS AND AUDITORY SPATIAL SCHEMATA.

Kendall, G.S. (2010). Spatial Perception and Cognition in Multichannel Audio for Electroacoustic Music. *Organised Sound*, 15(03), pp.228–238.

Kim-Boyle, D. (2008). Spectral Spatialization-An Overview. In *Proceedings of the International Computer Music Conference, Belfast, Ireland*. [online]. Available from: http://classes.berklee.edu/mbierylo/ICMC08/defevent/papers/cr1549.pdf [Accessed June 30, 2013].

Kramer, J.D. (1988). *The time of music: new meanings, new temporalities, new listening strategies*. Schirmer/Mosel Verlag GmbH.

Lazzarini, V. (2010). New Perspectives on Distortion Synthesis for Virtual Analog Oscillators. *Computer Music Journal*, 34(1), pp.28–40.

Lewis, A. (1998). Francis Dhomont's *Novars* *. *Journal of New Music Research*, 27(1-2), pp.67–83.

Litauer, M. (2008). Der Nahbesprechungseffekt. [online]. Available from: http://www.sengpielaudio.com/NahbesprechungseffektLitauer.pdf [Accessed June 30, 2013].

Lotis, T. (2004). The creation and projection of ambiophonic and geometrical sonic spaces with reference to Denis Smalley's Base Metals. *Organised Sound*, 8(03). [online]. Available from: http://www.journals.cambridge.org/abstract_S1355771803000232 [Accessed June 30, 2013].

Lynch, H. and Sazdov, R. An Investigation Into Compositional Techniques Utilized For The Three-Dimensional Spatialization Of Electroacoustic Music. [online]. Available from: http://www.ems-network.org/IMG/pdf_EMS11_lynch_sazdov.pdf [Accessed June 30, 2013].

Magnusson, Thor. (2011). *Thor Magnusson live coding*. [online]. Available from: http://www.youtube.com/watch?v=njXTlHpaJe4&feature=youtube_gdata_player [Accessed August 11, 2013].

MeldaProduction. MeldaProduction, professional audio processing software. [online]. Available from: http://www.meldaproduction.com/ [Accessed January 22, 2014a].

Menezes, F. (2002). For a morphology of interaction. *Organised Sound*, 7(03), pp.305–311.

Moore, A. (2009). Knowledge and Experience in Electroacoustic Music: where is the common ground? [online]. Available from: https://www.shef.ac.uk/polopoly_fs/1.26359!/file/composition_positionpaper.pdf [Accessed July 3, 2013].

Moore, A. (2007). Making choices in electroacoustic music: bringing a sense of play back into fixed media works. *Online text*. [online]. Available from: http://www.soundartarchive.net/articles/Moore-%203%20Pieces%20Text.pdf [Accessed June 30, 2013].

Moore, A., Moore, D. and Mooney, J. (2004). M2 Diffusion–The live diffusion of sound in space. In *Proc. ICMC*. pp. 317–320. [online]. Available from: http://clearing.sheffield.ac.uk/polopoly_fs/1.17357!/file/ajmicmc2004.pdf [Accessed June 30, 2013].

Mountain, R. (2006). From Wire to Computer: Francis Dhomont at 80. *Computer Music Journal*, 30(3), pp.10–21.

Native Instruments. Komplete : Synths & Samplers : Skanner Xt | Products. [online]. Available from: http://www.native-instruments.com/en/products/komplete/synths-samplers/skanner-xt/?content=1823 [Accessed August 10, 2013].

Nattiez, J.J. (1990). *Music and discourse: toward a semiology of music*. Princeton, N.J.: Princeton University Press.

Nilson, C. (2007). Live coding practice. In *Proceedings of the 7th international conference on New interfaces for musical expression*. pp. 112–117. [online]. Available from: http://dl.acm.org/citation.cfm?id=1279760 [Accessed June 30, 2013].

Norman, K. (1996). *A poetry of reality*. Amsterdam: Harwood Academic Publishers. [online]. Available from: http://helicon.vuw.ac.nz/login?url=http://vuw.etailer.dpsl.net/home/html/moreinfo.asp?isbn=0203986385&whichpage=1&pagename=category.asp [Accessed November 4, 2013].

Norman, K. (1994). Telling tales. *Contemporary Music Review*, 10(2), pp.103–109.

Norman, K. (2010). Conkers (listening out for organised experience). *Organised Sound*, 15(2), pp.116–124.

Norman, K. (2012). Listening Together, Making Place. *Organised Sound*, 17(03), pp.257–265.

Normandeau, R. (2009). Timbre spatialisation: The medium is the space. *Mod. Intellect. Hist. Organised Sound*, 14(3), pp.277–285.

Normandeau, R. (2010). A revision of the TARTYP published by Pierre Schaeffer. In *Proceedings of the Seventh Electroacoustic Music Studies Network Conference*. Shanghai. [online]. Available from: http://www.ems-network.org/IMG/pdf_EMS10_Normandeau.pdf [Accesssed November 4, 2013].

Oppenheim, Y. (1998). The Functions of Film Music. [online]. Available from: http://facultyn-h.syr.edu/dhquin/Newhouse_Fall2011/Newhouse_Fall2011/Courses_Fall_2011/TRF456_Fall/Resources/The%20Functions%20of%20Film%20Music.pdf [Accessed October 2, 2013].

Otondo, F. (2007). Creating Sonic Spaces: An Interview with Natasha Barrett. *Computer Music Journal*, 31(2), pp.10–19.

