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MATERIALS, MEANING AND METAPHOR: UNVEILING SPATIO-TEMPORAL PERTINENCES IN ACOUSMATIC MUSIC

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Thesis submitted in fulfilment of the degree of
Doctor of Philosophy in Music

City University London
Centre for Music Studies
Department of Creative Practice & Enterprise
School of Arts & Social Sciences

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Composition Folio Contents

- *Chat Noir*: 1999, duration 10'06"
  Stereo Acousmatic Composition.
  Recorded onto Audio Compact Disc 1, Track 1.
  Performance requirements: professional sound diffusion system or high-quality home listening.

- *Neon*: 2001, duration 10'04"
  Stereo Acousmatic Composition.
  Recorded onto Audio Compact Disc 1, Track 2.
  Performance requirements: professional sound diffusion system or high-quality home listening.

- *Ether*: 2001, duration 13'45"
  Octophonic Acousmatic Composition.
  Recorded onto Audio Compact Disc 1, Track 3.
  Recorded onto DVD-ROM.
  Performance requirements: professional multichannel sound diffusion system with a minimum of eight loudspeakers, although sixteen or more loudspeakers are preferable.

  Commissioned by *Musiques & Recherches*

- *Les Forges de l'Invisible*: 2003, duration 14'
  Octophonic Acousmatic Composition.
  Recorded onto Audio Compact Disc 1, Track 4.
  Recorded onto DVD-ROM.
  Performance requirements: professional multichannel sound diffusion system with a minimum of eight loudspeakers, although sixteen or more loudspeakers are preferable.

- *Protopia/Tesseract*: 2007, duration 13'49"
  Octophonic Acousmatic Composition.
  Recorded onto Audio Compact Disc 1, Track 5.
  Recorded onto DVD-ROM.
  Performance requirements: professional multichannel sound diffusion system with a minimum of eight loudspeakers, although sixteen or more loudspeakers are preferable.

Audio Compact Disc and DVD-ROM Contents

Audio Compact Disc 1:

Stereo works and stereo reductions of multichannel works:
Track 1. *Chat Noir*, 10'06" duration
Track 2. *Neon*, 10'04" duration
Track 3. *Ether*, 13'45" duration
Track 4. *Les Forges de l'Invisible*, 14' duration
Track 5. *Protopia/Tesseract*, 13'49" duration
Track 6. *L'éveil*, 10'04" duration (pre-doctoral work included for reference)

Audio Compact Disc 2:

Stereo sound examples for the dissertation (preceded by sound example number):
Track 1. (2.1) *Neon* (extract, 3'09" – 4'43"), 1'34" duration
Track 2. (2.2) Transformed "swell" sound, 27" duration
Track 3. (2.3) Synthesized sound, 7" duration
Track 4. (2.4) Synthesized sound (transformed), 6" duration
Track 5. (2.5) Synthesized sound (re-transformed), 7" duration
Track 6. (2.6) Elastic sounds, 13" duration
Track 7. (2.7) Ambiguous sustained pitched sound N° 1, 8" duration
Track 8. (2.8) Ambiguous sustained pitched sound N° 2, 18" duration
Track 9. (2.9) Thunder (source sound), 15" duration
Track 10. (2.10) Metal ball in enamel container (source sound), 9" duration
Track 11. (2.11) Tuning pegs in piano (source sound), 24" duration
Track 12. (2.12) Tuning pegs in piano (transformed), 16" duration
Track 13. (2.13) Downpour (rain, source sound), 15" duration
Track 14. (2.14) Synthetic iterations, 12" duration
Track 15. (2.15) Pitched, synthesized sound, 20" duration
Track 16. (2.16) *Neon* (extract, 1'30" – 3'10"), 1'40" duration
Track 17. (2.17) Calm sea (source sound), 43" duration
Track 18. (2.18) Calm sea (transformed - medium high pass filter), 27" duration
Track 19. (2.19) Calm sea (transformed - band pass filter), 14" duration
Track 20. (2.20) Calm sea (transformed - high pass filter), 11" duration
Track 21. (2.21) Metallic *crépitements* and impacts (source sound) 21" duration
Track 22. (2.22) Glassy friction (transformed), 3" duration
Track 23. (2.23) Glassy friction (time-stretched), 6" duration
Track 24. (2.24) Glassy friction sampled at lower pitch, 4" duration
Track 25. (2.25) Filtered recording of stone on wood friction, 3" duration
Track 26. (2.26) Low pass filtered sea, 12" duration
Track 27. (2.27) Metal friction (transposed/time-stretched), 33" duration
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Track 37. (2.37) Bowed violoncello (source sound), 4” duration
Track 38. (2.38) Water falling into water (source sound), 7” duration
Track 39. (2.39) Duct tape pulled off (source sound), 3” duration
Track 40. (2.40) Synthesized sound, 16” duration
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Track 45. (2.45) Metallic cascade particles, 11” duration
Track 46. (2.46) Glass rebound (comb filtered/Doppler effect), 23” duration
Track 47. (3.1) *Les Forges de l’Invisible* (extract, 3’57” – 4’12”), 15” duration
Track 48. (3.2) *Neon* (extract, 4’42” – 4’49”), 7” duration
Track 49. (3.3) *Balancement* (swaying) 11” duration
Track 50. (3.4) Oscillation, 8” duration
Track 51. (3.5) Train (source sound), 23” duration
Track 52. (3.6) *Protopia/Tesseract* (extract, 1’28” – 1’48”), 20” duration
Track 53. (3.7) Transformed train (resonant filters/Metasynth), 8” duration
Track 54. (3.8) *Protopia/Tesseract* (extract, 3’16” – 3’30”), 15” duration
Track 55. (3.9) Transformed train (tessitura rises Augmented 4th), 11” duration
Track 56. (3.10) *Protopia/Tesseract* (extract, 5’20” – 5’44”), 24” duration
Track 57. (3.11) Transformed train (frequency shift/resonant filters), 6” duration
Track 58. (3.12) *Protopia/Tesseract* (extract, 7’40” – 7’51”), 11” duration
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Track 61. (3.15) Transformed train (resonant filters/stretching), 14” duration
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Track 86. (6.2) *Chat Noir* (extract, 2’23” – 3’41”), 1’18” duration
Track 87. (6.3) *Ether* (extract, 0” – 56”), 56” duration

DVD-ROM:

Audio Files for multichannel works and multichannel sound examples:

- *Ether*: 8 flat mono AIFF Audio Files (16 bit, 44.1 kHz). Use the *Ether* primary loudspeaker placement scheme or, when logistics render it impossible, the *Ether* alternate loudspeaker placement scheme. Refer to Appendix 2 for the loudspeaker placement schemes.

- *Les Forges de l'Invisible*: 8 flat mono AIFF Audio Files (16 bit, 44.1 kHz). Refer to Appendix 2 for the loudspeaker placement scheme.

- *Protopia/Tesseract*: 8 flat mono AIFF Audio Files (24 bit, 44.1 kHz). Refer to Appendix 2 for the loudspeaker placement scheme.

- Multichannel sound examples: 8 flat mono AIFF Audio Files (24 bit, 44.1 kHz). The following list displays the multichannel sound examples in the order they are heard; the list also includes the sound example number as referred to in the dissertation, the work from which the sound example is taken, as well as the timing of the example in the context of the work. Refer to Appendix 2 for the loudspeaker placement scheme.

  1. 0" – 16", Sound example 2.44, *Ether*, (8'07" – 8'23")
  2. 19" – 35", Sound example 3.1, *Les Forges de l'Invisible*, (3'57" – 4'12")
  3. 38" – 58", Sound example 3.6 from *Protopia/Tesseract*, (1'28" – 1'48")
  4. 1'01" – 1'16", Sound example 3.8, *Protopia/Tesseract*, (3'15" – 3'30")
  5. 1'20" – 1'44", Sound example 3.10, *Protopia/Tesseract*, (5'20" – 5'44")
  6. 1'48" – 1'59", Sound example 3.12, *Protopia/Tesseract*, (7'40" – 7'51")
  7. 2'01" – 2'18", Sound example 3.14, *Protopia/Tesseract*, (8'06" – 8'23")
  8. 2'19" – 2'33", Sound example 3.16, *Protopia/Tesseract*, (10'22" – 10'36")
  9. 2'37" – 2'47", Sound example 3.17, *Les Forges de l'Invisible*, (5'55" – 6'05")
  10. 2'49" – 3'34", Sound example 3.18, *Ether*, (8'39" – 9'24")
  11. 3'36" – 5', Sound example 3.20, *Protopia/Tesseract*, (10'18" – 11'42")
  12. 5'02" – 5'25", Sound example 3.23, *Les Forges de l'Invisible*, (10'18" – 10'40")
  13. 5'32" – 5'45", Sound example 3.25, *Protopia/Tesseract*, (7'38" – 7'51")
  14. 5'48" – 8'36", Sound example 3.26, *Ether*, (2'30" – 5'18")
  15. 8'40" – 9'20", Sound example 3.28, *Ether*, (8' – 8'40")
  16. 9'23" – 9'42", Sound example 3.29, *Les Forges de l'Invisible*, (13'12" – 13'31")
  17. 9'43" – 9'54", Sound example 4.1, *Les Forges de l'Invisible*, (11'45" – 11'56")
  18. 9'58" – 12', Sound example 4.3, *Ether*, (56" – 2'58")
  19. 12'03" – 13'06", Sound example 4.4, *Les Forges de l'Invisible*, (1'16" – 2'19")
  20. 13'15" – 13'30", Sound example 4.5, *Les Forges de l'Invisible*, (4'21" – 4'36")
  21. 13'35" – 14'03", Sound example 5.1, *Ether*, (9'16" – 9'44")
  22. 14'09" – 15'47", Sound example 5.2, *Les Forges de l'Invisible*, (4'56" – 6'33")
  23. 15'51" – 16'47", Sound example 6.3, *Ether*, (0" – 56")

- Multichannel sound examples for *Ether*: 8 flat mono AIFF Audio Files (24 bit, 44.1 kHz). The following list displays the multichannel sound examples in the order that they are heard; the list also includes the sound example number as referred to in the dissertation, the work from which the sound example is taken, as well as the timing of the example in the context of the work. Use the *Ether* primary

loudspeaker placement scheme or, when logistics render it impossible, the *Ether* alternate loudspeaker placement scheme. Refer to Appendix 2 for the loudspeaker placement schemes.

1. 0" – 16", Sound example 2.44, *Ether*, (8'07" – 8'23")
2. 20" – 1'05", Sound example 3.18, *Ether*, (8'39" – 9'24")
3. 1'10" – 3'58", Sound example 3.26, *Ether*, (2'30" – 5'18")
4. 4'01" – 4'41", Sound example 3.28, *Ether*, (8' – 8'40")
5. 4'49" – 6'51", Sound example 4.3, *Ether*, (56" – 2'58")
6. 6'57" – 7'25", Sound example 5.1, *Ether*, (9'16" – 9'44")
7. 7'30" – 8'26", Sound example 6.3, *Ether*, (0" – 56")

This dissertation is dedicated to the memory of my father,
Colonel Ronald M. Anderson, U.S.A.R.

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Declaration

I, Elizabeth Anderson, grant powers of discretion to the University Librarian to allow this dissertation to be copied in whole or in part without further reference to me.

Abstract

This dissertation addresses two topics. The first is a preliminary investigation into the listening strategies for electroacoustic music by François Delalande. A listening experiment was undertaken to test Delalande's strategies and to learn from listeners' responses in order to apply them to compositional practice. This process prompted the conception of a new, integrated reception behaviour framework for electroacoustic music that comprises four listening strategies: *sonic properties, structural attributes, self-orientation, and imaginary realms.* The second topic is the poietico-esthesic analysis of the folio of acousmatic compositions from the perspective of the reception behaviours framework.

The intention of the reception behaviours framework is to illuminate those sounds and structures in electroacoustic music that could be perceived as carriers of meaning. The analysis of the acousmatic compositions in the portfolio, from the perspective of the reception behaviours framework, aims to illustrate how the acousmatic composer can attempt to create meaning in an acousmatic work.

While space is observed as the common denominator in the reception behaviours framework from an *esthesic* perspective, space and time are proposed as common denominators that carry all *poietic* intention. Hence, space and time can be seen as universal carriers through which meaning can subsequently be conveyed and perceived.

Introduction

The listening strategies for electroacoustic music conceived by François Delalande provide a valuable frame on which to build a new reception behaviours framework. Further, the reception behaviours framework can also serve as a foundation to explain notions about acousmatic composition from a poietico-esthesic perspective.

Chapter 1 centres on Delalande's listening strategies, the listening experiment, the issues arising from the experiment that led to a reconsideration of Delalande's approach, and the reception behaviours framework. Recurring observations by listeners of the sounding flow led to the conception of the listening strategy entitled sonic properties. Chapter 2 centres on sonic properties while chapter 3 centres on the listening strategy named as structural attributes. However, the salient points developed in these listening strategies are used as windows through which to analyse the works in the folio poietically. For example, in the same way listeners can opt to discuss sonic properties, aspects of the pieces in the folio are discussed from the viewpoint of sound creation. In reflecting the traits of sonic properties, this discussion includes spectromorphological characteristics of sounds in the works from the perspective of source-bondedness and transformation, as well as abstract musical properties. However, the sound-object is also regarded as an aural trace resulting from a physical gesture that unfolds through energy models – whether manifested in source recordings or produced virtually through transformational processes – as guided by the composer's imagination.

The quest for terms that could convey the importance attributed to the notions of energy and the composer's imagination in acousmatic composition led to the discovery and exploration of the Matter-Energy continuum, one of the three interconnecting continua devised by the Indo-Tibetan scholar, Tarab Tulku Rinpoche XI, Lharampa Geshe, Ph.D. His philosophy would prove to be useful in the development of diverse aspects of post-reception behaviours framework research, including poietico-esthesic ideas about the works in the folio as viewed through the reception behaviours framework. Tarab Tulku's research also provided another perspective for the elaboration of the listening strategies, which exemplified traits of interconnectivity similar to those he proposed. The notion of interconnectivity also arises in the accompanying sound examples as well as in the findings from the listening experiment insofar as certain sound examples and findings are repeated in the dissertation in order to illustrate different poietico-esthesic points.

As introduced in Chapter 2, one of the tenets put forth by Tarab Tulku suggests

the human being contains the potential for all forms of expression, a basis for expressive potential that is extended to the creation of gesture in acousmatic sound and to the moulding of sound spectra within the aural trace left by gesture. As exposed in Chapter 2, the research on abstract musical properties inspired the conception of the spectral content/tactility factor double continuum which is based on two interrelated characteristics inherent in sound spectra – the 'material' quality that specific frequency components are perceived to possess as they deploy in space over time. Tactility, otherwise viewed as texture, is suggested to be a less explored abstract musical property. Hence, the spectral content/tactility factor double continuum aims to increase the composer/reader's awareness of this property, which, as we shall see, can be divorced from any 'natural' association it may have with different forms of sound spectra and be considered in its own right as expressed through, for example, a sleek, minnow-like texture, wide-bore granularity or any guise in between.

In Chapter 3, structural attributes, which is founded on Delalande's notion of taxonomy, also serves as a window through which to analyse the works in the folio from a poietic perspective. The exploration of structure begins with an observation of the significance of sounding gesture in structure. Discussion initially centres on the structuring processes offered by small-scale gesture from the viewpoint of energy models as well as reshaped gestures. Discussion then turns to the syntactic possibilities offered by other small-scale gestures in the form of incomplete and distorted sounds and the much larger meta-sound. The belief in the primacy of energy also extends to large-scale structure, where sonic topologies are developed using the principles of energy and matter, notably in figure-ground relationships. Discussion about sonic webs, which are essential to figure-ground relationships – and are also conceived through the same energetic perspective – illustrates how webs can be positioned on the fulcrum between figures and grounds where they can 'reach out' toward a figure, 'stretch' back into a ground, support an important structural event, and hold the three-dimensional space of a sonic void after the event.

Discussion in Chapters 4 and 5 is founded on the listening strategies entitled self-orientation and imaginary realms, and centres on the extensions of Delalande's listening strategies, empathy and figurativisation, respectively. The first part of Chapter 4 is dedicated to the development of empathy into self-orientation, a strategy where the listener can opt for the inherently reflexive response proposed by empathy. However, as suggested, listeners may also choose strategies that do not involve overt reflexivity and, instead, either centre on general descriptions and opinions of the music or physiological sensations, emotions and evaluations as ends. Listeners may also refer

to typo-morphological descriptions of sounds or general descriptions of the sound world while centering on topics that appear to be 'extrinsic' to the self and the music, or they can elaborate on topics that are external to themselves and the music, but which the music is thought to have brought forward.

The latter part of the discussion in the chapter, Self-Orientation, focuses on the ways the listener can construct meaning. Meaning can arise through perceptual vectors, otherwise viewed as 'mental tunnels', through which elements in an acousmatic piece can appear to *evoke* thoughts or perceptions exterior to the piece, or through which such elements can be perceived to change *function*, *behaviour* or *meaning* in a way that listeners consider to be different from the elements' 'objective' spectromorphological and/or spatio-temporal contexts. Further, as elaborated, all perceptions take a *form* as they unfold, before they materialise into a final perception, whether the perception unfolds through a perceptual vector or not. In the final part of the chapter, Self-Orientation, aspects of the works in the folio are discussed as perceived through perceptual vectors; the poietic process is addressed through the composer's esthesic response.

Chapter 5, Imaginary Realms, is organised following a similar principle. Discussion initially centres on the expansion of Delalande's figurativisation into imaginary realms, which comprises other strategies in addition to figurativisation, notably fiction, fantasy and surrealism. The definition of imaginary realms is followed by a discussion of certain works in the folio through the viewpoint of imagination, where the poietic process is deduced in retrospect from the composer's esthesic response.

The dissertation concludes with Chapter 6, which is devoted to space, the common denominator in all listening strategies. Discussion in Chapter 6 begins with the role of space as perceived, esthesically, in the four reception behaviours, and then addresses notions of composed spectral and three-dimensional space in the stereo and acousmatic idioms from a poietic perspective as illustrated through excerpts from works in the folio.

The diverse themes presented in the dissertation have been developed and integrated over several years, during which it was essential to share the various stages of research in different venues. The process of communicating ideas to others as well as listening to feedback was invaluable to the development of the ideas. The early stages of research were delivered in a paper given at a conference on 'Experiments and Models in the Psychology of Music' at the University of Leeds in 2000 and, again, in a conference at the International Electroacoustic Festival *L'espace du son* in Brussels in

2003. Later stages of research were delivered in conferences at the Institute of Musicology at the University of Cologne in 2006 and 2007, and in a paper given at De Montfort University in 2007 in the framework of the Electroacoustic Music Studies Network 2007.

This research on reception behaviours is, at present, limited to the findings from a number of listeners who participated in a listening experiment in 1999. Extensive listening experiments would need to be carried out in controlled circumstances in order to test and complement the ideas I put forward. Nevertheless, it is hoped that my research can serve to broaden the field of reception behaviours in electroacoustic music, and, from a poietico-esthesic perspective, illuminate the wondrous possibilities open to the composer specialising in acousmatic techniques.

Chapter 1. The Reception Behaviours Framework

1.1 The Acousmatic Medium

Acousmatic music is a type of electroacoustic music that exists in a recorded format. It is transmitted and perceived, during performance, via the loudspeaker, thereby eliminating all visual stimulation that the listener customarily associates with sound production.[1] The circumstances associated with the performance and perception of acousmatic music release the sounds from the visual context associated with the sound-making and sound-shaping processes. The listener is, subsequently, liberated from a type of perception that traditionally combines the visual with the auditory.

Annette Vande Gorne proposes that this invisibility stimulates listeners to access their imagination, sensations, and emotions (Vande Gorne, 1999: 6). However, if invisibility is paramount, do recordings of instrumental or vocal music not incite similar types of responses, or is acousmatic music eminently suited to this type of communication? While instrumental and vocal music do access the imagination, acousmatic music is particularly well adapted to this purpose for a number of reasons. Unlike instrumental music, there is no typical sound or sound world as defined by the timbres and registers of traditional instruments and their combinations. There are no human limits imposed on the execution of the sounds, nor is there a convention surrounding the understanding of what Trevor Wishart calls 'landscape' (Wishart, 1996).

Acousmatic music does not usually rely on the pulsed structuring of time or on the type of sound spectra as found in the standard concert repertoire of the schooled Classical tradition in Western instrumental and vocal music.[2] Rather, it respects the inherent rhythmic and spectral properties found in a sound or sound world. Each work therefore comprises a unique set of rhythmic and spectral properties and relationships. In addition, the combination of possible superimpositions of sounds or sound worlds a

[1] I suggest the spatialisation or diffusion of a stereophonic acousmatic work in a concert setting requires a minimum of eight loudspeakers. Four pairs of loudspeakers placed equidistant from front to back in a concert hall provide four spatial zones, the simplest arrangement that can adequately represent diverse spatial dimensions in the stereophonic acousmatic repertoire. The number of channels in a work dictates the minimum number of loudspeakers for the performance of multichannel acousmatic works. However, in my experience, doubling or tripling the minimum number of required loudspeakers in the performance of a multichannel work allows for two or three loudspeakers, that are, preferably, close together, to be assigned to one channel, which allows for a more subtle interpretation of the work.

[2] Nevertheless, acousmatic music can rely on the pulsed structuring of time as evidenced in the first movement, *Jeu et rythme*, of Robert Normandeau's work *Éclats de voix,* (Normandeau, 1991), as well as in Åke Parmerud's work, *La vie mécanique* (Parmerud, 2004).

composer may create in an acousmatic piece is infinite. According to John Young, these organised acoustic images function together in a continuum between the poles of 'Reality' and 'abstraction' (Young, 1996: 83-84). If we accept the 'Reality-abstraction' continuum, we can observe that the gradations between the two poles are immeasurable. In addition, each acousmatic work not only shifts in its unique way between these two poles but, due to the complexity of the genre, it is also possible to perceive simultaneous, yet divergent, progressions within the 'Reality-abstraction' continuum.

These concepts were particularly interesting from a compositional point of view during the preliminary stages of my doctoral research. Of equal intrigue were the seemingly inexhaustible types of listener responses to the same work. Judging from diverse listener reactions it became apparent that an acousmatic work expresses ideas exterior to itself. What, then, are the hidden meanings in this music? Which sounds are carriers of meaning? Which meanings do they carry and for whom?

1.2 *Music Analysis and Reception Behaviours:* Sommeil *by Pierre Henry:* A Summary of the Listening Strategies Devised by François Delalande

An examination of the investigation into *listening strategies*, conducted by François Delalande at the *Groupe de Recherches Musicales* in Paris in 1997, proved to be advantageous to the orientation of my research.[3] The main objective of Delalande's listening experiment, conducted with reference to the movement *Sommeil* from Pierre Henry's acousmatic work *Variations pour une porte et un soupir,* was to study, describe and differentiate listening or reception behaviours.

> "In listening attentively to a piece of music one adopts, more or less consciously, a goal: one expects something at this moment of listening (which becomes clearer during listening), which determines a strategy and specific focuses on this or that, contributing not only to the forming of a perceptual image of the work with its symbolisations and meaning, but also to the provoking of sensations, and eventually emotions, which in turn reinforce or reorientate expectations. It is this act, where objective, strategy, perceptual construction, symbolisations, and emotions are mutually dependent and progressively adapt to the object, that we call 'listening behaviour'" (Delalande, 1998: 23).

Methodological considerations for this type of experiment are considerable. An in-depth examination into an acousmatic work is not without its difficulties, as unlike traditional music "[...] this type of music presents the analyst with all problems simultaneously: no score, no system, and no 'pre-segmented' discrete units like notes" (*ibid*.: 14). Pierre Schaeffer's[4] prior research distinguished between the sound-object[5], constructed phenomenologically by the listener, and the physical signal[6] to which it is attributed. While Schaeffer focused on the analysis of the sound object, Delalande proposed that the "[...] object of analysis is really the physical signal itself, the material object, the result and trace of the material acts of the composer, even if the method of

[3] My preliminary research is summarised in my paper *Perception in Electroacoustic Music: A Preliminary Investigation and Expansion of the Reception Behaviours Devised by François Delalande* (unpublished, 2001).
[4] Pierre Schaeffer, composer and researcher, wrote the *Traité des objets musicaux* (Schaeffer 1966).
[5] In Schaeffer's first definition of the term, a sound-object "[…] is what one hears when 'reduced listening' is put into practice, which means that causal and associative meanings of a sound are deliberately ignored" (Schaeffer in Delalande, 1998: 14).
[6] "The physical signal is either the electrical signal obtained by reading the analogue recording, […] the sound file in the case of digital recording, or the acoustic wave emitted from the loudspeaker" (Delalande, 1998: 15).

analysis relies largely on listening" (*ibid*.: 15).[7] My reception behaviours framework, introduced in this chapter, and on which this dissertation is based is, additionally, founded on the investigation of the physical signal, defined here as the acousmatic composition.

In addition to methodological considerations, one must also decide what are the criteria for one's own, or for that matter any listener's reactions. According to Denis Smalley, the issue of uncovering pertinent criteria is problematic. He notes, "In trying to analyse electroacoustic music aurally there is always the fundamental problem of uncovering pertinent criteria. What I find depends on what I hear, what I strain to hear, what I choose to hear" (Smalley in Delalande, 1998: 22). The manner in which listeners interpret music is influenced by the interplay of diverse parameters during the listening experience. These include personal background, and culture as well as mood, a capacity for memorisation, and a general level of interest during listening. In addition, Delalande noted that one never hears a piece the same way twice. However, despite obstacles in establishing criteria, Delalande determined that there were consistencies in listening strategies and that there was not an infinite variety of ways a listener could apprehend a piece (Delalande, 1998: 23).

Eight listeners were invited to listen to the movement, *Sommeil*, by Henry. Several individuals were electroacoustic composers, others were musicians with some knowledge of electroacoustic music, and one was a novice to the domain. Some listeners heard the movement once and others two or three times. Each listener heard the movement in the company of at least one of the analysts. The environment in which the experiment took place was pleasant and comfortable (*ibid*.: 24).

Delalande admitted that the small scale of the experiment would prevent the formulation of conclusions about reception behaviours. His aim was to discover if similarities existed and, in regards to listener reactions to *Sommeil*, he observed a coherence in reception behaviours despite the small sampling (*ibid*.: 25). The three primary types of listening behaviours revealed in this experiment are outlined. A brief discussion follows that addresses the concept of the listening dynamic.

1.2.1 Taxonomic listening as a reception behaviour

According to Delalande, this mode of perception is born out of the desire to make a brief, general survey of the work. The listener searches for an overriding structure in

[7] Schaeffer and Delalande's concepts of the term, object differ from the concept of the object in the frame of Indo-Tibetan philosophy, a topic that is introduced in Chapter 2.

the piece, and in addition, shows sensitivity to the temporality of events. *Taxonomic listening* (*ibid*.: 26-29) occurs when the listener has a tendency to:

(i) Differentiate the larger morphological sections in a work and identify them.

(ii) Create an overall image of the work that takes into consideration its proportions.

(iii) Search for contrasts and introduce discontinuities in the musical flow.

(iv) Attempt to memorise the data.

(v) Use metaphors in order to label sounds.

(vi) Find this type of listening laborious and less pleasurable than other reception strategies.

(vii) Create an impartial base from which to develop more personal reactions.

1.2.2 Empathic listening as a reception behaviour

The listener who displays this attitude responds to the "physiological" product of the sound and comments first on the level of feeling. *Empathic listening* (*ibid*.: 37-40) can be distinguished when listeners:

(i) Describe the events in the music as if they are subjected to these movements themselves.

(ii) Focus attention on the present moment and avoid establishing connections with the musical discourse prior to that instant.

(iii) Do not attempt to score the music.

(iv) Create two sets of metaphors: The first type concentrates on the morphology of the sound, however, the sounds are not simply listed, they "act on each other and, in a symbolic way, also act on the listener" (Delalande, 1998: 39). The second type is organised into perceptions that are more personal. In the case of listener responses to Sommeil*, these took the form of "complex narrative images which (clarified) relations and (conveyed) metaphors for the object more explicitly ... like a kind of ... karate in slow motion (...) like the demonstration of martial art" (ibid.: 39).*

(v) Use metaphorical descriptions to attempt to develop the object/subject[8] *association.*

[8] In Delalande's definition of object/subject, the subject is understood as the listener and the object is understood as the piece. This differs from the Indo-Tibetan concept of Subject-Object explained in 2.2.1, where the listener is the subject and the listener's thoughts, feelings, and sensations are objects in addition to any entity or stimulus exterior to the listener, for example, the sound, or the piece.

These descriptions emerge as 'sensations', the objective of this listening behaviour.

1.2.3 Figurativisation as a behaviour: a stage for the 'living' being

According to Delalande:

> "*Figurativisation* relies on a contrast between sonic configurations which are associated with the living being and other configurations which have a contextual function (decor, signal, scene)" (my italics) (*ibid*.: 47). "Narrativity is not only […] a metaphor for form but also provides a model for perceptual construction […]" (*ibid*.: 52).

Figurativisation (*ibid*.: 47-50), has characteristic traits in which the listener:

(i) Imagines during listening that various sounds suggest something that moves, ultimately living.

(ii) Searches for a contrast between sonic constructions, which are associated with the image of the 'moving entity', and other elements that have a contextual function, for example, the stage, the scene or the decor.

(iii) Does not use metaphors simply to label sounds but, instead, uses them to describe the images which imposed themselves during the listening act.

(iv) Creates metaphors of a second order that are more personal and illustrate the opposition between the central characters in the sound world and the context that frames them.

(v) Describes the musical form metaphorically or, instead, the adventure that the listener experienced while listening.

1.2.4 Incompatibilities in listening behaviours

In addition to these strategies, Delalande also briefly elaborates on the concept of the listening dynamic, centering particularly on the laws that govern listening and the issue of conflicting behaviours. The first *incompatibility* thus exists between non-listening and all types of listening. Non-listening is an oft noted listening behaviour, which occurs when individuals experience motivations while listening that induce them to

disengage from the listening act. Non-listening often occurs when there is little native interest in the work or when the listener becomes distracted (*ibid*.: 63).

Additionally, Delalande observes that incompatibility exists between taxonomy and empathy, implying that these strategies cannot co-exist simultaneously. The resolution of the conflict is perceived in the guise of a sudden shift in listening, a type of internal command that the listener issues and follows during the act of listening. The moments that encapsulate the changes often comprise observable emotional responses some of which are recounted by listeners as instances of aesthetic emotion. However, potential incompatibility between reception behaviours is not certain because the dynamic of the listening act requires further study (*ibid*.: 63).

1.3 Listening Experiment

1.3.1 Overview

In 1999, I devised a *listening experiment* in order to investigate Delalande's reception behaviours.[9] During the experiment, a group of listeners heard one movement from a multi-movement acousmatic work and three extracts from three separate acousmatic works. Although the listeners were requested to respond anonymously, they were invited to express their reactions in the form of a written description of their perceptions. They were also encouraged to make scores, designs, or drawings where needed, in order to allow for the widest possible range of responses on paper, since I suggest, words cannot convey all meanings. The titles of the pieces and the composers' names were disclosed to the listeners at the end of the experiment.

Acousmatic music played

During the experiment, listeners heard the second of two adjacent movements (3'03" duration) from *Deux aperçus du jardin qui s'éveille* by Jacques Lejeune from his eleven-movement stereo acousmatic work, *L'invitation au départ,* composed in 1984.[10] Listeners then heard a 2'27" extract (3'22" – 5'49") from the stereo acousmatic work, *Bois* (12'27" duration), composed in 1986 by Annette Vande Gorne and, subsequently, a 3'12" extract (3'35" – 6'47") from a stereo acousmatic work, *Crystal Music* (14'43" duration), composed in 1994 by Stéphane Roy. The experiment concluded with a 3'08" extract (8'01" – 11'09") from a stereo acousmatic work, *The Gates of H* (18'08" duration), composed in 1993 by Ludger Brümmer.

Dates, venues and participants

The experiment was carried out three times in three locations: May 26, 1999 at City University, London, during my post-graduate electroacoustic music research seminar, on May 31 and June 1, 1999 during the electroacoustic composition course at the *Académie de Musique de Soignies*, Soignies (Belgium), and on June 15, 1999 during a general music class at the International School of Brussels. The experiment was conducted in English at City University, where the group of twelve participants comprised members of the Music Department faculty and English-speaking post-graduate music students. The experiment was also carried out in English at the

[9] See Appendix 4 for a complete description of the listening experiment.
[10] The two *aperçus* have a combined duration of 6'40".

International School of Brussels, where the group of seventeen listeners consisted of eleven- or twelve-year-old, English-speaking sixth grade elementary school students. It is notable that, although the students at City University and the International School of Brussels were English speakers, English was not necessarily their first language. The twelve listeners at the *Académie de Musique de Soignies* were French-speaking Belgians; hence the listening experiment was conducted in French.

1.3.2 Issues

Although this listening experiment was limited in scope, a survey of the findings from the experiment yielded a number of *issues*. First, listeners often elaborated on sonic properties. This tendency sometimes appeared independently of other strategies though occasionally listener articulations about the sound world did include taxonomic, empathic or figurative overtones. However, it was the focus on sound, which separated, however slightly, a behaviour that was oriented to the sound world as opposed to one that was anchored in the territory of the structural, the empathic, or the imaginary. Discussion of sonic properties took diverse forms. Listeners often demonstrated a desire to debate and identify the sound sources or discuss and label abstract sounds in a generalised way. Listeners also exhibited a desire to identify and elaborate on specific spectromorphological qualities pertaining to one sound or a sound world.[11]

Secondly, listeners also occasionally deliberated the *function* of the sound or sound world, in addition to articulating its audible pertinences, assigning to it one of several purposes. For example, the function of a sound or sound world can refer to a structural role it is perceived to fulfil within the work itself. However, the sound or sound world's function can be perceived to shift to a secondary perceptual construction as conceived by the listener, which might or might not be related to the structure of the work, or indeed to the work. Evidence of the relationship between the term, function and perceived musical structure can be seen in remarks from Listener C at City University. In response to the second movement of *Deux aperçus du jardin qui s'éveille,* by Lejeune, Listener C described and identified elements in the sound world and assigned a structural function to them. This is illustrated in the following remarks, "[…] Fragments – many coloured, change to higher pitched, shorter, dissipates, gets

[11] Smalley coined the term, 'spectromorphology', in his article, *Spectromorphology: explaining sound-shapes*, to describe the interplay between sound spectra and the manner in which they evolve and are shaped over time (Smalley, 1997: 106).

quieter, bird sounds, fragments are serial, less superimposed, organ sounds return now and give a sense of recap […]" (Anderson, 2001: 19). Evidence of the relationship between the term, function and a secondary perceptual construction can be seen in the description of the sounds and the allusion to photography as noted in the remark about Lejeune's work from Listener E at the *Académie de Musique de Soignies:* "Piano, camera, bird, forest, songs […] a man takes photos. Each photo is about a different world" (*ibid.*: 26).[12] This observation might indicate that while the sound of the camera shutter has structural importance within the work, perhaps because it is recognisable and creates an initial frame for both movements, like the sound of a closing door, it possesses an extra-musical structural meaning for the listener quite possibly because of its proximity to source-bonded and transformed sounds that succeed it.[13] Therefore, the function of sounds may shift to a secondary perceptual construction, which supercedes their description and identification as well as their importance within the musical form.

Thirdly, listeners sometimes articulated a significance that the sounds or sound worlds *evoked,* in addition to discussing their spectromorphological pertinences. Evocation, meaning to elicit or provoke, was often observed to be a harbinger of the imaginary, although topics evoked by the sounding flow did not seem to be limited to the imaginary. For example, listeners first acknowledged and referred to a sound or sound world, which then appeared to become the basis for a secondary perceptual construction. An example of this type of remark can be seen in the response from the *Académie de Musique de Soignies* Listener E to an extract from *Bois* by Vande Gorne, "[…] a door opens, it makes me think of a hangar filled with machines. It also makes me think of a factory […]" (*ibid.*: 29).[14]

It is necessary to clarify the slight but distinct difference observed between function and evocation. In the case of function, a sound can be perceived to have a structural function in a piece, it can be perceived to function as another sound in the piece particularly when the sound to which the function is transferred is spectromorphologically similar to the sound from which the function is transferred, or the sound can be perceived to function in a secondary perceptual construction. In the case of evocation, the listener appears initially to contemplate the sound or sound world. The *act* of contemplation, expressed during the listening experience, serves as

[12] The sound of a camera shutter occurs at the beginning of each movement in the work. My translation of the response from *Académie de Musique de Soignies* Listener E: *«Piano – apareil [sic] – oiseau – forêt – chants […] Un homme prend des photos. Chaque photo porte sur un monde différent»*.
[13] Source-bonded is the past tense of 'source-bonding' a term invented by Smalley to indicate "the natural tendency to relate sounds to supposed sources and causes […]" (Smalley, 1997: 110).
[14] My translation of the response from *Académie de Musique de Soignies* Listener E: *«[…] Une porte s'ouvre. Cela me fait penser à un hangar avec plein de machines. Cela me fait aussi penser à une usine […]»*.

the basis for or, otherwise, becomes allied to, a secondary perceptual construction during the course of listening. It is difficult, at this early stage, to comprehend fully the similarities and differences between function and evocation and the resulting shifts in meaning they impart. However, this will be explored in Chapter 4.

Fourthly, despite Delalande's division of listener responses into three behaviours, there appears to be an overlap between the more profound levels of empathy and figurativisation. Within the more evolved levels of empathy, listener responses exist in the form of metaphors that are "articulated in more complex, narrative images which clarify relations and convey metaphors for the object more explicitly" (Delalande, 1998: 39). This supposedly stands apart from the metaphorical language in figurativisation where Delalande suggests the metaphors are not simple descriptive labels but images that impinge upon the listener. It was difficult to establish to what extent the complex narrative images discovered in responses to the listening experiment were decidedly empathic or figurative. We must then ask if the more abstruse metaphorical images in empathy and figurativisation are concatenated.

Fifthly, although Delalande intimates that listeners might exercise different reception strategies in one sitting, he proposes that simultaneous reception behaviours are incompatible, and discusses the challenge as to how these opposing strategies can be resolved. We must then inquire if multiple reception behaviours are inherently conflicting. Does the listener migrate from one strategy to another via auto-command, as suggested by Delalande or is it possible that listeners can entertain two or more behaviours simultaneously? The findings yielded by the experiment indicate the latter. What remains to be understood are the dynamics that motivate behavioural co-existence and behavioural shifts.[15]

Sixthly, the results from the experiment exhibit an array of listener responses that impart a wider domain of personal reflection than the concept of empathy, defined by Delalande as a behaviour that first centres on the physiological, notably at the level of feeling. Dispassionate remarks, such as the one in reaction to *Bois* from City University Listener H, "[…] doesn't make that much sense […]", were observed in the responses for this extract as well as for others (Anderson, 2001: 31). These contrasted with other stronger yet non-physiological reactions such as the remark from *Académie de Musique de Soignies* Listener L: "[…] very interesting and well put together […]" (*ibid.*: 31).[16] Although it is difficult to gauge the intention of these phrases, it seems

[15] However, the complexity of listening behaviour is beyond the scope of this dissertation.
[16] My translation of the response from *Académie de Musique de Soignies* Listener L: *«[…] Fort interessant [sic] et bien mis ensemble […]»*.

logical to enlarge the concept of empathy to include a broader range of responses that also comprises more neutral and contemplative reactions.

Finally, with regard to listener responses to *Sommeil*, Delalande defines the reception behaviour figurativisation as one in which the listener "[…] tends to think that certain sounds evoke something that moves, ultimately living […]" (Delalande, 1998: 47). Furthermore, allied to figurativisation is a search for a contrast between sounds that are associated with the living being and others that represent the context or frame. The responses from the experiment suggest that the listening imagination can be referenced in ways additional to that of figurativisation.

1.4 Framework for Reception Behaviours

In light of the issues encountered while analysing listener responses using Delalande's strategies, I formulated a new *framework for reception behaviours*. It comprises four strategies. Refer forward to page 32 for an explanation.

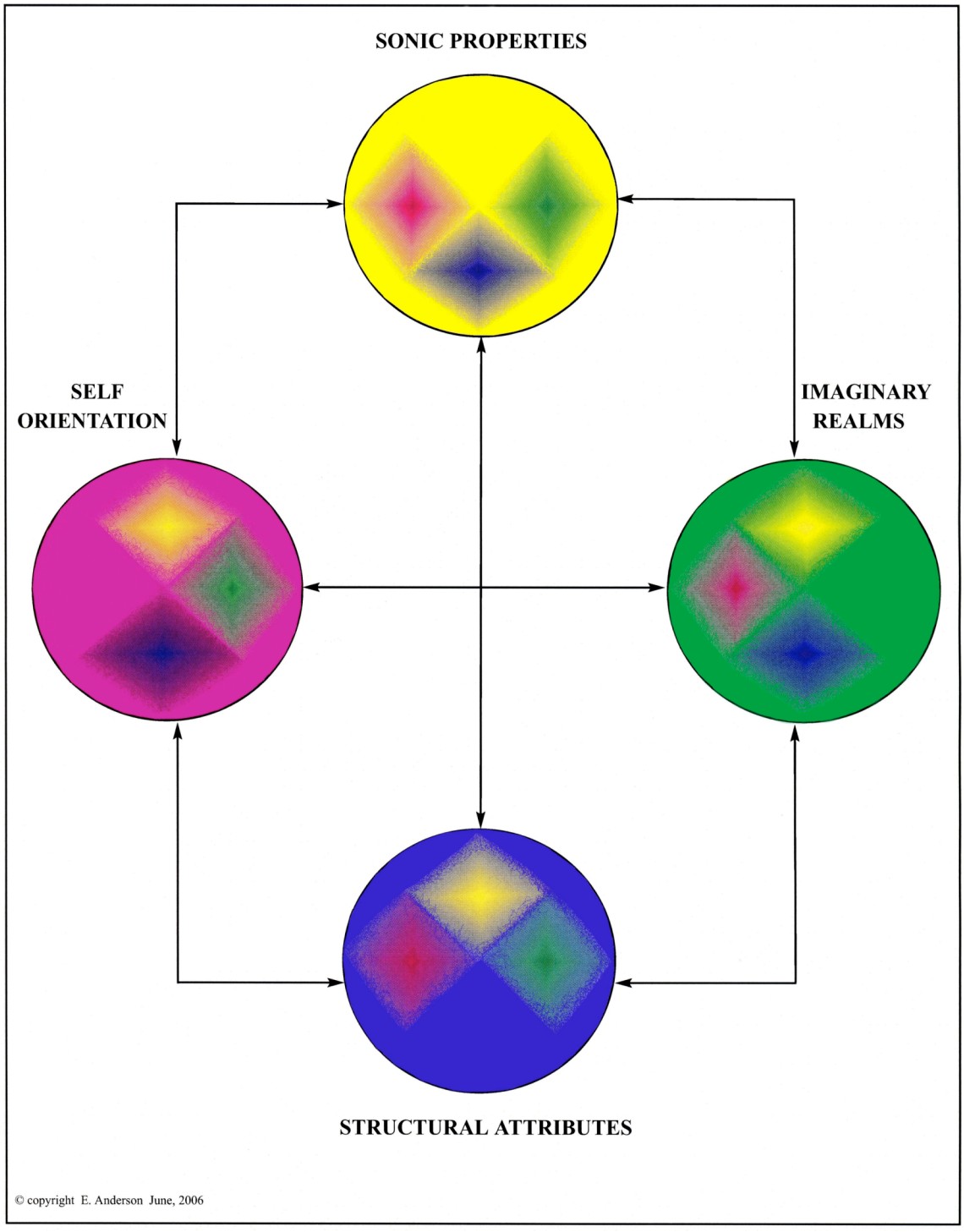

Figure 1-1. Framework for reception behaviours

1.4.1 Sonic Properties

We shall begin with the listening strategy*, sonic properties*. In this type of strategy, the listener has a tendency to focus on the 'sound' or 'sound worlds' in the music. The behaviour is borne from a myriad of listener responses where the discussion of 'sound' is cultivated, often exclusively, though speculations about the sound world may at times include personal assessments, forays into the listening imagination, or qualities that suggest an appreciation of structure. Articulation of sonic properties can take different forms in which the listener may:

(i) Identify and/or label sounds particularly those which are perceived to be source-bonded.