Oxford Dictionary. Triptych: definition of triptych in Oxford dictionary (British & World English). [online]. Available from: http://oxforddictionaries.com/definition/english/triptych [Accessed August 22, 2013].

Paine, G. (2007). Sonic Immersion: Interactive Engagement in Real-Time Immersive Environments. *SCAN Journal of Media Arts and Culture*, 4(1). [online]. Available from: http://www.s-can.net.au/scan/journal/display.php?journal_id=90 [Accessed June 30, 2013].

Paine, G. (2009). Gesture and Morphology in Laptop Performance. In R. T. Dean, ed. *The Oxford Handbook of Computer Music*. Oxford University Press, pp.299–329.

Pakarinen, J. and Yeh, D.T. (2009). A review of digital techniques for modeling vacuum-tube guitar amplifiers. *Computer Music Journal*, 33(2), pp.85–100.

Paul, N.O. (2011). paulnasca/paulstretch_cpp. *GitHub*. [online]. Available from: https://github.com/paulnasca/paulstretch_cpp [Accessed January 28, 2014].

Perez, H. (2013). hervé perez's stream on SoundCloud - Hear the world's sounds. *SoundCloud*. [online]. Available from: https://soundcloud.com/herveperez [Accessed October 12, 2013].

Perkis, T. (2009). Some Notes on My Electronic Improvisation Practice. In R. T. Dean, ed. *The Oxford Handbook of Computer Music*. Oxford University Press, pp.161–165.

Peters, N. et al. (2008). Spatial sound rendering in Max/MSP with ViMiC. In *Proceedings of the 2008 International Computer Music Conference*. [online]. Available from: http://nilspeters.info/papers/ICMC08-VIMIC_final.pdf [Accessed June 30, 2013].

Peters, N. (2010). *Sweet [re]production: Developing sound spatialization tools for musical applications with emphasis on sweet spot and off-center perception*. Montreal: McGill University.

Popp, C. (2013). A Few Notes on Stem-based Composition: A Case Study. In Sound, Sight, Space, Play. De Montfort University. [online]. Available from: https://www.escholar.manchester-.ac.uk/uk-ac-man-scw:209327 [Accessed October 12, 2013].

Radiolab. Podcasts - Radiolab. [online]. Available from: http://www.radiolab.org/series/podcasts/ [Accessed October 22, 2013].

Randel, D.M. (2003). *The Harvard Dictionary of Music*. Harvard University Press

Ramsay, B. (2011). Tools, Techniques and Composition: Bridging Acousmatic and IDM by Ben Ramsay. [online]. Available from: http://cec.sonus.ca/econtact/14_4/ramsay_acousmatic-idm.html [Accessed June 30, 2013].

Rumsey, F. (2001). *Spatial audio*. Oxford; Boston: Focal Press.

Salazar, D. (2009). *Portfolio of Original Compositions*. Manchester: University of Manchester.

Salem, S. *PORTFOLIO OF ORIGINAL COMPOSITIONS*. Manchester: University of Manchester.

Schoenberg, A. (1969). *Structural Functions of Harmony*. W. W. Norton.

Smalley, D. (2007). Space-form and the acousmatic image. *Organised Sound*, 12(01), pp.35–57.

Smalley, D. (1997). Spectromorphology: explaining sound-shapes. *Organised sound*, 2(2), pp.107–126.

Smallwood, S. et al. (2008). Composing for Laptop Orchestra. *Computer Music Journal*, 32(1), pp.9–25.

Smith, S.W. (1997). *The scientist and engineer's guide to digital signal processing*. San Diego, Calif.: California Technical Pub.

Stavropoulos, N. (2006). Multi-channel formats in electroacoustic composition: Acoustic space as a carrier of musical structure. In *Proceedings of the Digital Music Research Network Conference, London, UK*. [online]. Available from: http://doc.gold.ac.uk/~map01ra/dmrn/events/dmrn06/papers/stavropoulos2006multichannel.pdf [Accessed June 30, 2013].

Stefani, E. and Lauke, K. (2010). Music, Space and Theatre: Site-Specific Approaches to Multichannel Spatialization. *Organised Sound*, 15(3), pp.251–259.

Stockhausen, K.-H. (1963). Momentform: Neue Beziehungen zwischen Aufführungsdauer, Werkdauer und Moment. In *Texte zur Musik*. Cologne: DuMont Schauberg, pp.189–210.

Tenney, J. (1969). Form in 20th Century Music. [online]. Available from: http://www.plainsound.org/pdfs/Form.pdf [Accessed June 30, 2013].

Timothy Place. FLEXIBLE CONTROL OF COMPOSITE PARAMETERS IN MAX/MSP. [online]. Available from: http://hdl.handle.net/2027/spo.bbp2372.2008.132 [Accessed June 30, 2013].

Tremblay, P.A. and McLaughlin, S. (2009). *Thinking inside the box: A new integrated approach to mixed music composition and performance*. Ann Arbor, MI: MPublishing, University of Michigan Library. [online]. Available from: http://www.researchgate.net/publication/230687318_THINKING_INSIDE_THE_BOX_A_NEW_INTEGRATED_APPROACH_TO_MIXED_MUSIC_COMPOSITION_AND_PERFORMANCE/file/9fcfd502f5064b4f6e.pdf [Accessed June 30, 2013].

Uimonen, H. (2011). Everyday Sounds Revealed: Acoustic communication and environmental recordings. *Organised Sound*, 16(03), pp.256–263.