This strategy is frequently employed and it appears to be a method whereby a listener can create a useful, preliminary base from which to develop a more in depth response. The response to Lejeune's work from International School of Brussels Listener L, which includes drawings of birds, a baby, a camera, a computer, an extra-terrestrial being, and a tree, exemplify this approach (Anderson, 2001: 22).[17]

(ii) Describe and discuss particular sounds or groups of sounds in a generalised fashion with less, or sometimes no, emphasis on their supposed sources or analysis of their components.

This strategy is a variation of *(i)*. Listeners also frequently engage in this type of listening, an example of which is found in a response to Lejeune's work from *Académie de Musique de Soignies* Listener A: "– Pleasant sounds in the ensemble […] – image of a free bird […] – almost rhythmic – certain sounds [are] recognisable like [a] camera, baby, bird, or a stringed instrument" (*ibid.*: 25). [18]

(iii) Label and/or further elaborate on certain spectromorphological components of a sound or sound world.

These can include its morphology including description of non-instrumental gestures,

[17] It is important to note that the listeners from the International School of Brussels were less experienced than listeners from the *Académie de Musique de Soignies* and City University. Hence, the custom of associating the visual with the auditory in the perception of music may have been called into question by the incongruity and inexplicability of the invisible aural images that streamed by them. This is why their responses often took the form of drawings 'depicting' the sonic properties they perceived (Anderson, 2001: 23).

[18] My translation of the response from *Académie de Musique de Soignies* Listener A: *«– Sons agréable dans l'ensemble […] – image d'un oiseau libre […] – presque rythmé – certains sons reconnaissable comme appareil photo, bébé, oiseau, ou instrument à cordes».*

behaviour, texture, non-pitched spectral content including inharmonicity and noise, and the spatial properties inherent in these components, or otherwise describe transformational processes that enhance such spectromorphological qualities. An illustration of this strategy can be found in response to the extract from *Bois* by Vande Gorne from Listener H at City University: "[…] cultural artefacts, emphasis on objects/materials, a stronger narrative streak, nodal spectromorphologies […]" (*ibid.*: 30).

(iv) Comment on abstract musical properties that may be perceived to be allied to traditional Western music practice.

These can include spectral content (notably pitch and harmony), instrumental gesture and its vestiges, and their inherent spatial qualities. An example appears in the response, from City University Listener A, to an extract from *Crystal Music* by Roy: "[…] beautiful details, offset against instrumental/intervallic metric elements, removed by new arrival of context, more abstract, retains feeling of string instruments extended through elongation […]" (*ibid.*: 33).

Because spectromorphology comprises all aspects of the sounding flow, by definition, there can be an overlap between *(iii)* and *(iv)*. This is often apparent in listener elaborations about space. However, in view of listener tendencies, the discussion of space is separated into two areas: those properties that are allied to less tangible musical characteristics, notably the vestiges of instrumental gesture, spectral values centering on pitch and harmony, and the spatial properties inherent in these components, *or* discussion of sonic properties that otherwise centres on morphology, behaviour, texture, inharmonic or noise-based spectra and their accompanying spatial properties.

Listeners may additionally articulate the *function* of a sound or sound world, in addition to distinguishing its aural features. Assigning a function to a sound allows listeners to allocate to it one of several purposes, notably a structural role. This is apparent in the designs from Listener D at The International School of Brussels who, in response to the second movement of *Deux aperçus du jardin qui s'éveille,* designed images of sound sources including two quavers, the face of a female vocalist, a submarine, and an apparently prehistoric bird. These images appear serially yet are united on a musical staff that emanates from the drawing of a radio (*ibid.*: 22). One could therefore surmise that the individual sounds *function* within a radiophonic work.

The function of a sound or sound world can also imply purposes that can be

distant from the structure in a work. As I noted in 1.3.2, the function of sounds, in the listening imagination, can differ from and, hence, supercede their description and identification as well as their perceived importance within a musical framework.

A sound may play an *evocative* role for the listener. In this case, a listener will demonstrate an initial awareness of the existence of a sound or sound world and occasionally an awareness of its properties. The process of evocation, thus, usually begins with the qualification of the sound or sound world. However, the sound or sound world, or a mechanism internal to the listener propels or inspires the listener to engage in another strategy, which then becomes a harbinger for a secondary perceptual construction. My findings suggest that listeners initially tend to discuss the sound, sonic property or sounding flow, which subsequently appears to serve as a base for another image. The findings also intimate that it is more rare for listeners to begin the discussion with an image elicited by the sound or sonic properties and to conclude their observations by referring to the sound or sonic properties. This is, perhaps, because the image is catalysed and maintained in the listening imagination by the amalgamation of perceived sonic properties, though composer/listeners may also be influenced by their own composing experiences which consist, primarily, of assembling elements to create an image.

An illustration of evocation based on perceived sonic properties is witnessed in the remark about the extract from *The Gates of H* from Listener D at City University: "[…] explosions like trains appearing then running away […]" (*ibid.*: 42). The response might indicate that the explosions heard in the music *evoke* trains even if they are not perceived as such. The relationship between evocation and the imaginary is notable in a series of drawings, from International School of Brussels Listener Q, that are interspersed with labels describing perceived sound sources in response to the second movement of *Deux aperçus du jardin qui s'éveille.* The sound source labels include terms such as "birds, baby, band, another language, [and] robots […]", and the drawings depicting the sound sources include images of a computer, a person sawing a tree and a space ship (*ibid.*: 23). However, other terms used by Listener Q, such as "Night, the future, outer space, [and] haunted house of doom", indicate non-sounding ideas that may be *evoked* by the sound world apprehended during listening (*ibid.*: 23).

1.4.2 Structural attributes

The listening strategy *structural attributes* is an expansion of taxonomy. Like

taxonomy, a discussion of structural attributes attempts to take into account the global design of the work. The concept of structure is discussed characteristically using formal terms, and listeners may embrace descriptions of morphological units to enable the process, but metaphors and imagery can additionally be utilized if their ultimate goal is to describe and otherwise illuminate structure. The latter is liable to be a predominant behaviour with listeners who lack a 'formal' vocabulary.

The findings from the listening experiment reveal numerous inclinations regarding the perception of structure. Although the experiment consisted of one short acousmatic work and three extracts, making a global apprehension of form problematic, listeners, on occasion, demonstrated an interest in one or more segments in lieu of a 'global form', inherent in the extract, thus offering an alternative to the quest to 'memorise all this data' (Delalande, 1998: 27). Delalande also maintains that taxonomic listening is an unwieldy construction and that it impinges on and conflicts with the natural formation of other behaviours. However, he observes it does not preclude other strategies from materialising and suggests that taxonomic listening develops predominantly in tandem with other listening strategies in that it exerts influence on them although it does not affect their outcome. Apprehension of structure is allied to our own experiential basis. However, I envisage this behaviour as a natural by-product of experience. The findings from the experiment indicate that listener interest in structure does not appear to conflict with the natural formation of other behaviours. Indeed, there is evidence it can, on occasion, foster and otherwise enhance their development. Additionally, listeners occasionally seemed to apprehend structure to the exclusion of other strategies as evidenced by their decision to discuss the perceived architecture of the music and the way it evolved in time. They also exhibited a non-linear (non-temporal) comprehension of the structure in addition to an awareness of a linear (temporal) organisation. Moreover, listeners who took into account the organisation of the music at times added personal observations that did not necessarily appear to be 'laborious', an adjective Delalande associates with taxonomic listening. Finally, listeners noted similarities and continuities in the global image apprehended in addition to contrasts and discontinuities. The category of structural attributes therefore includes the following criteria:

(i) Listener discussion that comprises partial as well as global structure.

An example of the perception of a global temporal structure illustrated using metaphorical terms, occurs in a design from International School of Brussels Listener E

regarding the extract from *The Gates of H* where individual drawings of birds, a thunderstorm, animals, trees and a human being exist in tandem with a swirling cyclone, a church and a bell. At first glance, the designs appear to be arbitrary; however, on further analysis they are organized temporally. The cyclone appears on the left side of the page, the church, and bell in the bottom centre of the page, thus creating a 'frame'. The various animals emanate from the cyclone in rightward moving poses above the church and bell, and are organized spatially to correspond with natural principles of gravity: the snake, rabbit and deer are placed above the church steeple, each subsequent animal in a slightly more elevated position. Drawings of birds and the thunderstorm appear near the top of the page. All seem to pursue the human being, whose image appears at the right margin, apparently fleeing in a rightward direction (Anderson, 2001: 41). An example of the apprehension of partial structure appears in the response to the extract from *Crystal Music* from City University Listener F: "[…] high/low immediately – mysterious, breath-length gestures with intrusions, it's body centred, very imagistic, dissonant ruptures: the resonant electronic world comes to the fore, fragments, then continues busily […]" (*ibid.*: 32). It is notable that this discussion about structure is bereft of closure. Possibly the listener altered strategies in the course of listening or otherwise decided to disengage from the perception of form.

(ii) Listener interest in structural components that are non-linear (non-temporal) as well as interest in linear (temporal) components, including deliberation about the density or mass of the sounding flow.

An example of this occurs in the response to Brümmer's *The Gates of H* from City University Listener F "[…] polyphony of plans/layers, clear sensation of space/time, dramatic exchanges […]" (*ibid.*: 47). It is interesting to remark that this listener first addressed non-linear structure with the remark, "polyphony of plans/layers", before delving into temporal significances.

(iii) Observations about structure in which other listening strategies co-exist and where evidence exists revealing the impact of structural attributes on the formation and outcome of other behaviours (or vice versa), notably sonic properties, personalised assessments or evaluations (which will be defined in self-orientation), or imaginary themes (which will be defined in imaginary realms).

An example of this type of dual strategy exists in the response to the second movement of *Deux aperçus du jardin qui s'éveille* from City University Listener B: "[…] I related

to bird-like sounds, too random for my comfort, I needed a different kind of structure […]" (*ibid.*: 26). Despite a remark about source-bonded sounds, the apprehension of the structure clearly influenced the listener's personal assessment of the work.

(iv) Listener recognition of similarities and continuities in the form as well as contrasts and discontinuities.

An example of this strategy exists in the response to *Bois* from *Académie de Musique de Soignies* Listener K who notes, "Superb landscape, all the sounds gather together almost as one [.] Lets the imagination discover it; it can make us think of a workshop, machines busy with workmen [.] End of the mix is special […] indeed a bit contrary […] everything stays in the same landscape and never changes orientation […]" (*ibid.*: 31).[19] Although this response comprises several strategies, the remarks, "[…] all the sounds gather together almost as one […]" and "[…] never changes orientation […]", indicate a perception of structure that is synergistic.

1.4.3 Self-orientation

Self-orientation is an expression of opinions and thoughts that centre on or emanate from the self. The 'listening consciousness' is mobilised by personal estimation or judgement. Listeners who espouse this strategy may respond to the qualities germane to the sounding flow or are observant of their own emotional and physiological reactions *to* the sounding flow and, more broadly, to the listening experience. These terms are qualified as *physiological sensations* and *emotions.* Self-orientation also refers to a type of perception of the sounding flow or the listening experience that allows for more neutral deliberations resulting in contemplation or reflection. These deliberations are qualified as *evaluations* (see Figure 1-2 for examples of emotion/physiological sensation and evaluation). Self-orientation thus includes the prospect of a greater degree of dispassion and detachment, one that permits listeners to centre on and develop their impressions without confining their appreciation to the utterance of physiological sensation or emotion.

Implicit in self-orientation is the distinction between its three components for the purpose of analysis. These components may appear simultaneously. Moreover,

[19] My translation of the response from *Académie de Musique de Soignies* Listener K: *«Superbe paysage, tout son se rassemblent presque en un [.] Laisse imagination à découvert [sic]; peu [sic] nous faire penser à une salle de travail, des machines occupées par des ouvriers [.] Fin de mélange assez spéciale … voire un peu contrariante […]».*

these strategies may be either *subject* or *object* orientated owing to the fact that listeners may focus on themselves or on qualities they perceive to be inherent to the sounding flow, which impinge upon the listener, as illustrated in Figure 1-2.[20]

Behaviour	<u>Subject</u>	<u>Object</u>	<u>Piece</u>
Physiological Sensation	"[…] We have the impression of being in a stomach […]", *Académie de Musique de Soignies* C (Anderson, 2001: 47).[21]	"[…] Attacks you […]", City University Listener A (*ibid.*: 47).	*The Gates of H*
Emotion	"[…] I feel I am supposed to listen for some kind of symbolism […] I feel confused as how to listen […]", City University Listener K (*ibid.*: 30).	"[…] It is too threatening and violent […]", City University Listener B (*ibid.*: 30).	*Bois*
Evaluation	"[…] I needed a different kind of structure […]", City University Listener B (*ibid.*: 26).	"[…] Playful, humorous […]", City University Listener I (*ibid.*: 26).	Second movement of *Deux aperçus du jardin qui s'éveille*

Figure 1-2. Subject-/object orientated observations[22]

Self-orientation, therefore, has numerous manifestations. An illustration of an appreciation of the sounding flow that is at once an evaluation, an object-orientated physiological response, and, additionally, a purview of structure, is illustrated in the remark about *The Gates of H* from City University Listener C: "[…] Sounds gimmicky at the beginning, loud – attacks you, put me off, build-up of voice-like sounds – very busy, then a cutback and build-up, dies away […]" (Anderson, 2001: 47). An example of an emotional reaction that is both subject and object-orientated exists in the response from City University Listener B to the extract of *Bois*: "[…] On an intuitive level, I dislike this, it is too threatening, violent […]" (*ibid.*: 30). An object-orientated evaluation can be seen in the response to the second movement of *Deux aperçus du jardin qui s'éveille* from *Académie de Musique de Soignies* Listener L: "Taking a [sound of a] camera to do [depict] the garden is not bad [as an idea]. – Instruments [–] baby's voice – birds – people […]" (*ibid.*: 27).[23]

During examination of the listener responses that exemplified self-orientation, I

[20] The concepts of subject and object are developed in Chapter 2.
[21] My translation of the response from *Académie de Musique de Soignies* Listener C: *«[…] On se croit dans un estomac […]»*.
[22] Discussion of Figure 1-2 is developed in Chapter 4.
[23] My translation of the response from *Académie de Musique de Soignies* Listener L: *«Le fait de prendre un appareil photo pour faire le jardin n'est pas mal. Instruments [–] voix bébé – oiseaux – gens […]»*.

discovered that subject- and object-orientated references to the human condition abounded, including expressions of tension, loneliness, delight, confusion, and boredom. Nevertheless, as previously indicated, self-orientation is not constrained to observations about the physiological qualities inherent in the sounding flow. A listener may also respond in a physiological or emotional manner to, or otherwise evaluate, the perceived structure of the work, or alight on and respond to images that are perceived to be exterior to the work, but which the sounding flow and the listening experience invoke. These types of responses can comprise physiological sensations, emotions, and thoughts about topics remote from the human condition and the acousmatic piece in question, but which the listening experience spawns. This process occurs through *evocation*, which I introduced in 1.3.2. Although the process of *evocation* frequently begins with the qualification of a sound or sound world, hence justifying its alliance to sonic properties, such a qualification, or a mechanism internal to listeners, inspires them to engage in another strategy exterior to sonic properties. This process of 'perceptual dislocation' allows for other avenues of thought and reflection to occur and develop, and can yield themes that are far ranging, examples of which can occur as physical states and activity as well as thoughts of a literary, theatrical, social, religious or mediatic nature.[24] Several examples are given in Figure 1-3.

Reference	*Example*	*Extract*
Physical states or activity	Drawings of what appear as a detonating device and an explosion, by International School of Brussels Listener B (Anderson, 2001: 43).[25]	*Crystal Music*
Literary/ Theatrical Topics	"[…] Classical drama, Greek chorus […]", as noted by City University Listener C (*ibid.*: 47).	*The Gates of H*
Religious or Social Issues	Drawing of what appears as the Devil in Hell is accompanied by written remarks, "Represents Hell. High-pitched voices are of people who die in the fire. Low-pitched voice is the devil. Morbid ambience; sombre. Good structure of sounds" by *Académie de Musique de Soignies* Listener L (*ibid.*: 48).[26]	*The Gates of H*
Mediatic Images	Drawings of what can be interpreted as Darth Vador's mask and a light sabre, by International School of Brussels Listener N (*ibid.*: 40).	*Crystal Music*

Figure 1-3. Types of listening strategies in self-orientation[27]

[24] This list is by no means exhaustive.
[25] See Appendix 5 for the integral set of findings from listeners at the International School of Brussels.
[26] My translation of the response from *Académie de Musique de Soignies* Listener L: *«Répresente [sic] l'enfer. Voix aigue [sic] = gens qui meurent dans le feu, voix grave = le diable. Ambiance morbide; sombre [.] Bonne structure des sons»*.
[27] Discussion of Figure 1-3 is developed in Chapter 4.

Within the sphere of extrinsic reflection,[28] the topic of mediatic imagery is particularly complex. The issue concerning mediatic influence arose from the analysis of many written responses and drawings from younger listeners that included themes from outer space. If we take the remark, "I see astronauts on the moon", we can consider it as a 'generalised' impression whereby the listener accesses a stock image, made available through the media, in order to help explain the listening experience. However, if we consider the statement, "An invisible spaceship blocked radio and video transmission between the Earth and the astronauts while they walked on the moon", the following difficult question presents itself: Is this construction a more elaborate version of the first statement, a stock image that serves as a foundation upon which an imaginary scene is constructed, or is the image a product of the listener's imagination? Further research needs to be conducted on listening strategies in order to ascertain whether these types of responses are innately different.

It is important to address the listener relationships with 'extrinsic threads' (Smalley, 1997: 110), and their points of derivation. As explained in the introduction to sonic properties (1.4.1), a sound, sonic property or sounding flow in an acousmatic work may be perceived to assume a secondary function for the listener outside of a primary function as apprehended within the context of the work. It can also be perceived to become the basis of a secondary perceptual construction through the process of evocation.[29] The sound or sounding flow is, in most cases, the instigating element. When the 'listening consciousness' engenders thinking that is extrinsic to the work, whether a personal judgement, an image that is culturally or universally shared, or an archetype, and it appears without preamble regarding the sounding flow, we may inquire if it is seized upon by the listener *during* listening in order to *illuminate* the listening experience or to impart meaning to yet *another* experience extrinsic to the piece, the human condition included. Although a shift of focus between the intrinsic qualities of the music and extrinsic references occurs in both cases, the difference of directionality lies at the point of initiation and may affect the evolution of the listening strategy, and its outcome.

1.4.4 Imaginary realms

Imaginary realms is an enlargement of figurativisation insofar as it allows for

[28] The term, 'intrinsic-extrinsic threads', was devised by Smalley to define attributes and relationships inherent to a piece of music and relationships or experiences that are external to the piece (Smalley. 1997: 110).
[29] The concept of evocation is discussed in Chapter 4: Self-Orientation.

variations in figurativisation and, additionally, embraces other reception behaviours, notably fiction, fantasy, and surrealism, in which the listener exercises imagination as an *end* in itself. Listeners may respond to an acousmatic work by addressing the sound world, structure, or physiological sensations, emotions and thoughts using imaginative terms. Nevertheless, imaginary realms differs in that the images fabricated by the listening consciousness are not perceived to be inherent in the work nor in a culturally or universally appreciated or defined construction, although certain spectromorphological qualities apprehended during listening may influence the inception of the image and the manner in which it unfolds.[30] The strategy, imaginary realms, has its origin in Delalande's figurativisation, a type of listening where form is perceived to unfold through narrativity, which additionally furnishes a basis for perceptual construction (Delalande, 1998: 52). A listener who adopts this behaviour is inclined to seek the figurative in the music and consider that various sounds imply something that moves, as if alive. The listener also searches for a contrast between sonic constructions that are associated with the living being and other elements that have a contextual objective (*ibid.*: 47).

Evidence of figurativisation appears among the responses from the listening experiment. This strategy is detected in a response from International School of Brussels Listener P who made the following observation about the second of the *Deux aperçus du jardin qui s'éveille*: "I think that this music is a tropical rainforest with many bird [sic], insects and creatures in it. The creatures are furry and have high-pitched voices. There are different noises made by these creatures in the forest" (Anderson, 2001: 28). The text accompanies a drawing of a forest and animals. While it is possible the citation of birdcalls refers to source-bonded birdcalls audible in the work, the allusion to lively forest life demonstrates the creative powers of the listening consciousness. Another example, from *Académie de Musique de Soignies* Listener C who listened to *The Gates of H,* combines figurativisation and evaluation: "Too loud, we have the impression of being in a stomach – a sewer filled with screaming rats – well-researched sounds. Difficult to identify" (*ibid.*: 47). [31]

From these findings, we can see that Delalande's original concept can be expanded to account for a broader response to the acousmatic repertoire. Imaginary realms, therefore, comprises fantasy, defined as the fabrication of extravagant or visionary images (Oxford, 353: 1996). A drawing by International School of Brussels

[30] This will be explored in Chapter 5: Imaginary Realms.
[31] My translation of the response from *Académie de Musique de Soignies* Listener C: *«Trop fort, on se croit dans un estomac – un égoût [sic] plein de rats qui crient – sons bien trouvés. Difficiles à identifier»,*

Listener D, in response to the extract of *The Gates of H,* exemplifies fantasy. The drawing consists of a meteor, labelled "Past," which is careening through space towards a planet on which the city, "Future," is the sole element (Anderson, 2001: 48).

I consider surrealism, the irrational juxtaposition of images, as another constituent of imaginary realms. An example of surrealism can be seen in a series of three drawings, in reaction to *Crystal Music,* from International School of Brussels Listener E (*ibid.*: 36). In the tableau, the first drawing, on the top left, is of a cube, on which 'sits' a cemetery. A thunderstorm appears to 'brew' above the cemetery and an abyss and underground lake appear to exist below it. The second drawing, on the right, portrays a person suspended above flames, while the third drawing, on the bottom, depicts three people in proximity to a gong. Although the construction appears naive, the unification of such disparate scenes demonstrates the capacity of acousmatic music to elicit the imagination in a manner that is *non sequitur*.

Notable in all listening strategies, but perhaps most frequently observed in imaginary realms, are the subtly diverse ways the listening imagination may unfurl, instances of which may defy existing reception behaviour definitions. The point here is not to countermand the qualities inherent to Delalande's figurativisation, but to loosen their bindings thus allowing for a broader interpretative scope of the creative powers engendered by the listening consciousness. This wider perspective of figurativisation can be viewed in the response to *The Gates of H* by International School of Brussels Listener N in the form of a drawing (*ibid.*: 45). Although the castle, sword, and shield seem to function as a decor for the person at the bottom of the tableau, the illustrations of the ghost and the machine gun firing at a target, in the middle and at the top of the tableau respectively, do not appear to function in the same decor. Further, if the ghost and machine gun are regarded as independent entities, they appear bereft of contexts and living beings. An example of a response, that appears to be rooted in the imaginary yet that lacks a visual element, is observed in the evaluation and creative thought about *Crystal Music* by *Académie de Musique de Soignies* Listener C: "It feels like we're in space [,] good echoes [,] good" (*ibid.*: 39).[32] Narrativity, often a vehicle for the description of form in imaginary realms, may be allied to a series of images conceived by, yet appearing "external" to, the listener. The form may also be interpreted as "[…] the adventure which the listener has lived during listening […]" (Delalande, 1998: 50). Yet, despite the surfeit of narrative qualities, listener responses may also be non-narrative. An instance of such a reaction, that is also an evaluation, exists in *Académie*

[32] My translation of the response from *Académie de Musique de Soignies* Listener C: *«On se croit dans l'espace [,] bons échos [,] bien».*

de Musique de Soignies Listener I's account of *The Gates of H:* "Echo deformed by the walls of the cellar which brings a sensation that is sometimes mysterious [,] sometimes funny but not frightening" (Anderson, 2001: 47).[33]

1.4.5 Space

Spatial parameters, known collectively as the "composed space" in an acousmatic composition, are innate to the multiple components of the sounding flow, since each sound comprises a spatial frame (Smalley, 1997: 122). Accordingly, space, the sole common denominator in all four listening strategies, is omnipresent in perceptual constructions whether overtly elucidated, or insinuated.[34] Listeners who elect to concentrate on sonic properties will frequently comment on the proximity of the composed space in the work in general or the proximities of individual sound events.

It is possible to observe spatial contexts interpolated in the remarks about sonic properties from City University Listener A to the second of the *Deux aperçus du jardin qui s'éveille:* "[…] Camera, concert hall, speech, strings, inside/outside references through simulation of spaces, birdsong […]" (Anderson, 2001: 21). A concert hall implies a limited space yet one of potentially considerable proportions. The expression, "inside/outside references through simulation of spaces", refers to ersatz spatial contexts that aid in the categorization of 'interior' and 'exterior' sounds. The latter appear to be apprehended and grouped in function of their spatial qualities, and not their supposed sources.

If the composer considers all sonic traits as potential structural material for an acousmatic work, the spatial parameters relevant to each sound will also serve as structuring processes. As a result, listeners may consider the composed space in the work to be part of the form by referring to the immediacy of sound events in the context of a discussion about form. Indeed, listeners may apprehend the form of a work in terms of its spatial contexts and transformations. We discern an example from *Académie de Musique de Soignies* Listener H who addresses the structure perceived in the extract from *Bois* and retains an impression of the sounding flow on a physiological level: "At first we feel the manipulation which rises up little by little [.] We wait for an explosion but it falls back into a very recognisable sound that changes little by little and

[33] My translation of the response from *Académie de Musique de Soignies* Listener I: *«Echo déformé par les parois de la cave qui procure une sensation parfois misterieuse [sic] [,] parfois amusante mais pas effrayante».*
[34] In Chapter 6, I investigate how space contributes to sonic properties, structural attributes, self-orientation, and imaginary realms.

diminishes" (*ibid.*: 29).[35] Indigenous to the terms 'explosion' and 'collapse' is the conception of violent spatial change. Whereas the spectromorphological metamorphosis of the sounding flow is most likely to be the true factor, the sound events leading to the anticipated 'explosion' and actual 'collapse' are, nonetheless, apprehended and explained with spatial terminology.

The listener may respond dramatically or dispassionately to the composed space in an acousmatic work, its apprehension translated into physiological sensations, emotions, or evaluations that are impregnated with spatial contexts or vice versa. In this circumstance, listeners may often consider the composed space in the work to be an extension or constriction of their personal space. Perceptions akin to these tend to engender remarks such as "I feel attacked by the sound" or "I feel like I am floating" in addition to more neutral observations of the perceived space. An example of the latter manifests itself in the account by City University Listener F in response to *Bois,* the structure of which is perceived and organised following spatial variations: "[…] door opens, extended world of closed spaces, claustrophobic, homing in on details, space also widens, textures lose real-world references, fades […]" (*ibid.*: 31).

Fictive scenes that are contrived by the listening consciousness often reveal an extraordinarily accurate translation of the composed space in an acousmatic piece. Listeners may conjure scenarios that take place in extreme spatial or atmospheric conditions, notably underwater, underground, or in outer space but also frequently in standardised spatial circumstances such as indoors or the out-of-doors. The context for the fictitious anecdote is often a metaphor for the general spatial framework of the piece; still listener interpretations of the spatial positions and trajectories of the work's individual sounds may influence the breadth of the 'imagined' activity within its corresponding spatial structure.

1.4.6 Extended structure of the reception behaviours framework

It is important to highlight the existence of the following parameters in addition to the four listening strategies illustrated in the reception behaviour framework (Figure 1-1).

(i) Listening Patterns

Listeners may engage in different listening patterns. An *independent* listening strategy,

[35] My translation of the response from *Académie de Musique de Soignies* Listener H: *«Au début, on sent de la manipulation qui petit à petit s'élève [.] On s'attend à une explosion mais cela retombe dans un son très reconnaissable qui se transforme petit à petit et diminue».*

exceedingly rare, is one that does not operate in tandem with another. A *hybrid* listening strategy combines two or more reception behaviours one of which is frequently more pronounced. *Dynamic* listening occurs when a listener's focus shifts repeatedly from one reception behaviour to another in the course of the listening experience. A *combination* of strategies, independent, hybrid, or dynamic is a, somewhat rare, conglomerate of behaviours a listener may adopt in the course of the listening act.

(ii) Directionality in Reception Behaviours

Reception behaviours that appear on the vertical axis of the framework in Figure 1-1, sonic properties, and structural attributes, are strategies that focus on the traits intrinsic to the composition. Self-orientation and imaginary realms, which appear on the horizontal axis, are behaviours whereby reflection is shifted away from the composition, either towards the listener in the case of self-orientation, or outwards toward non-real conceptions as expressed in imaginary realms.

(iii) Global-Specific Continuum

Listening strategies are articulated in a Global-Specific continuum. Listeners may choose to elaborate in a global manner, they may summarise their listening experience using precise terms, or they may combine global and specific observations. In Figure 1-4, three levels of observation are expressed within the context of each of the four reception behaviours.

Reference	*Sonic Properties*	*Structural Attributes*	*Self-Orientation*	*Imaginary Realms*
Generalised observation	"[...] Cultural artefacts, emphasis on objects/materials [...]", by City University Listener H in response to *Bois* (Anderson, 2001: 31).	"[...] Collage, anecdotic [...] ", by City University Listener H in response to the second of the *Deux aperçus du jardin qui s'éveille* (*ibid.*: 20).	"[...] Disturbing but superb landscape [...]", by *Académie de Musique de Soignies* Listener K in response to *Crystal Music* (*ibid.*: 34).[36]	"[...] It makes me think of a dream that transforms into a nightmare [...]", by *Académie de Musique de Soignies* Listener E in response to *Crystal Music* (*ibid.*: 39). [37]

[36] My translation of the response from *Académie de Musique de Soignies* Listener K: *«[…] Inquiétant mais superbe paysage […]»*.
[37] My translation of the response from *Académie de Musique de Soignies* Listener E: *«[…] Cela m'a fait penser à un rêve qui se transforme en cauchemar […]»*.

Moderately articulated observation	"[...] Clear images and sources, sounds radiophonic, interrupted sound, untransformed sounds [...]", by City University Listener D in response to the second of the *Deux aperçus du jardin qui s'éveille* (*ibid.*: 21).	"[...] Establishes relationships between the materials in the opening, knows what sounds follow to make the piece connect [...]", by City University Listener I in response to *Crystal Music* (*ibid.*: 32).	"[...] On an intuitive level I dislike this, it's too threatening, violent – very 'masculine' [...]", by City University Listener B in response to *Bois* (*ibid.*: 32).	Illustration accompanied by the text "[...] A ship landing with aliens communicating and diging [sic] wholes [sic]", by International School of Brussels Listener D in response to *The Gates of H* (*ibid.*: 45).
Detailed observation	"[...] Camera, concert hall, speech, strings, inside/outside references through simulation of spaces, birdsong [...]", by City University Listener A in response to the second of the *Deux aperçus du jardin qui s'éveille* (*ibid.*: 21).	"[...] Repeated intro, sounds not modified in repetition, construction of 'bricks' of sounds, quickly changing [...]" by City University Listener E in response to the second of the *Deux aperçus du jardin qui s'éveille* (*ibid.*: 20).	"[...] Similar listening approach to previous piece, but (!) my listening is affected by the piece 'implying' or hinting at the human vocal presence [...]", by City University Listener K in response to *The Gates of H* (*ibid.*: 43).	Illustration accompanied by the text "A drop on the end of a cliff. A *[sic]* earthquake hits and splits the land in half. Then a monster pops out of the see *[sic]* and you see him over the cliff. Rain hits", by International School of Brussels Listener O in response to *Crystal Music* (*ibid.*: 37).

Figure 1-4. Global–specific continuum

1.5 Summary

The reception behaviour framework introduced in this chapter is a tool I devised in order to aid the listener/analyst in understanding listening strategies for acousmatic music. Although it owes much to the reception behaviours developed by Delalande, I have expanded and redefined his concepts of taxonomy, empathy and figurativisation, and have suggested a fourth strategy which takes into account the perception of the sound world. Discussion additionally broaches listener sensitivity to composed acoustic space, the common denominator to all reception strategies, and identifies listening patterns because behaviours do not exist in isolation.

Subsequent chapters will be devoted to an examination of the acousmatic works in the folio with the aid of the four reception behaviour strategies sonic properties, structural attributes, self-orientation, and imaginary realms, as well as to the behaviours, themselves. The analysis of the accompanying compositional repertoire will offer the foundation for discussion about poietic (intended) and esthesic (received) messages in the music. A separate chapter will investigate how space contributes to the four listening strategies.

Chapter 2. Sonic Properties

2.1 Introduction

The analysis of the sounds in an acousmatic composition offers an understanding of the aural, and thus physical level, of the entity created by the composer. *Sonic Properties*, elemental to the acousmatic idiom are, collectively, "the material reality of the work […] the physical traces that result from the poietic process" (Nattiez, 1990: 15).[38] The trace of an acousmatic work is the sounding flow. It is produced by the loudspeaker, which transforms the recorded electrical signals on a supporting medium into rapid vibrations that are propagated by the air. The ear receives the vibrations and, in turn, "convert[s] acoustic energy into the electrochemical signals of the nervous system" (Slawson in Appleton and Perera, 1975: 49). Thus, the composer and listener can seem to have an identical physical and perceptual relationship with the acousmatic trace. As discussed in Chapter 1, the trace is the object of an analytical method largely dependent on listening. The composer's relationship additionally comprises the poietic process, whereas esthesic[39] discussion of the work, whether by contemplation of its sonic properties or structure, via personal assessment or through derivative images, is based on the perception of the sounding flow.

The poietic process initially involves the fabrication of sound material that a composer hopes is original, diversified, and optimally constructed because it is the matrix for the communicative power in a work. Creating finalised sounds for an acousmatic piece is a challenge, compounded by the prodigious array of potential source sounds and digital techniques of montage,[40] transformation, and superimposition currently available to the composer.

The predominant inspiration behind the works in the folio, and the breadth of environmental and studio-based source recordings, reflect the influence of extra-musical concepts designed to empower the quest to broaden the potential of the sound-shaping process. Many extra-musical themes associated with the compositions have their roots in my childhood experience, when living in Hawaii and Spain offered

[38] The term, poietic, signifies the "[...] process of creation [...]" (Nattiez, 1990: 11-12).
[39] The term, esthesic, denotes the construction of meaning, "[...] in the course of an active perceptual process" (Nattiez, 1990: 12).
[40] Montage: A film technique, adapted for electroacoustic/electronic composition, at the inception of the medium in 1948 at the studio *Club d'Essai* (Paris) and at the electronic music studio at Cologne Radio in the 1950s in which two or more discreet sections of pre-recorded tape are spliced together to form a continuous whole (Manning, 2004: 20,40) (my italics).

contact with different cultural, geographic, and geological settings. These impressions were later developed during my liberal arts education, where exposure to diverse subject matter cultivated a curiosity about the potential for the transfer of philosophies between domains, a *modus operandi* that was instrumental in developing a personal acousmatic music aesthetic. Extra-musical topics were liberated from their origins and became available, even desirable, as a point of departure for many of the works in the folio.

Paramount to the investigation into principles that could be applied to source sounds, and which would enable the inspirational drive for each work, is my fascination with malleability, which is germane to the plastic arts, as well as an interest in still-life paintings that bred a proclivity to create 'figure-ground' relationships. In addition, a frequently explored sound-shaping influence arose from the transplantation of photographic and filmic concepts into the sonic canvas, each with its particular scale and corresponding depth of field, ranging from the microscopic to the topological. Equally interesting was the concept of viscosity, borrowed from physics, which refers to the amount of internal resistance in a liquid, or its integral resistance to flow, a factor inherent in the spatial relationships between the spectromorphological components of a sound, as well as the dispersion of a sound in space over time.[41] Compositional ideas were also enlivened by inspirations taken from the natural sciences, particularly oceanography[42] and vulcanology,[43] owing to their innate relationship with the physical state of fluidity.[44] Thus, representations from literature, the plastic and visual arts, and from branches of the sciences, are notable forces behind the compositions. The various animi will be discussed in this chapter.

Pierre Schaeffer's *Traité des objets musicaux* (1966) was the first publication to address electroacoustic sounds that contained a specific vocabulary described in terms of morphological criterion,[45] and additionally, a classification of listening behaviours. In regards to his treatise, Schaeffer remarks, "It takes on the sonorous, all the sonorous, for the first time and this is doubtless its merit […]" (Schaeffer in Chion 1983: 9,

[41] Viscosity in relation to acousmatic sound will be examined in Chapter 6.
[42] Oceanography refers to the physical, chemical, and biological study of the oceans.
[43] Vulcanology concerns the study of volcanoes and volcanic phenomena.
[44] Fluidity refers to the physical character of "a substance, especially a gas or liquid, whose shape is determined by its confines [and which is] able to flow and alter shape freely" (e.g. the character of water, steam, lava, etc.) (Oxford, 1996: 378).
[45] John Dack and Christine North's translation of Michel Chion's text, which summarises Schaeffer's notions about morphological criterion, is followed by Chion's original text: "Morphological criteria are defined as observable characteristics in the sound object, *'distinctive features'* or *'properties of the perceived sound object'*. Theoretically infinite in number, they have been limited to 7: mass, harmonic timbre, grain, allure, dynamic, melodic profile, [and] mass profile" (Chion's italics) (Chion, 1983: 142, Trans. Dack and North, 2009). *«Les critères morphologiques sont définis comme des caractères observables dans l'objet sonore, des* 'traits distinctifs' *ou des* 'propriétés de l'objet sonore perçu'. *Théoriquement en nombre infini, on en a limité le nombre à 7 : masse, timbre harmonique, grain, allure, dynamique, profile mélodique, [et] profil de masse»* (Chion, 1983: 142).

Trans. Dack and North, 2009).[46] Nevertheless, however complete Schaefferian research may have seemed at the time, there was room for growth following the development of the electroacoustic idiom. One issue, elucidated by Guy Reibel and developed by Annette Vande Gorne, was the absence of a philosophy and practice that allowed for the invention of sound material destined specifically for acousmatic composition. Hence, Reibel conceived the *séquence/jeu* ('play/sequence').[47] A play/sequence is produced by performing with a *corps sonore* ('sounding body') in order to create a sequence of sound objects or a texture.[48] It is an environment relying on guided improvisation, which engenders aural invention. This is different from the standard idea of articulating an individual instrumental sound object. Play/sequences may, once recorded, serve as source material, the composer engaging in a different rapport with the sounding body than one traditionally associated with sounding gesture.

The sounding body is chosen in function of 'energy models,'[49] which are based on natural models such as friction, rotation, and fluidity. Through the energy model, the composer can develop a voluntary awareness of the internal stimulus which motivates and governs the energy flow unfolded through physical movement that results in gesture. Gesture is animated by and at the service of the energy model, and, therefore, is explored as an end in itself "[…] allowing the roots, the intimate bodily behaviour to appear [which are] often overwhelmed and eliminated by education and life" (Vande Gorne, 2006: 2).[50]

Energy models are responsible, on a tangible level, for the existence of the source sounds. However, on a higher plane, they aid and abet creative expression in terms of the conceptualisation and formulation of initial source material. The approach is twofold. Initially, the models offer the composer the opportunity to explore a sounding body by developing an energy-specific gestural vocabulary. Secondly, the relationship with a sounding body evolves in the context of play, inviting expressions of human emotion, that when articulated, pervade the play/sequence. The two conditions allow for a partnership between the composer and the sounding body that

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[46] Dack and North's translation of Schaeffer's text: *«Il assume le sonore, tout le sonore, pour la première fois, et c'est sans doute son mérite* […]*»* Schaeffer in Chion, 1983: 9).

[47] *Séquence/jeu*: A term invented by Guy Reibel which he used as a pedagogical basis in the electroacoustic composition class at the *Conservatoire National Supérieur de Musique de Paris* (1969 – 1981) (Reibel, 2001: 185). It was developed by Annette Vande Gorne in the electroacoustic composition class at the *Conservatoire Royal de Musique de Bruxelles* and the *Conservatoire Royal de Musique de Mons* (1987 – present).

[48] The term, *corps sonore,* is Schaefferian (Schaeffer, 1966: 411).

[49] *Modèles énergétiques*: A concept developed by Guy Reibel, the fruit of his research on gesture, which he explored in the electroacoustic composition class at the *Conservatoire National Supérieur de Musique de Paris*. It was expanded by Annette Vande Gorne in the electroacoustic composition class at the *Conservatoire Royal de Musique de Bruxelles* and the *Conservatoire Royal de Musique de Mons* (Vande Gorne, 2006: 1-7).

[50] My translation of Vande Gorne's text: *«[…] faire apparaître les racines, les comportements intimes corporels souvent dépassés et éliminés par l'éducation, la vie».*

transcends the traditional understanding of 'source-cause', a situation where the composer manipulates a sounding body with the intent of producing source material that is considered solely as a means to an end – the acousmatic work.

Although Reibel and Vande Gorne conceived the energy models on a human scale, in acousmatic composition they are not limited by human activity alone. I propose to regard them as a microcosm of energy models that exist on an environmental level.[51] Thus, any substance in liquid form is an example of fluidity; rotation can be perceived in a whirlpool or whirlwind; friction is can be heard in thunderclaps or the degeneration of ice during a spring thaw; corpuscles are heard when debris tumble down a mountainside in an avalanche; all matter bounces to a certain extent when it falls, illustrating rebound. Furthermore, any loud, sharp impact will produce a corresponding resonance. These post-Schaefferian ideas encouraged an alliance between personal experience and an innovative modus operandi that fosters the psychological power with which source material can be imbued. Section 2.2.1 will further examine the relationship between gesture and energy in acousmatic sound.

Once the constitution of base material is complete, the composer may turn from this preliminary step to the next – transformation. Two methods, *faire/entendre*[52] ('making/listening'), and *écoute réduite*[53] ('reduced listening') enhance the potentiality of the sounds by assisting the composer to make choices regarding suitable transformational techniques that enable the exploration of diverse methods for sound metamorphosis. The methods are applied in divergent approaches – for example, processes that act on spectra (e.g. the use of filtering to enhance, attenuate or eliminate existing spectra in a sound) and processes that reshape morphologies (e.g. the severance of the attack from a percussion/resonance[54] and the granulation of the remaining resonance).