Waters, S. (2002). *The musical process in the age of digital intervention*. Webarticle: http://www. ariada. uea. ac. uk/ariadatexts/ariada1/content/Musical_ Process. pdf. [online]. Available from: http://ariada.uea.ac.uk/ariadatexts/ariada1/content/Musical_Process.pdf [Accessed October 9, 2013].

Weave/Unravel. WeaveUnravel's stream on SoundCloud - Hear the world's sounds. *SoundCloud*. [online]. Available from: https://soundcloud.com/weaveunravel [Accessed October 23, 2013].

Westerkamp, H. (2002). Linking soundscape composition and acoustic ecology. *Organised Sound*, 7(01). [online]. Available from: http://www.journals.cambridge.org/abstract_S1355771802001085 [Accessed October 9, 2013].

Winkler, T. (1999). *Composing Interactive Music*. 2nd ed. Cambridge, Mass.: MIT Press.

Wishart, T. (1986). Sound Symbols and Landscapes. In *The Language of Electroacoustic Music*. pp.41–60.

Wishart, T. and Emmerson, S. (1996). *On sonic art*. Amsterdam: Harwood Academic Publishers.

Wuttke, S.S.G.J. (2000). *Mikrofonaufsätze*. Karlsruhe: Schoeps GmbH. [online]. Available from: http://www.schoeps.de/documents/Mikrofonbuch_komplett.pdf [Accessed June 30, 2013].

Zadel, M. (2006). Laptop Performance: Techniques, Tools, and a New Interface Design. In *Proceedings of the International Computer Music Conference*. pp. 643–648. [online]. Available from: http://hdl.handle.net/2027/spo.bbp2372.2006.132 [Accessed June 30, 2013].

12 Selected Discography

Adkins, M. (2011). *fragile.flicker.fragment*. Sheffield: Audiobulb Records.

Berezan, D. (2008). *La face cachée*. Montréal: empreintes DIGITALes.

Biosphere. (1997). *Substrata*. London: All Saints Records.

Chion, M. (2007). *Requiem*. Brussels: Sub Rosa.

Dhomont, F. (1996). *Sous le regard d'un solei noir*. Montréal: empreintes DIGITALes.

Dowlasz, B. (2012). *VISBY*.

Favreau, J. (2011). *Cowboys & Aliens*. Hollywood: Paramount Pictures.

Favreau, J. and Branagh, K. (2010). *Iron Man 2*. Hollywood: Paramount Pictures.

Feldman, M., Huber, R. and Ensemble, S.W.G.V. (2002). *Rothko Chapel*. Haenssler.

Ferrari, L. (1970). *Music Promenade*. Paris: INA-GRM.

Ferrari, L. (1990). *Presque rien avec filles*. Amsterdam: BV Haast Records.

Gobeil, G. (1994). *La mécanique des ruptures*. Montréal: empreintes DIGITALes.

Harrison, J. (2007). *Afterthoughts*. Montréal: empreintes DIGITALes.

Henke, R. (2004). *Signal to Noise*. Berlin: Imbalance Computer Music.

Minard, R. (2004). *The Book of Spaces*.

Monolake. (2010). *Silence*. Berlin: Imbalance Computer Music.

Moore, A. (2000). *Junky*. Montréal: empreintes DIGITALes.

Mozart, W.-A. *Requiem in D minor, K.626 - Lacrymosa dies illa*.

Normandeau, R. (2005). *StrinGDberg*. Montréal: empreintes DIGITALes.

Noto, A. (2007). *Xerrox*. Chemnitz: Raster-Noton.

Noto, A. and Sakamoto, R. (2011). *Utp_*. Chemnitz: Raster-Noton.

Obst, M. (2005). *Espaces sonores. Für Bläserquintett und kleines Orchester*. Brühl: Verlag Neue Musik.

Pamerud, Å. (1994). *Invisible Music*. Stockholm: Phono Suecia.

Parmegiani, B. (2001). *De Natura Sonorum*. Paris: INA-GRM.

Radiolab. (2013). *Radiolab Podcast Articles - Rodney Versus Death*. [online]. Available from: http://www.radiolab.org/blogs/radiolab-blog/2013/aug/13/rodney-versus-death/?utm_source=sharedUrl&utm_media=metatag&utm_campaign=sharedUrl [Accessed August 21, 2013].

Redolfi, M. (1988). *Desert Tracks*. Paris: INA-GRM.

Schafer, M. (1998). *Winter Diary*. Cologne: WDR.

Senking. (2010). *Pong*. Chemnitz: Raster-Noton.

Tremblay, P.A. (2011). *Quelques reflets*. Montréal: empreintes DIGITALes.

Westerkamp, H. (2010). *Beneath the Forest Floor*. Montréal: empreintes DIGITALes.

Westerkamp, H. (2002). *Into India*. Vancouver: Earsay.

Young, L. (1992). *The Well-tuned Piano 81 x 25*. New York: Gramavision.

Zimmer, H. (2010). *Inception*. Burbank: Reprise Records.