The results of the sound-shaping process depend on the time and attention dedicated to it. By reviewing an initial recording, creating transformations, and apprehending the results, the composer permits the sounds to exist in suspended

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[51] The concept of reduction in proportion, from the environmental to the human level, is an idea I developed in *L'éveil*, (1997 – 1998), the first work in a trilogy that includes *Chat Noir* and *Neon*. *L'éveil* explores the paradox of opposition, found in the environment, which is assimilated by the human being.

[52] *Faire/Entendre*: A Schaefferian technique fostered by the contiguous approach to composition on a supporting medium, where the composer vacillates between 'making' and 'listening' to a sound. My translation of Schaeffer's text is followed by his original text: "One thus shifts from the act of 'making' to that of 'listening' by a renewal of the 'listening' through the 'making'", *«On passe ainsi du 'faire' à l' 'entendre' par un renouvellement de l' 'entendre' par le ' faire'»* (Schaeffer, 1966: 98-99).

[53] *Écoute réduite*: A Schaefferian concept frequently used in acousmatic composition whereby a sound is listened to repeatedly so that it may be qualified solely by its morphological characteristics (Schaeffer, 1966: 270-272).

[54] *Percussion/résonance*: An energy model that becomes tangible through percussion, the "forcible striking of one especially solid, [often metallic,] body against another" (Oxford, 1996: 741). The resulting sound is the resonance, the continuation of the [initial percussive] sound that is reinforced or prolonged by reflection or synchronous vibration (Oxford, 1996: 864).

animation, as opposed to immediately deploying them in a musical context, thereby facilitating a full appreciation of their spectromorphological characteristics and inherent beauty. However, on a more profound level, these initial stages produce another advantage in that they allow compositional ideas to mature, subconsciously, in an organic manner.

Equally important is the categorisation of the sounds into groups, based on their aural qualities and probable function, an essential final step in the production of sound material, even though their role in a piece might finally become, and often is, different, even diametrically opposed, to the original classification. While I suggest a deliberate strategy of classification is necessary, it can often end up in being pre-empted by the greater contextual needs of the work. Nevertheless, this bifurcation creates a heightened awareness of the relationship between a sound's overt spectromorphological qualities and its ultimate place and meaning within a piece, which translates into increased sensitivity regarding a sound's real function.

Personal aesthetic preferences guide the fabrication of a distinct sonic vocabulary for each work as each vocabulary provides the building blocks of a unique perceptual matrix for the work. The examination, in this chapter, of certain aural characteristics indigenous to sound material in the accompanying pieces aims to reveal aspects about their poietic and esthesic roles.

2.2 'Source-Cause' Diagnosis

Source-cause refers to the sound and its cause. Source-cause comprises three elements. The first is a gesture, understood here as the unfolding of energy into a tangible level which is expressed through human, physical movement.[55] The second concerns the physical entity acted upon by the gesture, while the third element is the corresponding aural trace. This composite definition may translate, effectively, into the initial recordings for acousmatic composition when it is underpinned by an understanding of energy as a vector for the conveyance of ideas through the principles of energy models. As noted in 2.1, such a perspective aids the composer to liberate the fabrication of source material from an approach that relegates initial recordings as by-products of the relationship between gesture and a sounding body.

A more extensive understanding of source-cause can include transformed and synthesised sounds, which allow for an extension, or substitution, of source-bonded or transformed sound material in composition. Energy models imagined by the composer may also guide the techniques of sound metamorphosis and facilitate the creation of arborescent links between source recordings and their respective alterations. A 'conceived' model could be based on an existing phenomenon such as respiration or gravity/antigravity, for example. It could evolve with concave or convex spatial properties. Additionally, such models might contain 'serpentine' spectral movement, or encompass both forward-moving and repetitive types of energy. Smalley discusses sounds and sound transformations in relation to gesture, using the notion of surrogacy to indicate stages of remoteness from a known model (Smalley, 1997: 112).[56] Two final levels in Smalley's principles of gestural surrogacy are particularly relevant to the fabrication and classification of transformations, "*[T]hird-order surrogacy* […] where a gesture is inferred or imagined in the music," and "*[R]emote surrogacy* [which] is concerned with gestural vestiges" (Smalley's italics) (Smalley, 1997: 112). Moreover, synthesised sounds, which I employ frequently in my compositions, often simulate prominent energy/motion trajectories of source-bonded sounds and their derivatives.

Source-cause may also include sound metamorphosis, where resemblance to the

[55] Although gesture is not involved in all source-cause relationships, I refer to gesture as an initial element in the tripartite definition for source-cause because sounding and non-sounding gesture may be seen as related to the intention and resulting physical activity of human beings. It is, nevertheless, possible to interpret energetic expression, which occurs on a cultural or environmental scale, as an expansion of human gesture. Viewed from the other side, human gesture can be understood as a microcosm of energy expressed in a cultural or environmental proportion. This idea will be developed in 2.2.3.

[56] The first two levels in Smalley's principles of gestural surrogacy comprise "*first-order surrogacy* [which] projects the primal level into sound" [and] "*second-order surrogacy* [which] is traditional instrumental gesture" (Smalley's italics) (Smalley, 1997: 112).

most striking features in a source sound is attenuated in favour of developing other, less obvious, spectromorphological qualities. An instance occurs, for example, when a granular source sound, consisting of large, uniform, noise-based, but discrete particles, is transformed with a resonant filter, resulting in sustained pitched material the granulations of which become audible as unified, internal energy that contains slight, but repeated spectral fluctuations. Furthermore, this new 'model' can yield a variety of surrogates. By virtue of the shared spectromorphological properties intrinsic to the source recording, this transformed sound and its surrogates can be allied to other transformations, which highlight different qualities inherent in the source sound, whether these qualities may be prominent or secondary. The interconnectivity among families of transformations is perceived to be audibly palpable by virtue of their shared spectromorphological attributes. However, where the transformational process denatures the source sound, its natural acoustic properties often are preserved during the alteration, which helps to retain an aural link. These approaches generate a lattice-like amalgam of sonic relationships, the filaments of which are organically linked.

It becomes evident, at this point, how pervasive is the concept of energy in acousmatic sound. Energy inspires and drives sounding gesture, and enables the formulation of sounds stimulated by examples of non-sounding gesture as well as those catalysed by the composer's imagination. It animates the processes of synthesis and transformation. Source-cause forms the basis for examining the role of energy in sonic properties, and the various sources of inspiration behind the guises of this changeable force within the compositions.

2.2.1 Morphogenesis of gesture: the fulcrum between energy and sound

Hitherto, energy has been seen as the capacity of matter to do work. Rupert Sheldrake elaborates:

> "In the technical sense of physics, energy is the property of a system that is a measure of its capacity for doing work. […] Energy can be potential or kinetic, and it takes a variety of forms: electrical, thermal, chemical, nuclear, radiant and mechanical" (Sheldrake, 2006).

Indo-Tibetan tradition, as illustrated by Tarab Tulku Rinpoche XI[57] suggests a parallel

[57] Tarab Tulku Rinpoche XI, (1934 – 2004) was a Tibetan scholar and lama, the eleventh incarnation of the line of

between the universe's *Matter-Energy* continuum and the interdependent physical and psychological systems inherent in the human being. They are manifested in three interconnecting continua:

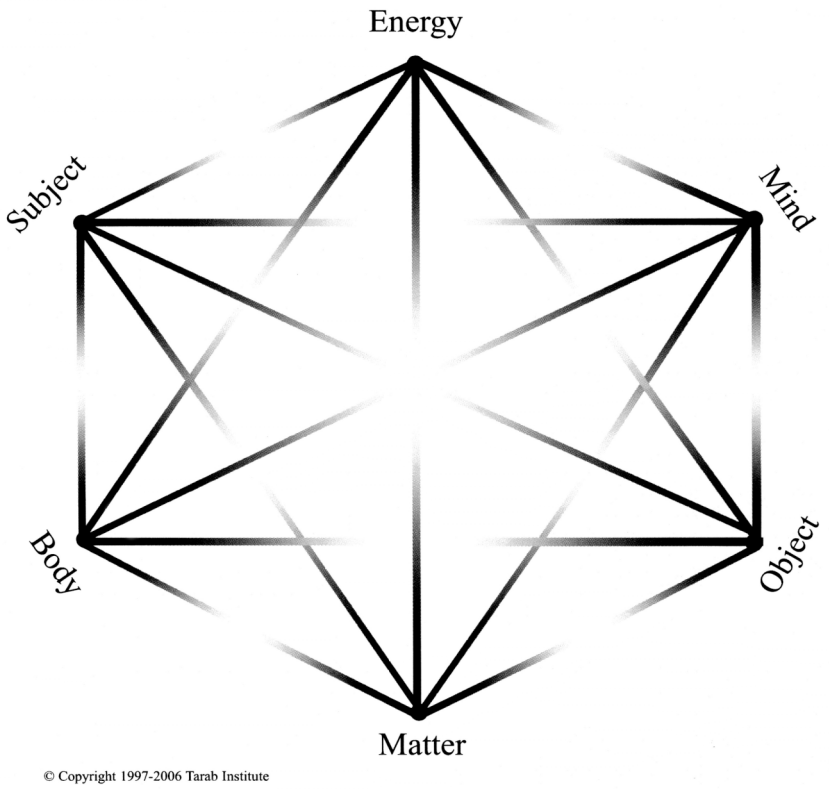

Figure 2-1. Three interconnecting continua as seen by Tarab Tulku Rinpoche [58]

> "In accordance with Tibetan metaphysics matter emerges from […] 'energy' […] such that energy is seen as both the basis of matter, and is continuously pervading matter. From this energy resource, all forms arise and return […] in a continuous movement of birth, existence, and death […]. […] we can understand the interconnection between body and mind as well as subject and object through this interrelatedness of matter and energy. Our solid bodies are inseparable from the basic energy of ourselves from which also mind develops […]"[59]

Tarab Tulku. Tarab Tulku pursued his studies at the Drepung Monastic University in Tibet, where he completed the Lharampa Geshe degree (Ph.D. in Buddhist philosophy and psychology). His research, *Science of Mind*, based on the extraction of universal principles from the Sutras and Tantras, tenets of ancient Indo-Tibetan knowledge, strove to render these concepts accessible for modern society. This part of his research is published, amongst others, in his book, *Unity in Diversity*, (Tarab Tulku's translation of *Einheit in der Vielfalt*) (Tarab Institute, 2010).

[58] (Tarab Institute, 2010).

[59] (Tarab Institute, 2010). Tarab Tulku developed these concepts, focusing on their interrelatedness, which is referred to as *Tendrel* in Indo-Tibetan tradition. He presented his research at the International Congress of Science and the Humanities: *Tendrel – Unity in Duality Conference,* in Munich, Germany, October 2002 and later developed it in *Einheit in der Vielfalt.* (Tarab Institute, 2010).

If we transpose these principles of the Matter-Energy continuum from a universal level to a human level, part of the 'energy resource' native to a human being contains the potential for all forms of expression. This basis for expressive potential can be extended to the creation of gesture in acousmatic sound, where the unfolding of energy into a tangible level concerns the aural trace left by the morphogenesis of gesture.[60] Further, if we consider that energy pervades all conceivable forms, the possibilities for gesture are not limited to the articulation of existing sounding and non-sounding models, gesture being the object: they are governed by the subject, in this case, the composer's imagination, imagination being understood as an expression of the mind. Seen from this perspective, the energetic perspective, accessed through the subject, allows gesture to be created as an unbridled expression of the imagination, thus facilitating an unhindered approach for the transfer of the composer's musical and extra-musical ideas onto the acousmatic canvas.

In referring to the unfolding of energy into a tangible level it is necessary to acknowledge a bifurcation in the expression of energy, as these two embodiments influence the aural trace in opposite ways: 'forward-moving' (otherwise known as temporal or linear) and 'repetitive' (most often cast in an atemporal or non-linear gestural mould). The term, forward-moving, signifies the unfolding of energy in such a way that gesture develops through time. Conversely, the term, repetitive, denotes the unfolding of energy in a manner that impedes gestural development through time. Forward-moving or repetitive expressions of energy and their embodiments may take any shape. For example, environmental or studio-based source recordings are initial sonic imprints that contain various energetic expressions, many of which may assume the form of forward-moving gesture. An equal variety of these imprints contain energetic expressions taking the form of repetitive gesture. Further, gesture can be transformed with the aid of digital signal processing techniques that act on its corresponding aural trace. Finally, composers may invent gestures from their personal imagination. In each instance, the energy materialises into a gestural form *through* the composer, as the subject forms the object.

With gestural expression thus clarified as the domain of the composer's imagination, we may now examine the morphogenesis of its various forms through their corresponding aural traces. The acousmatic composer creates and works with gesture through the tangibility of its aural trace. Figure 2-2 exhibits specific gesture-types viewed through the Matter-Energy continuum from the perspective of matter to

[60] Although an aural trace is a result of a physical gesture, for discursive purposes, the term, gesture, will refer to a sounding gesture.

energy. The materiality of the source recording relates to 'matter' and the revised spectromorphological qualities inherent in a *meta-sound*[61] relate to 'energy'. The six categories illustrate an evolution from a type of gestural expression that translates into dense and matter-oriented spectromorphologies frequently associated with source recordings, to expressions where matter is thinned out, yielding to energy. The latter spawn more intangible and energy-oriented spectromorphologies associated with transformed, synthesised, and meta-sounds.

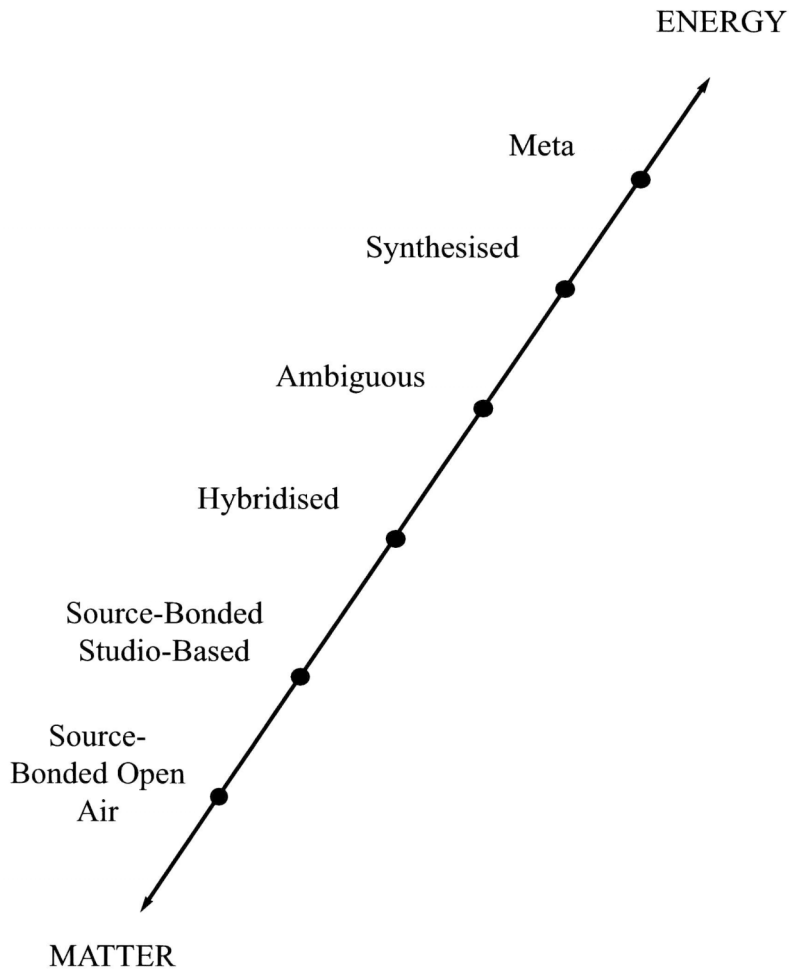

Figure 2-2. Gesture seen through the Matter-Energy continuum

2.2.2 Terminology

We have seen how the unfolding of energy into a tangible level refers to the aural trace left by the morphogenesis of gesture. The aural trace is the focus of analysis regardless of its form. However, for the purpose of this thesis, I shall refer to the aural trace in

[61] Meta-sounds are forms constructed and perceived on an environmental scale. They will be discussed in 2.2.3.

specific terms depending on the discussion. These terms include source recording, sound, sounding gesture, spectromorphology, transformation, sound-object, and meta-sound, when the discussion centres on a single sound. When a topic centres on more extensive topologies, the terms include 'meta-environment', sound world, or sounding flow. In this way, the terminology shifts to address audible pertinences and/or context.

2.2.3 Gesture in *Neon*

The comprehensive range of gestural categories described in the Matter-Energy continuum (Figure 2-2) is represented in *Neon*, a stereophonic acousmatic work, which contains both forward-moving and repetitive expressions of energy. The work features, in particular, sounds resulting from gesture-types that exist at opposite ends of the Matter-Energy continuum. The following discussion will explore the inclusive nature of the individual categories and will then turn to larger gestural contexts.

Salient forms

Although *Neon* embodies the gestural categories described in Figure 2-2, the strength of the piece lies in its extensive networks of forward-moving and repetitive sounds. These sonic expressions include source recordings made in open air and indoors, as well as transformed, synthesised, and meta-sounds. The sounding gestures work together to impart a central theme: the elevation of a microcosm of non-sounding phenomena, consisting of contrasted thoughts and feelings we experience in the human consciousness to a macrocosm that is incarnated, and whose opposing forces are reconciled, through simultaneous strata of acousmatic sound. Key to this construction was a series of source recordings made on a deserted stretch of the North Sea coast in Belgium and on a Spanish plain, where it was possible to witness energetic expression of environmental proportions. These recordings featured what I experienced as the uninhabited expansiveness of nature, and they captured the magnitude of its opposing forces. The expansiveness of the settings and magnitude of opposition appeared to contrast with the human dimension of similar phenomena experienced at an 'interior' level. Sounding phenomena, created by the opposition of forces in the open air, consisted of violent surges of waves against a stone jetty, the repeated impacts of wind-whipped sail rigging against empty masts of sailboats in dry dock, and thunder as it rolled through the air above a flat terrain. Equally pertinent was the aftermath of environmental confrontations, comprising oppositions on a less forceful scale.

Recordings of these events featured the sound of hiss and gurgles intrinsic to waves and foam as they receded from hard, wet sand, the spluttering and cracking of water against water recoiling from collision with an immobile mass, or the patter of rain on foliage between thunderclaps. Finally, there were numerous instances of small-scale oppositions, such as the rustle made by sea reeds in a breeze. Figure 2-3 illustrates the salient sounding gestures in *Neon,* derived from, or inspired by, the wave form and behaviour related to other expressions of fluidity.

Pertinence	*Wave Prototype*	*Noise*	*Hiss*	*Iterations*	*Impacts and Upthrusts*	*Surges & Swells*	*Aftermath and Backflow*	*Cascades*	*Whirlpools*	*Steam & Fog*
Spectral Qualities	Noise-based, but spectral content develops in tandem with the fluidity energy model.	In its widest definition, noise contains all frequencies expressed with equal intensity.	High-pitched band of noise.	Repetitive, high-pitched inharmonic spectra.	Sudden, brief, noisy 'cracks' or upward-moving spectral shifts.	Slight or sudden shifts in frequency and slight dynamic changes.	a) Large noise-based swell followed by porous 'crackling'. b) Sustained high-pitch noise band of hiss 'thickens' and swirls before dissipating,	Spectral descent is expressed through downward-moving particles.	Spectra repeat, cyclically, while either descending or ascending in a smooth, continuous motion.	Static, or shimmering translucent spectral swath.
Morphology	Rolls, cascades, and pummels.	Static, repetitive.	May retain vestiges of the wave morphology (if based on wave sound) or be static.	Can appear as sonic 'particles' or denser sound objects such as beads.	Impacts are incisive. Spectral motion in upthrusts implies vertical, physical movement.	Is 'forward-moving' with the different levels of thrust associated with the energy model fluidity.	a) Swell is dense, massive and later, becomes translucent. b) Can mimic part of the wave trajectory in reverse.	Constant stream of particles.	Rotation, cyclical movement.	Immobile, repetitive.
Relationship to energy model: Fluidity	Most 'energetic' example of fluidity.	Extremely malleable. Noise spectra are inherent in the source-bonded recording of waves crashing ashore.	This band of noise spectra is audible in the source-bonded recording of waves.	Tiny and slightly larger water droplets (non-sounding).	Impacts and upthrusts occur in the fluidity model. However, where the impact is sounding, the upward motion associated with an upthrust is customarily non-sounding.	Surges occur in nature but most often are perceived visually.	Indigenous to fluidity.	Indigenous to fluidity.	Indigenous to fluidity. However, it was possible to extrapolate further, and vary the cyclical movement by changing the speed and diameter of the rotations, thus achieving a tremolando effect.	Indigenous to fluidity but is non-sounding.
Compositional strategy	Employed as source-bonded sounds.	Noise is 'coaxed' into expressions of fluidity via fabrication of 'fluid' morphologies.	Is extracted from wave recording through high pass filtering or created synthetically.	Created by transformation through fragmentation and granular synthesis.	Spectral stretching, time stretching, and creation of new morphologies.	Spectral stretching, comb filtration, and creation of new morphologies.	Created by transformation through fragmentation and extensive filtering.	Created by transformation through fragmentation and filtering.	Transformation via application of tremolo and vibrato effects.	Filtering.
Listening strategy	Can be apprehended as a wave depending on context.	When shaped, noise can be apprehended as a wave depending on context.	Can be apprehended as hiss accompanying waves, or 'blown sand', etc.	Water droplets in mist, spray (non-sounding image becomes sounding).	Collision of water with another mass (sounding) or water roiling upwards (non-sounding image becomes sounding).	Water heaving forward, but not breaking, (non-sounding image becomes sounding).	Wake of a physical confrontation and dissipation of energy.	Waterfall.	Whirlpools and whirlwinds.	Steam, fog (non-sounding images become sounding).

Figure 2-3. Spectromorphological pertinences germane to expressions of fluidity in *Neon*

Having observed various expressions of fluidity in the form of sounding and non-sounding phenomena via different magnitudes of opposition in the open-air, I noticed the essential suppleness in the way energy unfolded. This resulted in innumerable hybridisations between forward-moving forms, such as the swirl of receding water, and repetitive (non-sounding) forms, such as fog. Additionally, each expression contained its own density that ranged from the opacity intrinsic to the breaking of a large wave to the translucency intrinsic to mist. Furthermore, any initial behaviour regarding movement or density could evolve into another behaviour.

During composition, it became apparent that the suppleness of the energy flow inherent in these various expressions served as a basis for gestural invention that involved source recordings of energy unfolding through the fluidity model, such as the hiss of sea foam, as well as other acoustic and synthetic material. Sound examples 2.2 – 2.15 illustrate a variety of forward-moving and repetitive sounding gestures that are either derived from source recordings made by the sea and inland, or are inspired by them, as well as by phenomena associated with the corresponding landscapes. Sound example 2.1 (audio compact disc 2, track 1) is an extract from *Neon*, (3'09" – 4'43") a topology consisting, principally, of sound-shapes inspired by sounding and non-sounding forms of fluidity, e.g. fog, mist, spume, whirlpools, thunder, and ocean swells. Sound examples 2.2 – 2.15, which either occur in the extract or are the parent source-sounds of transformations audible in the extract, expose this approach. Example 2.2 (track 2) is an ambiguous, sustained, low-pitched sound that is constructed on the interval of a perfect 4th (C3 to F3).[62] The sound's gentle swells are created by the slight, unsynchronised surges in amplitude of the two main spectra accentuating, alternatively, the C3 or F3. The spectral surges, which occur from 3'10" – 4' in *Neon*, attempt to call to mind the vision of a swell on high seas in the ocean, and their asynchronous nature can be interpreted as a sounding analogue to the variable speeds of ocean currents.[63] Examples 2.3 – 2.5 comprise a series of three high-pitched, sustained sounds. Example 2.3 (track 3) is a synthesized sound that contains both harmonic and inharmonic spectra. In example 2.4, (track 4) the sound was transformed, initially, with a chorus effect, which slightly attenuated the inharmonic spectra. The transformation was modified, again, by the addition of vibrato (in sound example 2.5, track 5), which created a quasi-cyclical sound. The three sounds were each extended, through layering, and were superimposed on each other in the order in

[62] The pitch names in this dissertation are based on the scientific pitch notation system, which labels octaves with numbers starting with C1 for the lowest C on a full-sized keyboard (Connexions, 2010).
[63] Sound example 2.2 can be heard in context in sound example 2.1, from 1" to 51".

which they were made. The result, in *Neon* from 3'10" to 4', demonstrates a subtle spectromorphological shift away from a diffuse, repetitive sounding gesture towards one that is focused spectrally and spatially.[64] Through its quasi-cyclical behaviour, which occurs over the background of the original non-cyclical sound, the latter part of this superimposed spectromorphology, at 3'23", is poised to become forward-moving. However, the quasi-cyclical behaviour is preceded, at 3'20", by elastic sounds, example 2.6 (track 6).[65] The elastic sounds have their roots in a recording of a metal whisk, which was twirled around the inside surface of a metal cylinder, that was filtered twice and then fragmented. It is notable that the elastic sounds, regardless of their 'inexhaustible' energy, impede the forward-moving behaviour as it develops in the quasi-cyclical spectromorphology by virtue of their non-evolving nature. Nevertheless, in two ambiguous, sustained, pitched sounds, example 2.7 (track 7), which also appears at 3'23", and example 2.8 (track 8), which occurs at 3'37", the spectral 'pulses' of which recall the 'swells' inherent in sound 2.2, renew the gentle forward-moving thrust by virtue of their cyclical quality albeit at a faster pace.[66]

The sound world becomes more insistent through the repetition, at higher levels of volume, of these ongoing sounding gestures, each with its distinct tempo and pitch plane, but large-scale events soon disrupt the sounding flow. Distant thunder, sound 2.9 (track 9), which is noticeable at 3'42", billows forward toward the listener at 3'59". Its unpredictable behaviour, rough contour, and opacity obscure the rhythmic context established by the preceding material. In sound example 2.10 (track 10), a metal ball is heard rolling in an enamel container. Through several stages of transformation, including filtering and the addition of reverberation, this source recording becomes a meta-sound. A meta-sound is a form that is constructed, and unfolds, on an enormous scale. It is inspired by the enthusiasm for the source-bonded sounding gesture but is not a mere amplification. The meta-rotation at 4'11", derived from sound example 2.10, cleaves the sound world with a force equivalent to the thunderclaps that precede and follow it. A second meta-rotation follows in the wake of the first at 4'15". This hybridised sound is derived from a studio-based recording, sound 2.11 (track 11), where the tuning pegs inside a grand piano are scraped. Sound example 2.12 (track 12), the transformed result, is softer, yet more expansive than the first meta-rotation. It unfolds in a leisurely fashion, allowing time for the listener to contemplate its notched,

[64] Sound examples 2.3 – 2.5 can be heard in context in example 2.1, from 1" to 1'02".
[65] An elastic sound is a repetitive sound-object that contains fluctuating, spectrally transparent, filigrees, which appear, contract and dissolve, often rapidly, into the larger context of the sounding flow giving the impression that the sound-object is able to perpetuate its shape spontaneously after the appearance and disappearance of these micro events.
[66] Sound examples 2.6 – 2.8 can be heard in context in sound example 2.1, at 12", 15", and 29" respectively.

spiral contour, as well as preserving the space for the thunder and ensuing source-bonded rain to dissipate.[67] The sound world closes with rough source-bonded iterations in the form of a downpour, example 2.13 (track 13), and synthetic high-pitched iterations, example 2.14 (track 14), both of which are 'repetitive' references to the notched character of the second meta-rotation. A pitched, sustained synthetic sound, example 2.15 (track 15) occurs at the closure of this section. During mixing, the synthesized sound was superimposed on itself, deliberately out of phase, and was reshaped into one final semi-rotation at 4'34" – 4'41".[68] I found it necessary to rework the sound's original form in the larger context of the piece in order for it to serve as a bridge between sections. In this way, it acquired a slightly circular motion that echoed the behaviour of the two meta-rotations, while its high-pitched, sustained character ushered in a new sound world. The creation of new gestures or the modification of existing gestures – via the enhancement or attenuation of spectromorphological qualities inherent in sounds within the larger context of superimposition – changes or hybridises the energy flow of the work. I undertake this compositional activity frequently, in view of aesthetic and compositional goals.

Extensive topologies

Although extensive topologies exist in numerous forms, I shall address the *meta-environment* due to its prominent role in *Neon*. A meta-environment, like a meta-sound, is inspired by an enthusiasm for source recordings, which drives its construction. However, this kind of topology is also the fruit of interest and eagerness which extend beyond the source recordings to embrace sounding and non-sounding phenomena associated with the source sounds' corresponding landscape. In an acousmatic work, this type of inspiration can translate into the meta-environment, which can be defined as consisting of multiple layers of source-bonded, hybridised, ambiguous, and, occasionally, synthetic sounding gestures that have certain shared spectromorphological characteristics. In order to retain characteristics among diverse sound groups, I examined spectral content separately from morphology, and focused on these components independently as each was significant in establishing links between the source sounds and their respective transformations. Most sound material for *Neon*, including the elements for its meta-environments, was thus constructed using methods that either preserved, built upon or were inspired by the spectral or morphological

[67] Sound example 2.9, the meta-rotation derived from sound example 2.10, and sound example 2.12 can be heard in context in sound example 2.1, at 41", 1'02", and 1'06" respectively.
[68] Sound example 2.15 can be heard in context in sound example 2.1, from 1'17" to 1'32".

qualities of the initial recordings.

The first method consisted of the union of source-bonded and non-source-bonded spectra with hybridised or ambiguous morphologies. The second method focused on the union of source-bonded or hybridised morphologies with different spectra. The third concentrated on sound synthesis, where source-bonded morphology was mimicked and/or extended, and source-bonded spectra were re-created or rarefied.

These processes generated a network of spectromorphological links that stretched from the source-bonded sound to its ambiguous counterpart, thereby broadening the source sounds' original significance to include material that would otherwise, on its own, have had little in common with the original recordings. Links to real world sounds existed through the common denominators of the spectra and morphologies that they provided, and which, in part, were preserved, reproduced or extended. This is different than if the listener were thrust into a completely ambiguous sound world. When apprehended, a meta-environment can therefore alter the listener's perception of reality without plunging him/her into the non-real imagery often associated with remote surrogacy.[69] Such a perceptual shift happens because the distinction is blurred between sounds that are apprehended as source-bonded, those that seem to be source-bonded, those that are hybridised, ambiguous, or synthesised, and the sounds' actual origins. The scope of the source-bonded sounding gesture is, consequently, elevated or magnified, and its meaning is changed. Meta-environments operate as hyper-realities, and in *Neon* serve as a fulcrum for the listening imagination to shift from reality to abstraction or vice-versa. They are portals.

Sound example 2.16 (track 16) is an extract from *Neon*, (1'30" – 3'10") a meta-environment that comprises two sections. Within the first section (0" – 51"), the sound world unfolds, develops, and thickens. At 52", the beginning of the second section, the meta-environment attains sufficient momentum and density in order to sustain itself. Inspired by the initial recordings of the North Sea, I created many hybridised, ambiguous, and synthetic sounding gestures for this topology using spectral or morphological denominators of crashing waves as a guide. The result included transformations of the recordings of the waves from a morphological perspective as well as sounding gestures that were based on abstractions of the morphologies, the fabrication of which frequently depended on other source recordings or sound synthesis as a point of departure. I also created sounding gestures that were inspired by the

[69] 'Remote surrogacy', a term devised by Smalley, is his final and most distant level of gestural surrogacy. It concerns sounding gestures, the sources or causes of which, are unknown or unrecognisable and are inferred (Smalley, 1997: 112).

noise-based spectra inherent in the sounds of the crashing waves, either by transforming existing spectra or by creating sounds that were based on abstractions of the waves' spectral identities.

The North Sea recordings were, thus, gradually extended from their original spectromorphological guise to include new territory. The new sound material was an organic extension of the original sounding landscape and was pivotal in the sonic incarnation of non-sounding phenomena associated with the landscape. Non-sounding phenomena often have a tangible shape, and can involve a distinct trajectory of motion, witnessed as petals falling from a flower, billowing clouds, or a person waving, yet they can be tangible and motionless, like a sculpture or a painting. They can also be the consequence of generalised physical activity, unfolding into invisible, diffuse, and seemingly motionless atmospheric states such as humidity and temperature. Additionally, non-sounding phenomena can include constructs borne from the faculties of the human mind, comprising fictional literary references like William Blake's *Tyger*,[70] movements in the fine arts such as Dadaism, or emotions akin to sorrow.[71] From this vantage, I created the sounding analogues for mist, spume, foam, underwater sea currents, and the seabed in addition to using source recordings.

The sound material for this meta-environment is thus wide-ranging and is, to a great extent, audible between 1'30" and 3'10". However, discussion will centre on the most pertinent gestures and their resulting aural traces. Sound examples 2.17 – 2.20 are derived from or inspired by recordings of the North Sea. Example 2.17 (track 17) features the calm sea, a prototype for sound transformation and synthesis. Noticeable in example 2.18 (track 18), a filtered recording of the sea, are the *crépitements*, swirling hiss, and noise-based yet 'diaphanous spray' present in the upper spectral register of the wave sounds.[72] In 2.19 (track 19), the sea recording is severely restricted with a band-pass filter, attenuating the capricious quality of the upper spectral register, leaving as a sole trace the movement of the larger sound mass, produced by the ebb and flow of the waves on the beach. Conversely, the transformational process for sound 2.20 (track 20) accentuates the upper spectral register of the sound of water as it impacts on a hard surface, which yields a microcosm of *crépitements*. The source for this sound example is rainfall, hence its wide-angle stereo field and steady state.

The distillation processes applied to the North Sea recordings generated

[70] (Blake, 1995: 33-34).
[71] Non-sounding phenomena are innumerable and, therefore, cannot be addressed, adequately, in this dissertation.
[72] *Crépitement*: A term widely used in the French electroacoustic aesthetic to denote different types of crackling sounds. I prefer this term because it is more inclusive of different types of crackling sounds than its English equivalent.

opportunities for further sound exploration. As hybridised sounding gestures were created via filtering, other source recordings that embodied similar types of energy were introduced in the transformational process. It thus became possible to highlight and develop spectromorphological components of the sea sounds by artificial means, with the goal of extending their breadth and ultimately, that of the listening experience. Sound examples 2.21 – 2.31, fruits of this strategy, are created primarily from studio-based recordings. These sounds are based on extrapolations of the spectrally transparent, quickly evolving, and often iterative morphologies present in the surface layer of seawater. They also comprise aural constructions that endeavour to represent non-sounding, sub-surface strata of seawater and the seabed as well as foam, spume and mist. (See Figure 2-4 for an illustration of these sounding gestures).

Sound 2.21 (track 21), derived from a studio-based recording of the manipulation of a slinky, consists of a series of micro events comprising metallic *crépitements* and impacts. Example 2.22 (track 22) originates from the sample of the sound of friction created by rubbing glass on glass. Clustered transpositions of the sample produced a brief aural swath of tiny, repeated glass shards. In 2.23 (track 23), the glassy friction is time-stretched into a smooth, undulating, ambiguous form, while in 2.24 (track 24), the same sound sample is played at a lower pitch, which highlights its more granular interior. Example 2.25 (track 25) is made from the recording of a stone scraped over a flat wooden surface. The sound is hewn by filtering, yet its prickly character is evident in this meta-environment, illustrated in Figure 2-4.

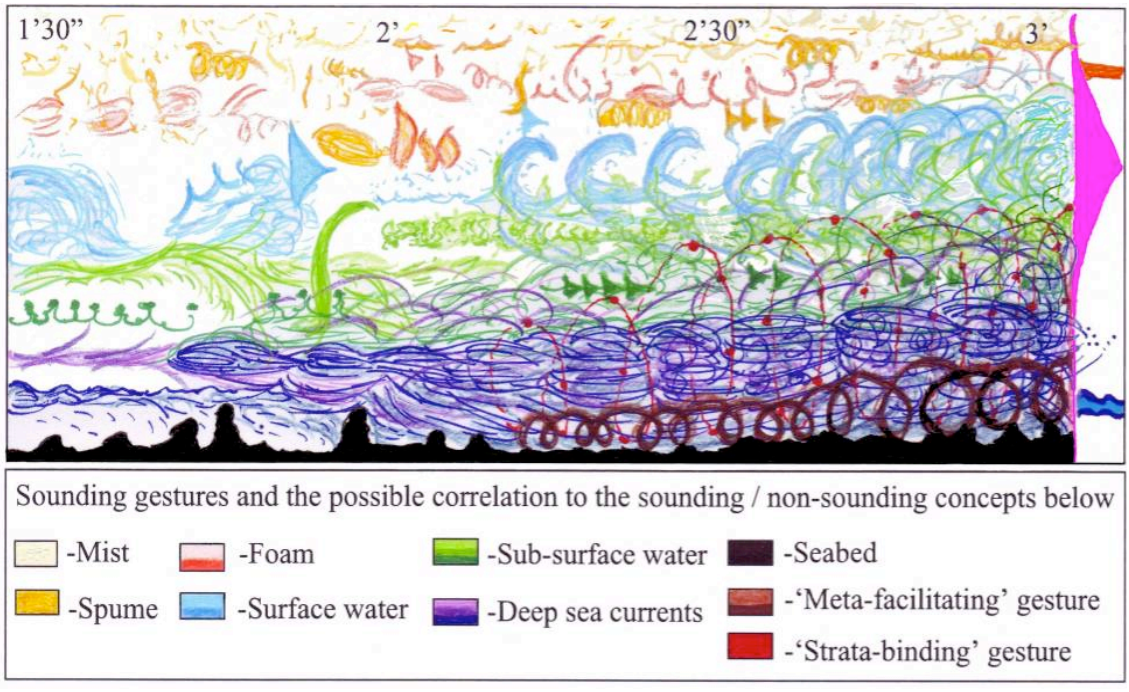

Figure 2-4. Morphological score of *Neon* from 1'30" to 3'10"

Examples 2.26 – 2.28 illustrate the lower end of the spectral register. Sound 2.26 (track 26) is a low, smooth, ambiguous, but acoustically boundless roar, created by the downward transposition and filtering of the sea recording. Sound 2.27 (track 27), originating from a studio-based recording of the rubbing of metal against metal, is a low-pitched, friction-based sound created through transposition and time-stretching. Although reversed, it shares several spectromorphological attributes with the sea sounds by virtue of its granular texture contained in an evolving, yet cyclical, form. Sound example 2.28 (track 28) probes the bottom of the spectral register in the meta-environment.

Dispersed among these strata is sound 2.29 (track 29), a source-bonded recording of swirling marbles and sand in a plastic container (see the red gesture in Figure 2-4). The sound's swirling character recalls the fluidity energy model. Sand, in the bottom of the container, adds grittiness, suggesting the noise spectra inherent in the sound of the sea, and the occasional high-pitched cracks refer, obliquely, to the high-pitched inharmonic canopy, found in the sea recording, albeit condensed in the form of minute spectral spikes. Sound example 2.30 (track 30) is synthetic and its discreet presence facilitates the evolution of other sounding gestures by virtue of its seamless 'cylindrical' motion (see the brown gesture in Figure 2-4). The meta-environment is shorn off, at 3'07", by a brief crash (the fuchsia gesture in Figure 2-4), example 2.31 (track 31), created with the Syter.[73]

[73] Syter, an acronym for *SYstème TEmps Réel*, is a digital audio system for sound synthesis, analysis, and transformation by computer. It was conceived by Jean-François Allouis, [1978] and developed by the *Institut National de l'Audiovisuel - Groupe de Recherches Musicales* (INA-GRM), in Paris (Guérin, 1992:1). Sound 2.31 was created with Syter, formerly located in the studios at the *Groupe de Musique Expérimentale de Marseille* (GMEM).

2.3 Abstract Musical Properties

In order to give perspective to the discussion of *abstract musical properties* it is helpful to return to the definition of a sound, since sound is the foundation for musical expression and its various pertinences. In 2.2, I explained how acousmatic sound is defined as an aural trace. In its most elementary form, the trace is the result of three elements. The first concerns the unfolding of energy into a tangible, gestural level, expressed through human, physical movement because, as previously noted, sounding and non-sounding gesture may be seen as related to the intention and resulting physical activity of human beings. The second element concerns the physical entity acted upon by the gesture, while the third is the corresponding aural trace. However, the aural trace may also be created through the techniques of sound transformation, synthesis, or superimposition. On a larger scale, a trace may unfold as the ensemble of sonic properties in an acousmatic work. Previously noted in 2.1, such an ensemble comprises the physical reality of the work, the aural traces resulting from the poietic process.

If we examine a sound, the interplay between spectral components/elements can be seen as the sonic content of the sound, and the way the spectrum evolves and develops over time creates the sound's morphological contour. By separating these two viewpoints (spectrum and morphology), the acousmatic composer can focus on a sound either from a spectral or morphological angle. The composer may then selectively probe spectral or morphological pertinences and achieve dramatic and surprising results, which, in turn, can impact on the way a piece is constructed. While discussion in 2.2 centred on the sounding gesture as a whole, abstract musical properties refer to the sonic content of a sounding gesture, notably the expression of spectrum and space. Chapter 6 will explore three-dimensional spatial properties and spectral space intrinsic to the works in the folio, whereas the following discussion will centre on sound spectra, the materiality they impart, and the way they develop and interact in spectral space.

A 'spectrum', the Latin singular of 'spectra', is a continuous range of frequencies within which waves have a specified common characteristic, for example, an audio-frequency spectrum, radio-frequency spectrum, visible spectrum, etc. (Van Nostrand, 1968: 1700). The radio-frequency spectrum and the visible spectrum are different portions of the electromagnetic spectrum, which constitutes:

> "The entire range of radiant energies or wave frequencies from the longest to the shortest wavelengths […]. […] The spectrum usually is divided into seven sections: radio, microwave, infrared, visible, ultraviolet, x-ray, and gamma-ray radiation" (Earth Observatory, 2008).

A radio-frequency spectrum refers to "The portion of the continuous range of frequencies of electromagnetic radiation […] used in broadcast transmission" (Truax, 1999), where a visible spectrum, for example, a rainbow, is the part of the electromagnetic spectrum visible to the human eye. However, an audio-frequency spectrum is based on acoustical energy and refers to the distribution of energy as a function of frequency for a particular sound.[74] It constitutes the sonic content of a sounding gesture, and is, in general, less tangible, less readily definable, and hence, more abstract, than a sound's morphological contour.

For Smalley, "[…] spectra or spectral space […] represent[s] the wide variety of sound-qualities, timbres and pitches perceived over the spectrum of audible frequencies" (Smalley, 1997: 118). This broad definition reflects the range of expressive possibilities available for the conveyance of spectra that are indigenous to the wide-open sound world with which the acousmatic composer works.

Since sound spectra are inherent in sounding gesture, they may be said to have a comparative expressive potential; to perceive this, it is helpful to return to the parallel between the universe's Matter-Energy continuum and the interdependent physical and psychological systems inherent in the human being, as suggested by Tarab Tulku, and described in 2.2.1.[75] Tarab Tulku proposed that if we transpose the principles of the universe's Matter-Energy continuum to a human level, as the Indo-Tibetan tradition does, part of the energy resource native to a human being contains the potential for all forms of expression. I suggested that, by extension, this basis for expressive potential also apply to the creation of gesture in acousmatic sound. Considered from this viewpoint, the unfolding of energy into a tangible level is the aural trace left by the morphogenesis of gesture. Further, as proposed in 2.2.1, the gesture (and resulting aural trace) is the object, when viewed in the *Subject-Object* continuum. Hence, the gesture, and therefore, the aural trace, is not limited to existing models, but is governed by the subject – the composer's imagination. This basis for expressive potential also extends to sound spectra, which can similarly be considered as an object, insofar as

[74] (wordnet.princeton.edu, 2010).
[75] The human 'energy resource' as described by Tarab Tulku Rinpoche differs from 'acoustical energy', which pertains to the realm of physical expression.

they refer to the distribution of acoustical energy as a function of frequency *within* the aural trace.