Appendix A: Technical Information (Surround Works)

The works are supplied in their original, high-resolution formats on a USB flash drive. To aid the listening of the materials, two audio CDs are also supplied which also include stereo reductions of the multichannel works. The channel to loudspeaker assignment for *skalna*, *pulses*, *beeps* and *triptych* can be found below, as well as in a technical rider supplied together with the audio files on the USB flash drive. For playback of the surround works within a sound diffusion system please refer to the piece's technical rider.

skalna

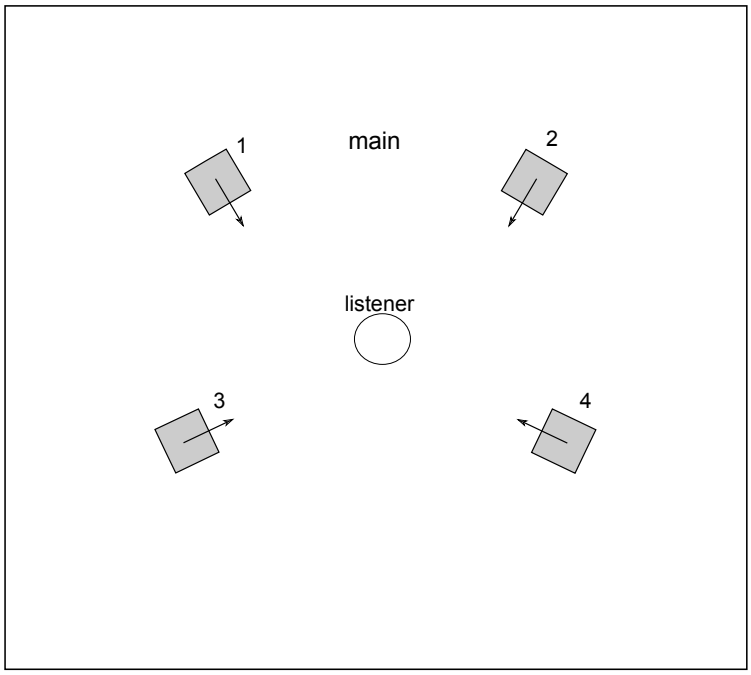

Figure 34: Loudspeaker assignment for *skalna*.

The rear loudspeakers follow a 5.1-ish angle to increase the perception of envelopment – they correspond to channel 5/6 in an octophonic ring (counted in stereo pairs with 1/2 as the front left/right).

pulses

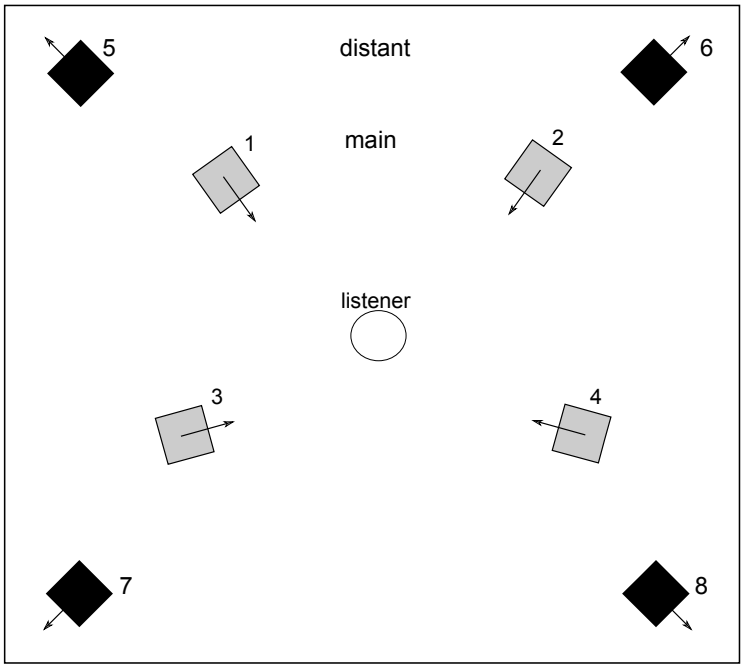

Figure 35: Loudspeaker assignment for *pulses*.

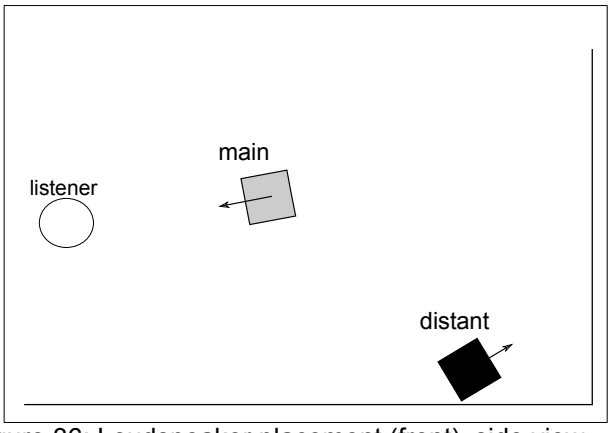

Figure 36: Loudspeaker placement (front), side view.

The rear loudspeakers correspond to channel 5/6 in an octophonic ring. The distant loudspeakers should be placed on the floor facing the wall at an angle of approx 30-45° (Figure 36).