Because sound spectra are essential to the tangibility of the aural trace, they may also be perceived to have, by default, a 'material' quality: energy distils into matter. This viewpoint is congruent with the philosophy of Schaeffer, who referred to sound as *matière sonore* ('sonic matter') and addressed the concept of materiality through his notion of 'grain': "The quality of the grain attached to sonic matter evoke[s] the surface of a material object and the sense of tactility"[76] (Schaeffer, 1966: 548, 556). Schaeffer's notion of grain is one of two criteria that address the sustained part of the sound among seven criteria regarding musical perception (*ibid.*: 548).

Grain can also be a way of defining the internal microstructure of sound spectra.[77] Therefore, like grain, the quality of the microstructure can be a basis for describing the type of materiality perceived in the sound. I refer to the type of materiality as the *tactility factor*, which can be seen to exist on a continuum, the extremes of which address 'smooth' or 'granular' types of materiality or microstructures. Personal sensitivity to the materiality in a sounding gesture is a result of my having been exposed to the Schaefferian tradition. Further, the consideration of sound as 'matter' in electroacoustic composition is also a Belgian aesthetic (Vande Gorne, 2008).

Sound spectra can be seen to exist on a second continuum that addresses types of spectra from the perspective of harmonicity or noise.[78] On the one extreme are harmonic spectra, which are based on the harmonic series. On the other is noise, which comprises all audible frequencies, involves random changes in frequency and amplitude, and has constant energy per unit bandwidth that is independent of the central frequency of the band (Van Nostrand, 1968: 1197). In between harmonic spectra and noise lie inharmonic spectra, possessing either noise or harmonic spectra or both in innumerable variations. An example of inharmonic spectra can be heard in metallic resonances, where the pitch components are relative and cannot be reduced to one note.[79]

The unique spectral composition of source-bonded sounds explains why the unfolding of spectra within sounds is frequently more complex, variable, and

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[76] My translation of Schaeffer's text: *«La qualité de grain attachée à la matière sonore évoquait la surface d'un objet matériel et le sens tactile».*

[77] Exact specifications of microstructure will be defined in 2.3.1

[78] The spectral content continuum refers to the 'note-noise continuum' devised by Smalley (Smalley, 1997: 120).

[79] Relative pitch can be understood in reference to intervallic pitch, which is based on the harmonic series. "In intervallic pitch we can hear precise pitch-intervals, and therefore their relationship to cultural, tonal usage will become important. In relative pitch contexts we hear with much less precision the distance between pitches and can no longer hear exact pitches or intervals […]" (Smalley, 1997: 119).

memorable than that of morphology, although the morphology is often more easily apprehended than the spectra. However, the manner in which the *spectral content* in a sound behaves over time is related to the nature of its morphology. For example, a source-bonded, forward-moving sound and its spectral content unfold in tandem. Spectral evolution forms the majority of the perceptual image of the forward-moving sound, although the very nature of the evolving spectrum might be difficult to describe. An example of this can be heard in the recording of a passing car, where the sound of the engine and tyre friction becomes louder, more defined, regresses in definition and descends in tessitura, which contributes to the source-bonded spectral percept. In contrast, a source-bonded, repetitive sound, such as a recording of cicadas, comprises spectral content that 'renews' itself. Spectral regeneration contributes, largely, to the perceptual image of the repetitive gesture, which often can be referred to as a texture.

Moreover, transformational techniques permit spectra to be modified in a sound-shape. For example, intervallic sound material (e.g. based on the harmonic series) can be 'acted on' in a way that disrupts and relativises the intervallic organisation. Inharmonic or noise-based spectra can also be 'threaded' into harmonic spectra. Conversely, when transformed, noise can adopt inharmonic or pitched attributes. Though possibilities for spectral transformation abound, Wishart describes two effective techniques:

> [1. A sound that is] "spectrally stretched […] means that the partials are moved upwards in such a way that their whole number relationships are preserved less and less exactly and eventually lost". [2…] "It is possible to extract the (time varying) spectral contour from one signal and impose it on another, a process originally developed in the analogue studios and known as vocoding […]. […] Vocoding […] works well on noisy sounds" (Wishart, 1994).

Disengaging spectra from morphological contour is possible, as Wishart observes:

> "We can use spectral freezing to freeze certain aspects of the spectrum at a particular moment. We hold the frequencies of the partials, allowing their loudnesses to vary as originally. Or we can hold their amplitudes stationary, allowing the frequencies to vary as originally" (Wishart, 1994).

By arresting the amplitude in a forward-moving sound-shape, we could expect the resulting sound transformation to have an amorphous exterior contour and a time-

varied interior spectral design. However, arresting amplitude in a complex signal most often produces the sense of freeze (Wishart, 1994). To combine spectral evolution with morphological arrest, the composer can apply the process of spectral freeze to different sections (contiguous or non-contiguous) of a forward-moving sound as well as to different transformations of the sound. The resulting sound files can be copied and superimposed in a way that they overlap, which creates a sound-shape that is morphologically static and yet has an evolving spectral interior. I used this technique to create sound material for channels three and four in the first minute of *Protopia/Tesseract.* Conversely, the repetitive silhouette 'surrounding' regenerating spectra can also be prodded into a seemingly more forward-moving guise by varying the amplitude throughout the sound.

Further, it is possible to transform spectra in source-bonded or synthetic sounds so that they can 'move to', 'gravitate around', or 'float between' points on the spectral content continuum in a variety of ways. Hence, spectra may appear to enter or exit a pitch-space, or to accrue or discard inharmonic components, depending upon the point on the continuum where the sound begins and how it evolves. The spectrum in a sounding gesture might also unfurl in several directions simultaneously. For example, the individual frequency components that create the spectral identity of a sound may grow further apart, bind together as a mass, overlap and intertwine, or converge to one point.

In the past, inharmonic and noise spectra were conveyed in Western music, although marginally, through percussion instruments, specific playing modes that were deliberately scored (e.g. *col legno* or *sul ponticello* for strings) or, more recently, through contemporary instrumental and vocal techniques. Yet, the vast spectral horizon now available in electroacoustic composition allows for a greater exploration of noise. I consider noise and inharmonicity to be very versatile examples of spectra due to their malleable character. Complementarily, the acoustic clarity provided by harmonic spectra is also an inherent element in the accompanying works.

2.3.1 Spectra and tactility: an issue of simultaneity

We have seen that the quality of the microstructure within sound spectra can be a basis for describing the type of materiality perceived in a sound. A tactility factor therefore is indissolubly bound to a sound spectrum, although it is more clearly remarked when it passes a threshold of perceptible smoothness or granularity.

For example, harmonic spectra often possess a smoother microstructure and, thus, may evoke a sleeker surface. Conversely, inharmonic and noise spectra frequently possess a granular microstructure, and, hence, may often impart a textured surface. Nevertheless, harmonicity is not espoused to the quality of smoothness, and inharmonicity is not inseparable from granularity. As we perceive in nature, civilisation, and culture, it is possible to combine diverse factors of tactility with diverse spectral identities.[80]

By focusing on a sound's spectral properties or its internal fibre, the composer can develop specific traits of one independently from the other. This opens the door to transformational possibilities, which may lead to innovative results. Sounds that comprise a diaphanous microstructure and predominately harmonic spectra, for example, may conjure up images of 'glowing red tunnels of silk' or 'gossamer satin'. Spectromorphologies that have a slightly less glossy microstructure and contain more inharmonic spectra may appear to 'stream like solar flares' or 'shimmer from static places'. In contrast, sounds that comprise subtly granular microstructures and inharmonic spectra might seem to 'blow like particles of sand or metallic dust', 'purr', 'twinkle', 'wink', 'boil', 'glisten', 'cascade like falling sequins', or 'repeat like a line of dots and dashes in the atmosphere'.[81]

Although the spectral content continuum comprises harmonic, inharmonic and noise spectra, the forces responsible for diverse tactility factors are less apparent. We may then ask what contributes to the qualities of smoothness or granularity. According to Barry Truax, grain can be defined as "The property of a sound object whose internal dynamics have a regular, modulatory quality, […] as opposed to irregular transients" (Truax, 1999).[82] Additionally, Truax proposes that the definition for grain also includes such modulatory processes as vibrato and tremolo. Hence, a sound-shape whose internal dynamics undergo perceptible systematic variations in intensity or in frequency may be perceived as granular. For example, systematic variations in intensity can produce the effect of discontinuity or fragmentation in a sound. Conversely, vibrato consists of regular fluctuations in frequency within sound spectra. Although non-transient white noise, such as static on a poorly tuned radio or television, involves

[80] For the purposes of this thesis, the double continua do not address degrees of spectral density or timbre directly unless density or timbre participates in the perception of inharmonicity or harmonicity or the tactility factor in the sound. In keeping with this logic, the duration, dynamics, and tessitura of a sound are quantifiable in the same way. Additionally, in 2.3.1, I address tactility and spectral content together. In subsequent sections, they will be addressed separately. Finally, although civilisation encompasses culture, in this discussion culture refers specifically to music.

[81] These are esthesic descriptions with poietic knowledge.

[82] The term, internal dynamics, refers to "The variations in intensity of the middle portion of the envelope of a sound object, between its attack and decay" (Truax, 2010).

random changes in frequency and amplitude, since it comprises all audible frequencies and has constant energy per unit bandwidth, it imparts the quality of granularity.

In this context, 'evenness' or 'uniformity' could be defined as the property of a sound whose internal dynamics are unmodulated. Without modulation, sound spectra unfold devoid of systematic internal fluctuations, which evokes the quality of smoothness. Let us now examine two components that constitute the tactility factor.

The tactility factor continuum

The tactility factor may, thus, be seen as a microstructural quality existing on a continuum, the extremes of which encompass smooth or rough types of materiality.

(i) Evocation of smoothness

As proposed, evenness or uniformity is the property of a sound whose internal dynamics do not possess a regular modulatory quality. When modulation is non-existent, imperceptible or not systematic, the microstructure of the sound can propagate seamlessly, free from modulatory turbulence, and can therefore be perceived to evoke a smooth surface of a material object. The quality of smoothness is often associated with harmonic spectra, which are implemented in the overtone system, and are most often apprehended through the Classical tradition of Western instrumental or vocal music. Such music is, in general, devoid of extensive granularity. When harmonic spectra are conveyed through these mediums, harmonicity and the quality of smoothness can be associated. However, as much as harmonicity does not exclude noise or granularity, inharmonicity and/or noise do not exclude harmonicity and smoothness. As posited by Kristoffer Jensen, "Noise is inherent in all musical sounds, including the human voice. Without noise and random fluctuations, most sounds are dull, lifeless and synthetic […]" (Jensen, 2004). Thus, noise can contribute to a sensation of richness and vibrancy within the context of harmonicity and smoothness.

(ii) Evocation of granularity or roughness

We know that grain occurs when a sound's internal dynamics possess a regular modulatory quality. This has a direct bearing on the microstructure of the sound, which can be perceived to evoke a rough or coarsely textured surface. A granular microstructure and thus the quality of granularity are often associated with inharmonic and noise spectra.

The spectral content continuum

Sound spectra can be seen to exist on a second continuum that addresses types of spectra from the perspective of harmonicity or noise. The extremes of the continuum include harmonic spectra, which are based on the harmonic series, and noise, which comprises all audible frequencies. In between harmonic spectra and noise lie inharmonic spectra.

The spectral content and tactility factor continua

By examining types of sound spectra and the qualities inherent in their microstructure, we can gain an understanding of abstract musical properties of a sound-shape. However, when regarded separately, these two criteria do not offer a sufficient overview of the vast spectral and microstructural universes available to the acousmatic composer. Therefore, I conceived a double continuum where spectral content and its microstructural quality – the tactility factor – can be regarded in tandem in forward-moving or repetitive sounds.[83]

Figures 2-5 – 2-12 illustrate a qualitative and subjective classification of source-sounds by the author as viewed on the spectral content and tactility factor double continuum. Sounds are classified into sound worlds according to common source-cause denominators (e.g. 'Western instrumental and vocal music', or 'Sounds from nature') in lieu of energy models for the purpose of illustration.[84] Figures 2-5 – 2-12 each contain a rectangle which depicts a sound world.[85] My aim is to depict spectral and tactility possibilities for eight different sound worlds, ranging from Western instrumental and vocal music to sounds from nature. Figure 2-13 depicts the eight sound worlds simultaneously, in relation to each other.

Spectral content is indicated in all figures as follows: Inharmonicity is represented on the x-axis either by progressively darker shades, moving left toward Harmonicity, or progressively paler shades, moving right toward Noise. The violet colour is used for sounds that can be *apprehended* as forward-moving as well as others that can be *apprehended* as repetitive. The graded shade of violet within each rectangle depicts the range of spectral content in each sound world, and is to be related to the placement of the respective sound world on the x-axis.

The tactility factor, or microstructural quality, inherent in sound spectra is

[83] This concept owes much to Schaeffer's construct of 'grain' and Smalley's construct of 'note-noise'.
[84] Examples of sound transformation and synthesis are not included.
[85] The following list of criteria, although not exhaustive, will affect the source-sound: mode of production, proximity, sounding body employed, atmospheric conditions, and spatial layout.

depicted as follows: smoothness evolves to granularity on the y-axis as illustrated by graphic representations: lines, closely and widely spaced dashes, and dots of increasing size. Two graphic representations within each rectangle, below and above the title of each rectangle, suggest the range of possibilities for tactility in each sound world and follow the placement of the sound world on the y-axis.[86]

The four corners in each rectangle, marked as "a", "b", "c", and "d", demarcate extremes in terms of spectral content and tactility within the framework of a particular sound world, which is further defined by its placement on the double continuum. In this way, the corners highlight the vast spectral and microstructural possibilities for each sound world. Corner "a" (top left) represents a greater degree of both harmonicity and granularity. Corner "b" (top right) illustrates a greater degree of inharmonicity and a greater degree of granularity. Corner "c" (bottom left) delineates a greater degree of harmonicity and a greater degree of smoothness. Corner "d" (bottom right) represents a greater degree of both inharmonicity and smoothness.

The three-dimensional rendering in each rectangle parallel to the x-axis represents a range of spectral attributes made possible through a three-tiered transformational process (first, second and third order transformations as illustrated by blue, turquoise and green stripes).[87] Source-bonded spectra and spectral transformation, the sonic states of which can be visually differentiated by the rectangle and the three stripes, follow the evolution from 'matter' to 'energy' as illustrated in Figure 2-2, albeit depicted in four categories in lieu of the original 6.[88] Thus, as sound spectra undergo first, second and third order transformations they become increasingly distanced from the 'dense' and 'matter-oriented' spectral characteristics frequently associated with source recordings. The distancing occurs as source-bonded spectra succumb to processes where their inherent attributes are 'culled out' and are replaced by more ephemeral and energy-oriented spectral attributes which are formed through transformation (the green stripe parallel to the x-axis).

The three-dimensional rendering in each figure parallel to the y-axis (a double-lined black arrow moving upward and from foreground to background over the blue, turquoise and green stripes) represents a range of tactility factors (smooth to granular),

[86] Considerable attention was given to the conception of Figures 2-5 – 2-13. Nevertheless, the visual rendering of auditory phenomena is limited.

[87] Second and third order transformations have their inception in 'transformation in cascade' techniques. In the past, cascading transformations were created with analogue equipment in real-time. Cascading transformations are, currently, produced through digital signal processing as applied in real, or non-real, time to a sound. The three stages represented are for the purpose of illustration.

[88] The terms, 'matter' and 'matter-oriented', refer to source-bonded sonic properties as viewed through the Matter-Energy continuum in Figure 2-2. They can be distinguished from the 'material' quality inherent in all sound spectra, which results from the distillation of acoustic energy into sound.

which can result from a three-tiered transformational process. A sound's source-bonded tactility factor and the possibilities for its transformation also follow the evolution from 'matter' to 'energy' illustrated in Figure 2-2. Hence, a sound's microstructure, which can be reworked through first, second and third-order transformations, may impart a sense of materiality or physicality that is increasingly removed from a type of 'dense' and 'matter-oriented' tactility factor frequently associated with source recordings. The distancing occurs as a sound's source-bonded microstructure is 'plied' and 'thinned out' by transformational processes and its innate qualities are substituted by those which are more energy-oriented.

My aim is to examine the spectral content and tactility factors of source-bonded forward-moving and repetitive sound-shapes in specific sound worlds, and to circumscribe the sound worlds by illustrating their most extreme examples of spectra and tactility. In so doing, and by increasing awareness and understanding of the vast domain of spectral and microstructural properties within each sound world, I hope to highlight and document the wealth of abstract musical properties available to the acousmatic composer as found in source recordings, possibilities for sound transformation as well as for sound synthesis.

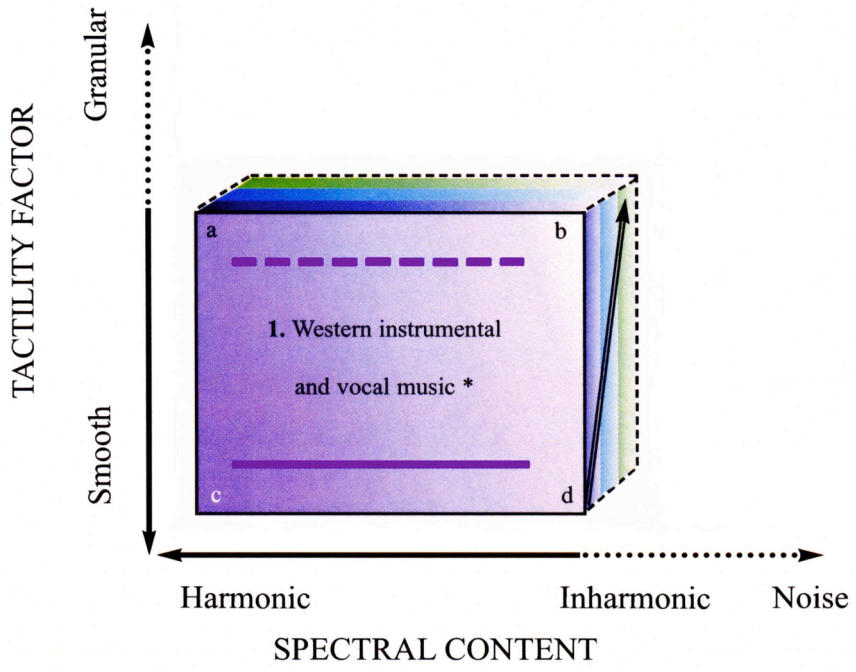


Figure 2-5. Western instrumental and vocal music

The rectangle in Figure 2-5 represents the standard concert repertoire of the schooled Classical tradition (*) in 'Western instrumental and vocal music' as seen on the spectral content and tactility factor double continuum. The four letters in the

corners of the rectangles demarcate four extremes in terms of source-bonded spectral content and tactility within the frame of 'Western instrumental and vocal music'. The following table proposes source sounds which illustrate the extremes. The middle column is devoted to forward-moving sounds, while repetitive sounds appear on the right.

1. Western instrumental and vocal music	*Forward-moving sounds*	*Repetitive sounds*
Corner "a"	Entire trumpet section playing a double-tongued melodic passage.	Bowed tremolos on one note, played at *forte* by an entire violin section.
Corner "b"	Viola snap *pizzicati* successively on several different notes.	Repeated notes played *pizzicato* on a string bass.
Corner "c"	*Bel canto* vocal style.	Sustained *tutti* instrumental chord.
Corner "d"	*Sul ponticello* violin techniques.	*'fp'* effect with a 'stopped' note on the French horn.[89]

Table 2-1. Examples for Figure 2-5: Western instrumental and vocal music

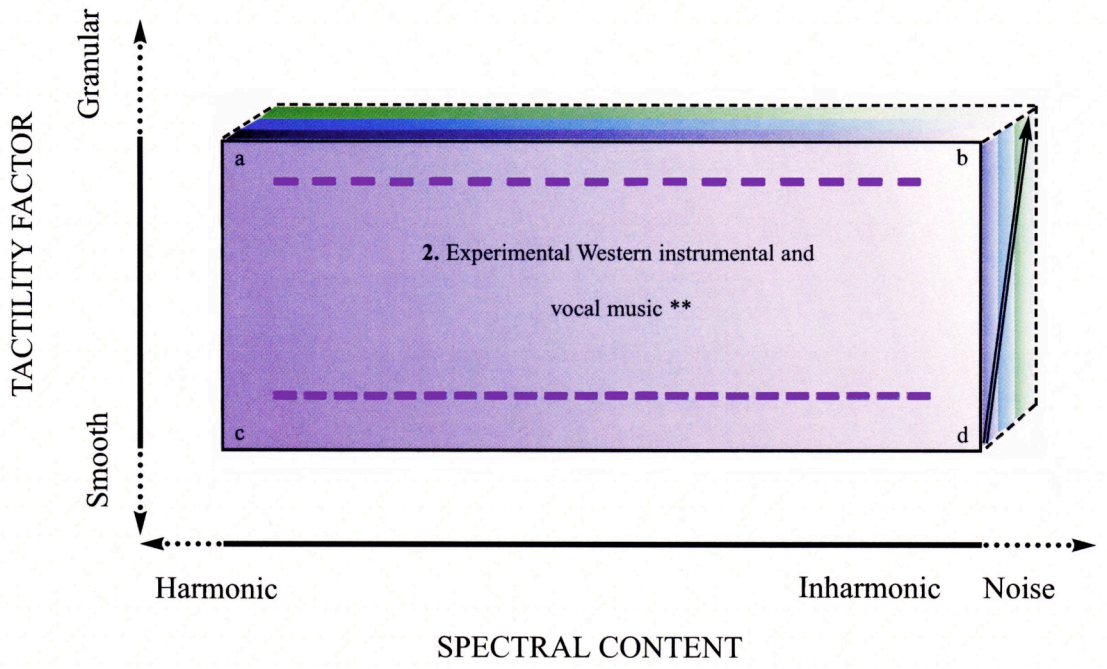


Figure 2-6. Experimental Western instrumental and vocal music

[89] (Kennan and Grantham, 1983: 132).