beeps

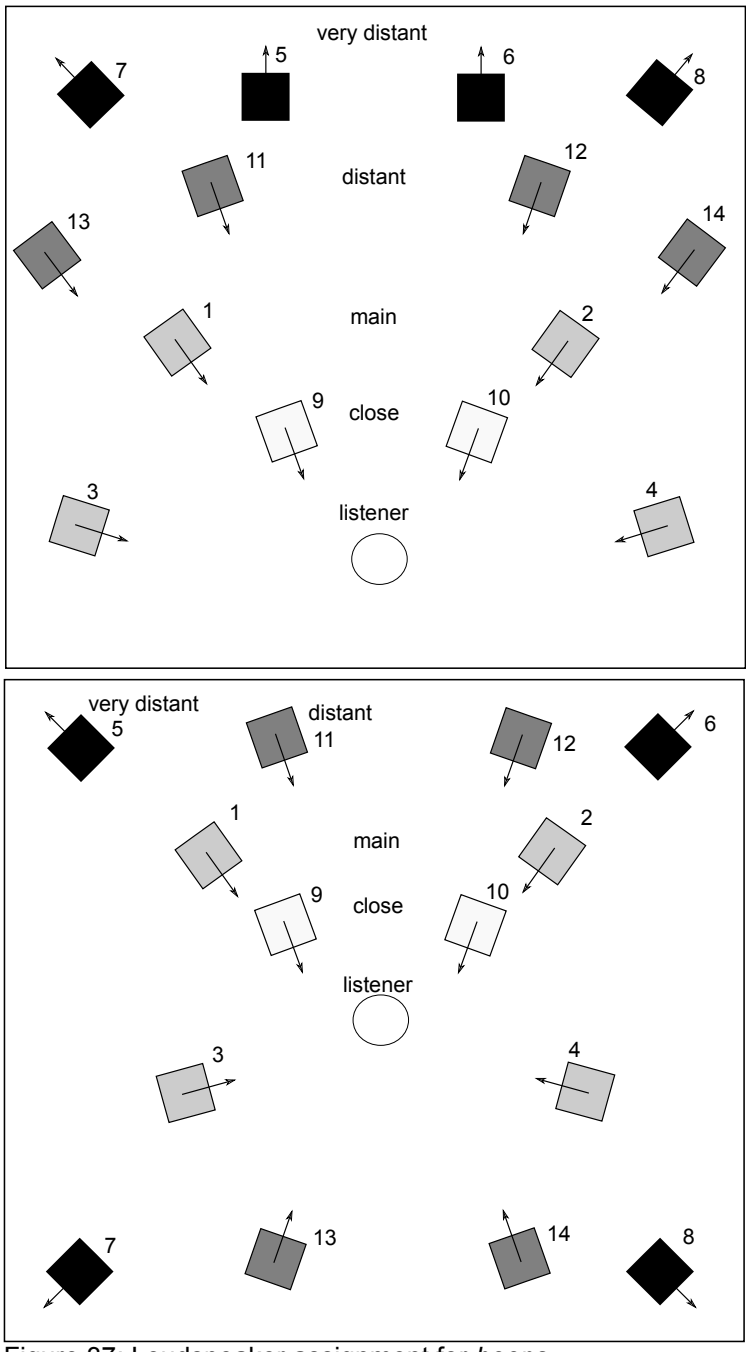

Figure 37: Loudspeaker assignment for *beeps*.

beeps has two main loudspeaker assignment versions (77). The first version mimics an orchestra-like setup, the second one is compatible to BEAST-like sound diffusion systems. In the orchestra-like setup the loudspeakers are all placed in front of and in various distances to the listener. In the BEAST-like system, the spatial positions of the channel 3/4 loudspeakers correspond to channel 5/6 in an octophonic ring. The loudspeakers for channel 5-8 should be placed on the floor, facing the wall. The loudspeakers for channel 9/10 are lower than the ones for channel 1/2 in order not to block their sound. Similarly, the loudspeakers for channel 11-14 can be suspended from the ceiling to increase contrasts between the channels.

triptych

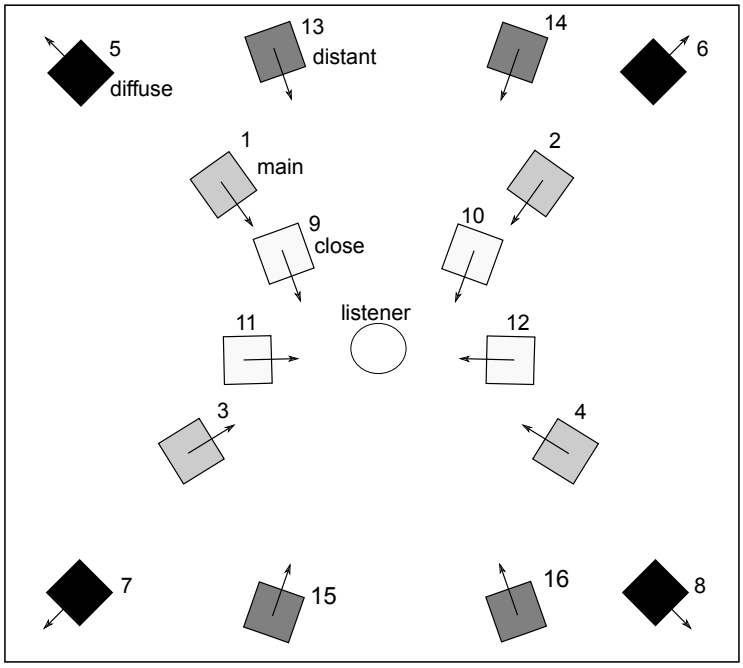

Figure 38: Loudspeaker assignment for *triptych*.


Figure 39: Photo demonstrating the set-up for channels 9-12.

The spatial positions of the loudspeakers for channel 3/4 correspond to channel 5/6 in an octophonic ring. The loudspeakers for channel 5-8 should be placed on the floor, facing the wall. Ideally the loudspeakers of channel 9-12 are lower than the loudspeakers for channel 1/2 so as to not block their sound. During concerts it is suggested to put the loudspeakers for channel 9-12 on stands around the mixing desk (Figure 39)[150]. The tweeters of these loudspeakers should be just above the listener's ears and their distance towards the listener maximised as much as possible. For example, the close front right channel is assigned to the close rear left loudspeaker and this loudspeaker is facing the front right. The loudspeakers for channel 13-16 can be suspended from the ceiling to increase contrasts between the channels.

[150] The photo was taken during rigging of the MANTIS festival in Manchester held on 26th/27th of October 2013.

Appendix B: Additional Information on the MANTIS Diffusion System

David Berezan, Sam Salem and Constantin Popp collaborated in the development of the software of the MANTIS Diffusion System. The MANTIS Diffusion System evolved over time with additions/implementations made by this author to facilitate the playback of electroacoustic music and wishes/suggestions from colleagues.

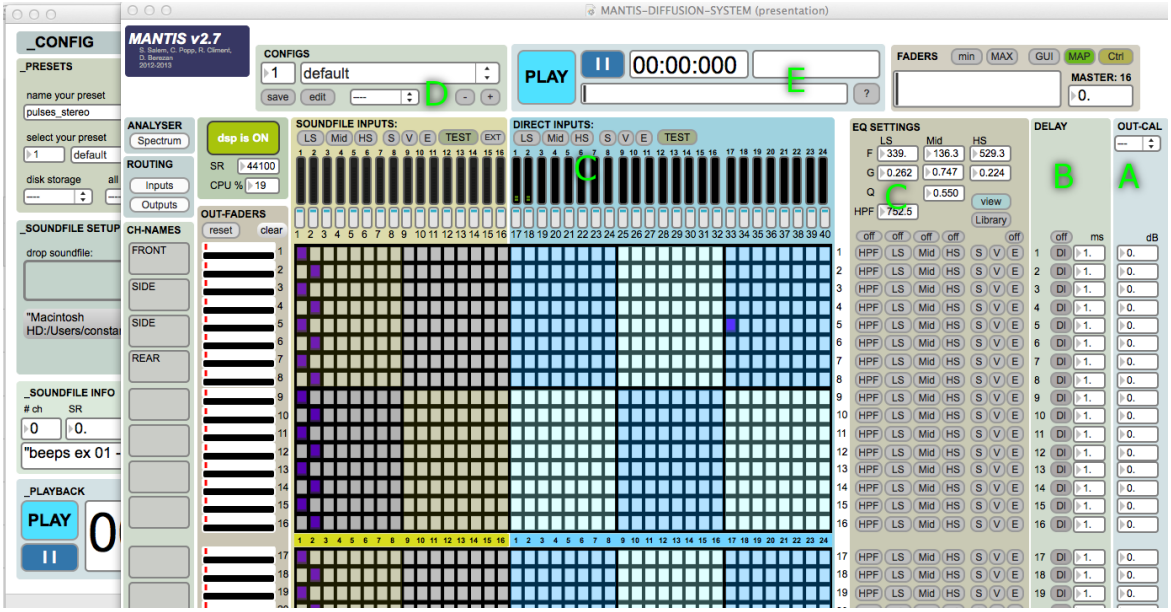

Figure 40: Screenshot of the MANTIS Diffusion System.

The additions were mainly (see Figure 40):

- A level calibration mechanism (A) for each output to correct (minor) differences in loudspeaker levels from within the software, as suggested by David Berezan. This offers the benefit of quick and simple access to level fine tuning. These settings will also be globally saved and recalled every time the software starts, resulting in a reduction in setup time during production / performance sessions if the same production / performance environment is used.

- A time correction mechanism for each output (single-tap delays) to ease problems caused by the precedence effect (B). The composer used these delays to help shape immersion during performance as materials could be mapped to many loudspeakers at once without obscuring the general orientation of a composition. This effect was heavily used in the performance of *empty rooms*.

- The addition of an up-to four band equaliser both on the inputs and outputs of the diffusion system (C). The equaliser can be used to correct / create spectral differences between different loudspeakers and room acoustics. The composer used the equaliser to reinforce spatial separation in the performances of *empty rooms*, *skalna* and *pulses* through, for example, mapping the composition's high frequency components to different loudspeakers than the lower frequency components.

- Rework of the session saving mechanism to facilitate saving, renaming and deleting settings (D).
- Various improvements to the GUI to facilitate interaction (E).
- An expansion to 44 hardware-inputs, 24 tape inputs, 40 diffusion inputs, 56 diffusion outputs and 64 hardware outputs. This accommodates differences between hardware, loudspeakers and routing requirements of compositions. The additions were result of concerts and discussions among MANTIS composers to support stem-based compositions in various formats and mixed-media pieces.
- Support for MIDI based motorised faders for full total recall.

Appendix C: Additional Information on the Portfolio Works

stone and metal

Program Notes

stone and metal is exploring the personal space of cold materials and presenting them in a very warm and sensual way. With excessive close miking of hand played gestures and textures of stones, metal and their interaction, it was possible to capture their beauty and organic, almost animate qualities, presenting them in a very intimate way to the listener. To further strengthen the peculiar sensation of space and its intimacy, the use of artificial reverberation has been completely relinquished. The sound transformations, on the other hand, provide the necessary contrast to the organic recordings, with both affecting the conception of space and beauty. The artificialness of the sound transformations are intentionally exposed to enhance the vividness of the sound recordings and also to provide the driving force of the musical development. Their energy, in terms of gestures, tends to invade and envelop, in terms of textures, the personal space of the listener, making him/her involved in exploring the manifold layering of the sounds.

Performances

- MANTIS Festival, Martin Harris Centre, Manchester, March 5th 2011

empty rooms

Program Notes

The Novars studio's quiet soundscape served as the initial (emotional) starting point of *empty rooms*. Because the studios are sonically highly insulated, sounds from outside of the studio are almost fully blocked and previously unheard sounds suddenly creep into the user's perception: The quiet transformer hums of the various electronics in the studios become audible, as well as the occasional chattering of other studio users behind doors or the slight distant rumble of passing trucks. But all those sounds occur on very, very low sound level, contrasting highly with the loud soundscapes of Manchester with its raving city centre and bars. In a way, both sonic states encroach on the listener's personal space equally: Both force him/her into the Now, pushing him/her out of the state of pure observation, either through silence as he/she becomes aware of his/her own overloaded senses, or is overwhelmed by a massive wall of sound. *empty rooms* aims to recreate this change in perception from observation to active partaking. It harnesses the physicality and power of encroaching on the listener's personal space through interlocked recordings of unpopulated spaces, mechanised spaces and overwhelming noise.

Performances

- MANTIS Festival, Martin Harris Centre, Manchester, June 10th 2011
- Music Since 1900 Conference, Liverpool Hope University, Liverpool, September 12th, 2013

Selected Performances (Video Version)

- Synchresis, Valencia, November 19th 2011
- Diagonale Kurzfilm Festival, Haus der Architektur HdA, Graz, April 19th 2012

- Backup festival 2012, Weimar, May 10th 2012
- Elektramusic, Strasbourg, October 20th 2012
- Filmladen, Kassel, November 13th 2012,
- Buchrest Int. Experimental Film Festival, Bucharest, November 20th 2012
- Film Mutations, Zagreb, December 12th 2012
- Galerie Lisi Hämmerle, Bregenz, June-July 2013
- Architekturzentrum Wien, April 17th-27th 2013
- NIT ELECTRO SONORA, Flix, August 3th 2013
- SonicIntermedia: NOVARS, Anton Bruckner Privat Universität, Ars Electronica Center, Linz, October 14th 2013

PLib / *weave/unravel*

Program Notes

weave/unravel is a collaborative duo between Hervé Perez (saxophone) and Constantin Popp (live-sampling and processing).

The improvisations focus on extended techniques and the abstract peripheral sounds of the saxophone. These sounds are then magnified and exploded through a delicate mixture of close-miking, amplification and diffusion. The saxophone becomes disembodied in favour of projecting its inner space to the public space of the concert hall. The process of sampling and spatialisation merges the performers' identities and places the listener inside the hyper-instrument.

Performances

- MANTIS Festival, Martin Harris Centre, Manchester, October 30th 2011
- The Showroom, Sheffield, March 31st 2012
- Living Room Concert, Sheffield, February 11th 2013

Additional Performances of the PLib in Other Collaborations

- with Mark Pilkington, David Berezan, Andreas Weixler, Se-Lien Chuang, SonicIntermedia: NOVARS, Anton Bruckner Privat Universität, Ars Electronica Center, Linz, October 14th 2013
- with Danny Saul, Martin Harris Centre, Manchester, October 11th 2012 and September 26th 2013
- with the Distractfold Ensemble, Nexus Art Café, Manchester, May 5th 2012
- with David Berezan, Kingston University, Kingston upon Thames, March 22nd 2012
- with Antoni Beksiak, Acousmain, Frankfurt, January 19th 2012
- with Antoni Beksiak, Mouth-o-Phonic, Łódź, February 20th 2011
- *Habitat*, with laborgras et al., p. 86

skalna

Program Notes

During the summer in 2011 I spent a lot of time recording soundscapes in the suburb of Stocki in Lodz, Poland. On one walk near the Skalna road, I found an abandoned mining site. The site's particular sound-world and atmosphere fascinated me instantly. Being a big hole in the ground with reliques of previous work, it was visually and aurally shielded from the city, spreading a timelessness to the spectator which was strengthened by the random squeaking of the old rusty machinery. The ruins of a metal reinforced concrete structure (was the reinforcement not strong enough or did someone just dump it there?) provided the ideal location to put down the recording equipment and start enjoying life, experiencing the space, time and the sun: I was listening to the insects, the creaking of the machinery, the breath of the wind traced in the trees and behaviour of the insects, the passing aeroplanes. I also played, throwing tiny stones to hear how their impact on the concrete floor would sound. And actively listening to the environment made me aware of its own musical rhythms: the spatial interplay of the insects (and stones), the slower coming and going of the wind, the looming of aeroplanes, the omnipresent metal. Thanks to the location recorder and a couple of microphones I could capture the space's sonic aspects and fabricate a vivid, surreal and dramatised version of the found landscape.

Performances

- MANTIS Festival, Martin Harris Centre, March 3rd 2012
- InShadow International Festival of Video, Performance and Technologies, Lisbon, December 6th 2012 (video version)

pulses

Program Notes

Our environment is full of quasi-musical situations. Those situations can serve as a vast resource for an electroacoustic composition. For example: Germany's traffic lights encode their state into different kinds of repetitive clicks. So if one stands at an intersection with lots of traffic lights one can hear their clicks coming from different directions and distances. Depending on the listener's vantage point the mixture of those clicks can appear as spatial cross rhythms, and if the listener moves the perceived rhythms will change, as well. In *pulses* I recorded those clicks and recreated an orchestrated, abstracted version of this situation. Those recordings served as one of the foundation stones of the piece. The other one stemmed from failed attempts to record things.

While capturing sounds in the open field lots of strange things can happen – especially with the technology involved. So I went out to attempt to record the peace of England's northern landscapes. Unfortunately, the microphone connector broke during the recording, superimposing a wonderful aggressive noise over the "silence" of the environment. Back in the studio I analysed the behaviour and context of that noise to be able to introduce it to other, cleanly recorded sounds. And consequently I arrived at two additional contrasting ideas to base my piece on: balancing and superimposing noise against silence.

Performances

- MANTIS Festival, Martin Harris Centre, University of Manchester, October 27th 2012
- Salford Sonic Fusion 2013, University of Salford, March 21-24th 2013

beeps

Program Notes

Some of our objects around us beep to make us pay attention to them. They make a disturbing, artificial, relatively high-pitched sound. Based on the context in which their sound is happening and the degree of their annoyance (i.e. resemblance to a scream) we can infer what they would like to tell us and how relevant this is to us. So they could imply things like: "careful, I'm moving towards you", "I'm working fine", "I received your input". Or imagine a beeping truck backing up and neither you nor the truck's driver are aware of each other's crossing paths. So in a way, one's chances of survival (or quality of life) will increase if the information associated with beeps is successfully deciphered.

But there's another side to the beeps as well: their musical potential. They not only have pitch, duration and timbre, but also imply structural relationships between them and other sounds. Those relationships can be musically harnessed. For example: a German radio station announces both the time and the news with a count-in at 60 bpm using sine tone beeps, making the new hour coincide with a new bar and the start of the news. What a wonderful idea!

So over the past few months I had been collecting and investigating different kinds of beeps and their structural implications to compose a metaphorical journey through our everyday experience.

Performances

- MANTIS Festival, Martin Harris Centre for Music and Drama, Manchester, March 2nd 2013
- Church Road, Liverpool, May 19th 2013
- SSSP 2013, Leicester, June 5th 2013

triptych

Program Notes

The spatial qualities of film soundtracks are utterly fascinating. The combination of dialog, sound effects, ambiences and symphonic music creates a surreal, abstract space as each sound type comes with its own reference to specific room acoustics. Although this conglomeration might seem fairly unrealistic, it feels very familiar, due to frequent usage in films and TV series.

The title of *triptych* refers to both the space and form of the piece. Firstly, similar to Hollywood's action movies, noisy, dry sounds populate the foreground which seem to be in their own, private close space, which might be embedded in slightly distant field-recordings, while very distant orchestra-like sounds provide a symphonic musical horizon and emotional connotation. Secondly, with regard to form, the piece is based on three distinct parts where each describes its own mo-

ment in time. This is similar to triptych paintings in Christian art where a protagonist's narrative is described in a three-part landscape.

Performances

- MANTIS Festival, Martin Harris Centre for Music and Drama, Manchester, October 26th 2013
- De Montfort University, Leicester, January 15th 2014

Appendix D: Additional Portfolio Works

Habitat

Program Notes[151]

Habitat is a design for an interactive, temporary performance installation that invites audiences to enter multiple layers of virtual and real space. Spectators experience how these spaces come to life from any perspective of their choice.

Concept: LaborGras & Volker Schnüttgen
Choreography: LaborGras (Renate Graziadei & Arthur Stäldi)
Performer: Renate Graziadei
Sculptures & virtual interior design: Volker Schnüttgen
Video art: Frieder Weiss & Martin Bellardi
Composition & live music: Constantin Popp
Costumes: Chantal Margiotta
Assistance Costumes: Claudia Janitschek
Sculpture assistance: Fernando Almeida
Technical director: Jochen Massar
Production: Inge Zysk
Public Relations: Yven Augustin

Wood-carved sculptures provide the general framework for the performance-installation space. Each individual sculpture also contains an intimate inner space that the viewer must discover. These interior spaces are equipped with a screen and speaker. The screen reveals a virtual space that is a media-generated extension of the sculpture, building a virtual stage for the dancer and her choreography. The dancer performs in a clearly defined area, which is integrated into the general performance-installation framework. Dance and sculpture are united through the use of new technology and a software programme developed especially for this performance. The real-time video projections establish a link between the choreography in real space and the dance taking place in the sculpture's virtual spaces. The virtual stages (screens) come alive as the dance unfolds. The dancer inhabits the sculpture's virtual spaces as a single image or as multiple clones of herself. Every movement is born of an exchange with, and in relation to, the sculpture's virtual inner spaces. As she performs, the dancer is aware of the habitats defined by her interaction with the sculpture's inner rooms. The choreographic interpretation remains part of the sculpture as a digital recording. The dancer inhabits separate Habitats of the sculptural installation without physically leaving the dance area. For the spectators, the environment is both performance and installation, challenging and encouraging them to leave the safety of simple observation and discover new ways to perceive the world around them. This accessible, walkable installation becomes the audience's temporary living space; a space that comes alive because the audience's own movement

[151] The program note is quoted from laborgras (2010). *Laborgras | Habitat*. [online] http://www.laborgras.com/index.php/habitat.html [Accessed 21/2/2014].

brings them to simultaneously discover the real and the media-generated life within the sculptures. There is no distance between stage, spectator, performer, sound and sculpture, so that the artistic process becomes transparent as the performance progresses.

Performances

- Radialsystem V, Berlin, 17-19th December 2010
- Tanz im August, Radialsystem V, Berlin, 19-25th August 2011