The rectangle in Figure 2-6 portrays 'Experimental Western instrumental and vocal music' starting from the beginning of the twentieth century (**) as viewed on the spectral content and tactility factor double continuum. The four corners of the rectangle demarcate extremes in terms of source-bonded spectral content and tactility, but within the context of 'Experimental Western instrumental and vocal music'. The corner letters are enumerated on the left in the following table. Forward-moving and repetitive source sounds that probe extremes are listed in the middle and right columns respectively.

2. Experimental Western instrumental and vocal music	*Forward-moving sounds*	*Repetitive sounds*
Corner "a"	*Sprechstimme.*	Flutter tongue on one note (trumpet).
Corner "b"	Playing on the tailpiece of a cello.	Sustained buzzing into a detached mouthpiece (brass section).
Corner "c"	Whistle tones (on a flute).	Sustained multiphonic sound on a clarinet.
Corner "d"	A series of unvoiced consonants enunciated, softly, by a mixed choir.	Non-pitched, sustained air tones on a flute without key strikes.

Table 2-2. Examples for Figure 2-6: Experimental Western instrumental and vocal music

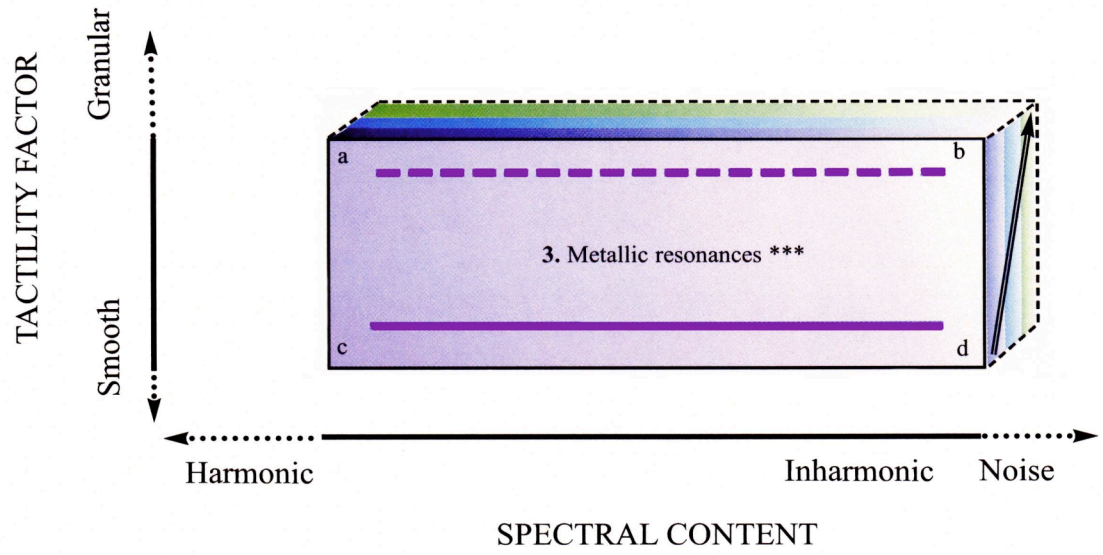


Figure 2-7. Metallic resonances

Figure 2-7 depicts 'Metallic resonances' as observed on the spectral content and tactility factor double continuum. The resonances (***) comprise those made with standard percussion instruments or other metallic objects using diverse energy models such as percussion resonance, shaking, and friction. Although this sound world is more unified due to the organic relationship between its source-causes – metallic resonances – extremes exist in terms of source-bonded spectral content and tactility. For example, the shimmering, silvery, swath of inharmonic spectra that arises from a continuous roll on a suspended cymbal contrasts with the shrill, pitched resonance of a bicycle bell.

3. Metallic resonances	*Forward-moving sounds*	*Repetitive sounds*
Corner "a"	Common American bicycle bell (entire sound).	Continuous scraping of a gong with a wooden stick.
Corner "b"	Shaken thundersheet with crescendo and diminuendo effect.	Tremolo on a small triangle (with metal beater).
Corner "c"	Resonance from a carillon.	Continuous bowing of the edge of a tam-tam with a violin bow.
Corner "d"	Resonance from a struck anvil.	Continuous roll (with a soft mallet) on a suspended cymbal.

Table 2-3. Examples for Figure 2-7: Metallic Resonances

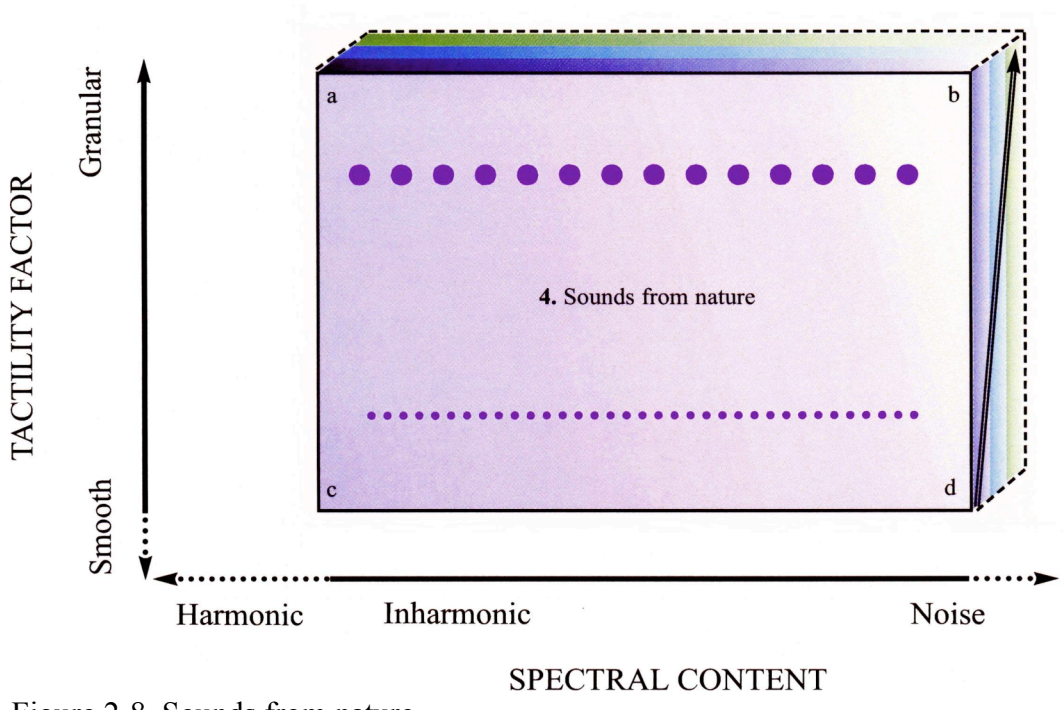


Figure 2-8. Sounds from nature

The rectangle in Figure 2-8 represents 'Sounds from nature' as seen on the spectral content and tactility factor double continuum. As in previous figures, the four corners of the rectangle delineate extremes in terms of source-bonded spectral content and tactility. However, the sound world in nature is spectrally and spatially unlimited because it includes sound produced by any natural physical activity and all animal utterance. The strikingly different extremes, thus, can be attributed to the unlimited variety of source-causes and acoustic settings found in nature.

4. Sounds from Nature	*Forward-moving sounds*	*Repetitive sounds*
Corner "a"	'Roars' and 'groans' from the humpback whale.	A pride of growling lions.
Corner "b"	Cracking river ice in springtime.	Crickets in the summer.
Corner "c"	Birdsong (e.g. North-American Warbling Vireo).	Birdsong: repeated cooing by mourning doves.
Corner "d"	Gust of wind in trees or wind-whipped sand.	ELF/VLF hiss.[90]

Table 2-4. Examples for Figure 2-8: Sounds from Nature

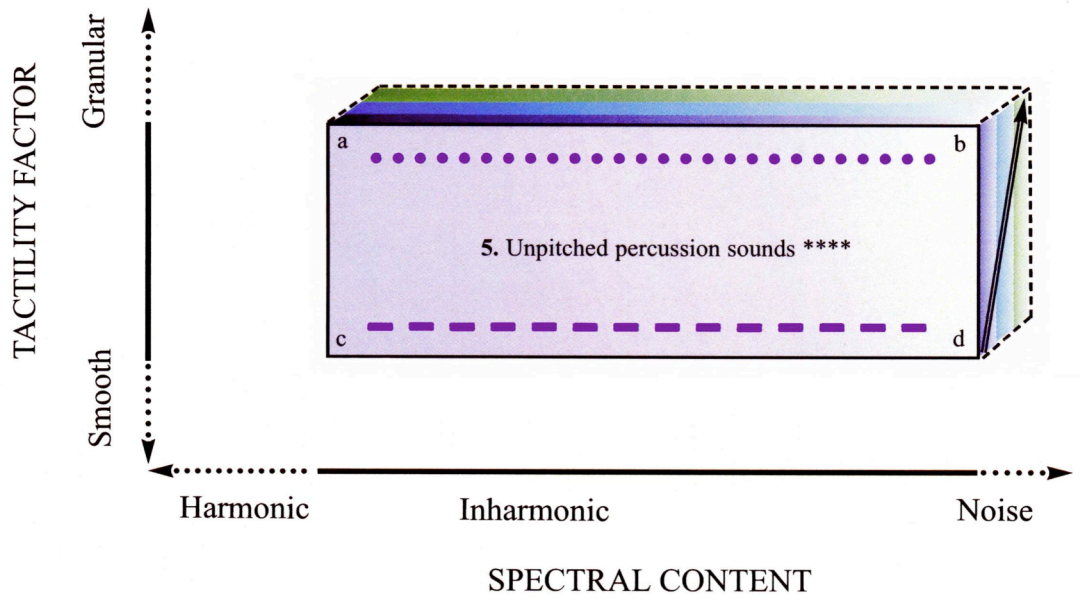


Figure 2-9. Unpitched percussion sounds

[90] "ELF [extremely low frequency] /VLF [very low frequency] hiss is a well-known form of electromagnetic emission having constant spectral density in the limited frequency band, which produces [a] hissing sound" (Helliwell in Singh et al, 2005: 17).

Figure 2-9 represents 'Unpitched percussion sounds' as observed on the spectral content and tactility factor double continuum (****). This sonic frame comprises percussion sounds made with unpitched standard and non-standard percussion instruments and includes, but is not limited to, percussive attacks. Similar to the sound world represented in Figure 2-7, 'Metallic resonances', this sound world is unified, hypothetically, due to the organic relationship between its source-causes – unpitched percussion sounds. Nevertheless, extremes abound in terms of source-bonded spectral content and tactility, particularly since percussion sounds are not limited to those produced in a musical context.

5. Unpitched percussion sounds	*Forward-moving sounds*	*Repetitive sounds*
Corner "a"	Abrupt and brusque clustering of bamboo wind chimes with hands.	Tremolo on two Temple Blocks at a uniform speed and dynamic.
Corner "b"	Clicking sounds produced by marbles colliding inside a cloth bag.	Repeated rhythm articulated by castanets.
Corner "c"	Crescendo roll on a bass drum with soft mallets.	Glass wind chimes set in motion by hand (continual).
Corner "d"	Squeezing a section of bubble wrap softly albeit unevenly.	Drawing a wire brush over the head of a snare drum (snare off) in a circular pattern.

Table 2-5. Examples for Figure 2-9: Unpitched percussion sounds

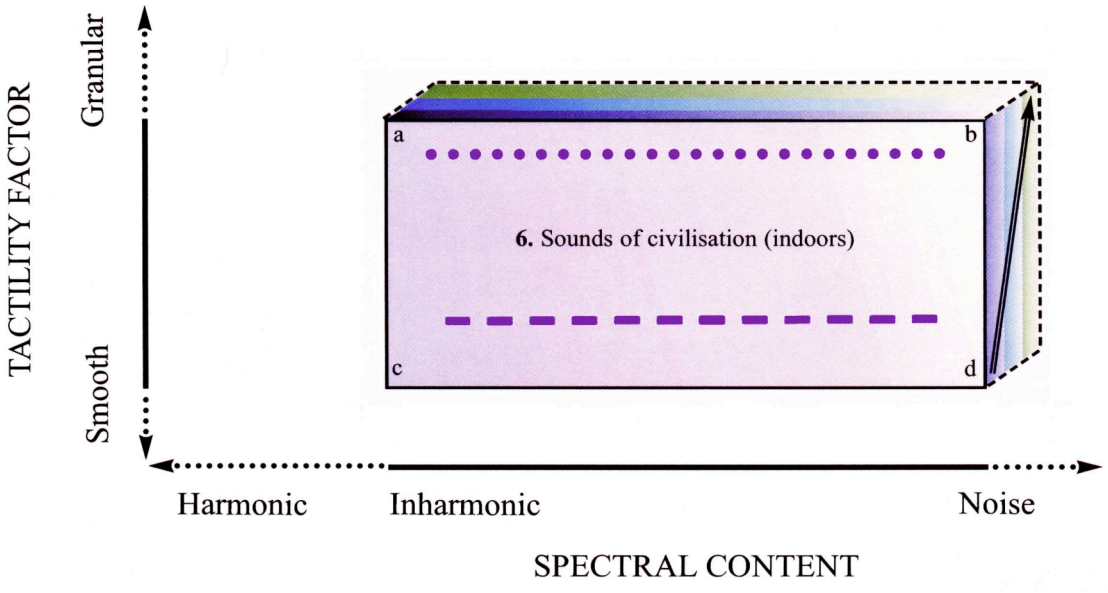


Figure 2-10. Sounds of civilisation (indoors)

Figure 2-10 depicts 'Sounds of civilisation (indoors)' as illustrated on the spectral content and tactility factor double continuum. As in all figures, the four corners of the rectangle represent extremes in terms of source-bonded spectral content and tactility. Although spatially, and therefore acoustically, limited to the interior, this sound world gives rise to a subtle yet tangible set of extremes due to the different source-causes found indoors and the variety of possible indoor acoustic spaces.

6. Sounds of civilisation (indoors)	*Forward-moving sounds*	*Repetitive sounds*
Corner "a"	Poured fizzing liquid (e.g. soft drink) from one glass bottle to another.	Distant din of pinball machines in a gaming gallery.
Corner "b"	Tearing a piece of aluminium foil brusquely.	Large household appliances (e.g. dishwasher, washing machine).
Corner "c"	Descending 'whistling' sound of a teakettle.	Repeated standard telephone ring (landline).
Corner "d"	Putting on or taking off velvet gloves.	Hum made by ocean liner engines as heard in the engine room of the Queen Mary.[91]

Table 2-6. Examples for Figure 2-10: Sounds of civilisation (indoors)

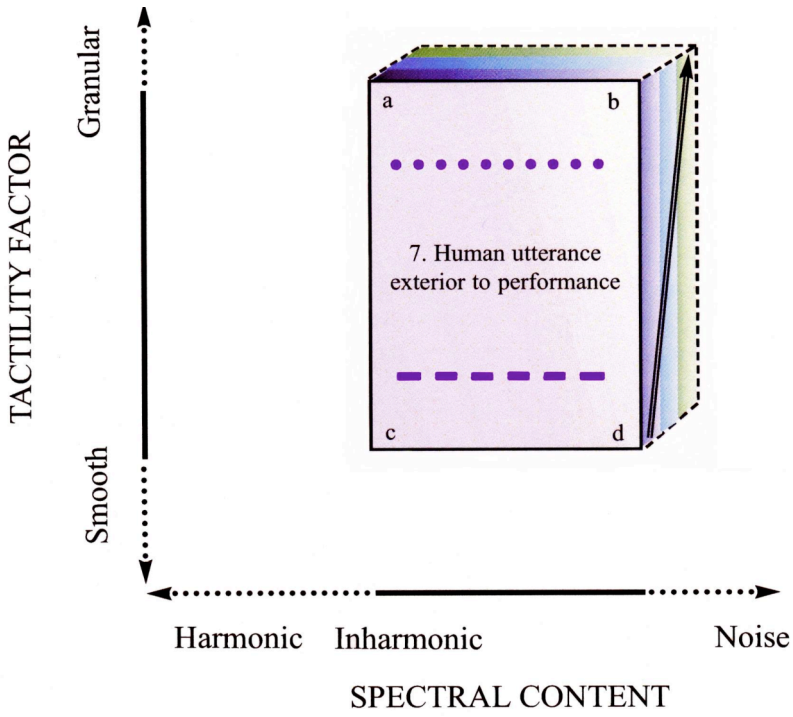


Figure 2-11. Human utterance exterior to performance

[91] The author apprehended this memorable sound during the penultimate transatlantic voyage of the Queen Mary from Manhattan, New York to Cherbourg, France in July 1966.

Figure 2-11 illustrates 'Human utterance exterior to performance' as seen on the spectral content and tactility factor double continuum. Similar to the sound worlds represented in Figures 2-7 and 2-9, this sound world is unified, organically, on the basis of its sole source-cause – human utterance exterior to performance. However, there are vast differences in terms of source-bonded spectral content and tactility, owing to the expressive range of the human voice, which can be multiplied in a group or crowd-like setting.

7. Human utterance exterior to performance	*Forward-moving sounds*	*Repetitive sounds*
Corner "a"	Crowd roar of approval.	Ululations.
Corner "b"	Intense, angry whispers.	Many people conversing animatedly in a small room.
Corner "c"	Laughter, gurgling.	Sustained, whistled note.
Corner "d"	Hissing.	Unpitched exhalation of breath.

Table 2-7. Examples for Figure 2-11: Human utterance exterior to performance

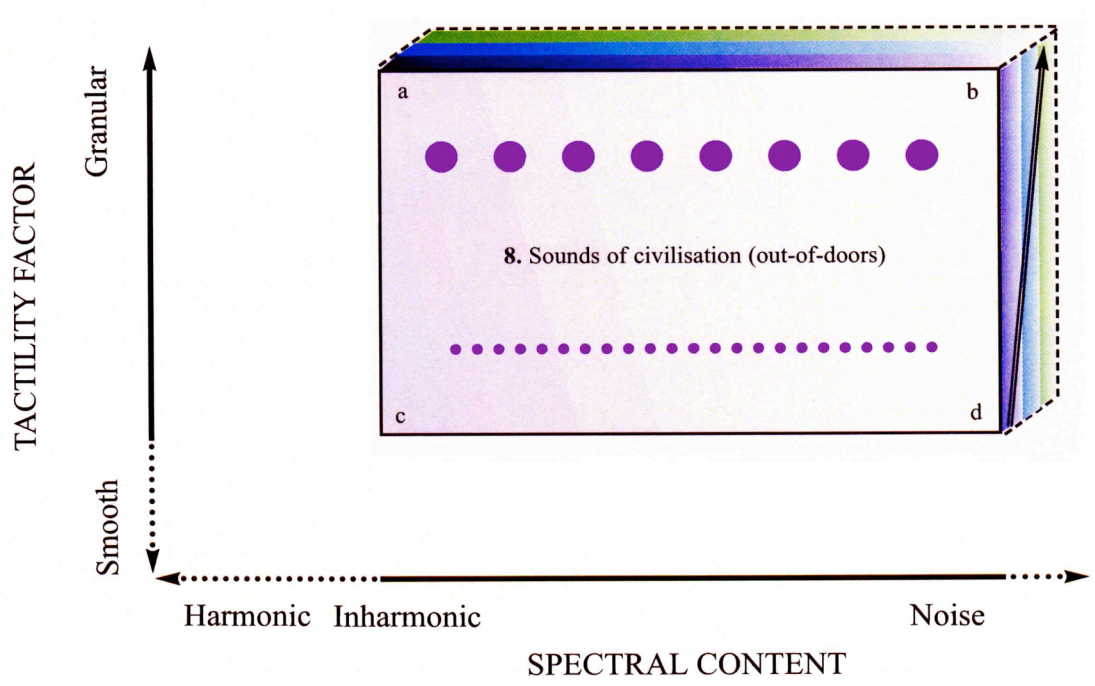


Figure 2-12. Sounds of civilisation (out-of-doors)

The rectangle in Figure 2-12 represents 'Sounds of civilisation (out-of-doors)' as depicted on the spectral content and tactility factor double continuum. In contrast with the sound world in Figure 2-10 – 'Sounds of civilisation (indoors)' – 'Sounds of civilisation (out-of-doors)' is spatially unlimited. Thus, it bears a closer resemblance to the sound world depicted in Figure 2-8 – 'Sounds from nature' – and therefore gives rise to sonic extremes due to its vastly different possible source-causes and acoustic settings.

8. Sounds of civilisation (out-of-doors)	*Forward-moving sounds*	*Repetitive sounds*
Corner "a"	Dragging a stick across a metal fence while walking, jogging, and then running.	Jigsaw cutting through the middle part of a piece of wood.
Corner "b"	Moving inner city rush hour traffic (close proximity), jet plane overhead.	Downpour on a rooftop.
Corner "c"	Whistle blasts from a steam engine in motion.	Standard car alarms.
Corner "d"	Bicycle pedalled uphill during several gear changes.	Distant roar of traffic.

Table 2-8. Examples for Figure 2-12: Sounds of civilisation (out-of-doors)

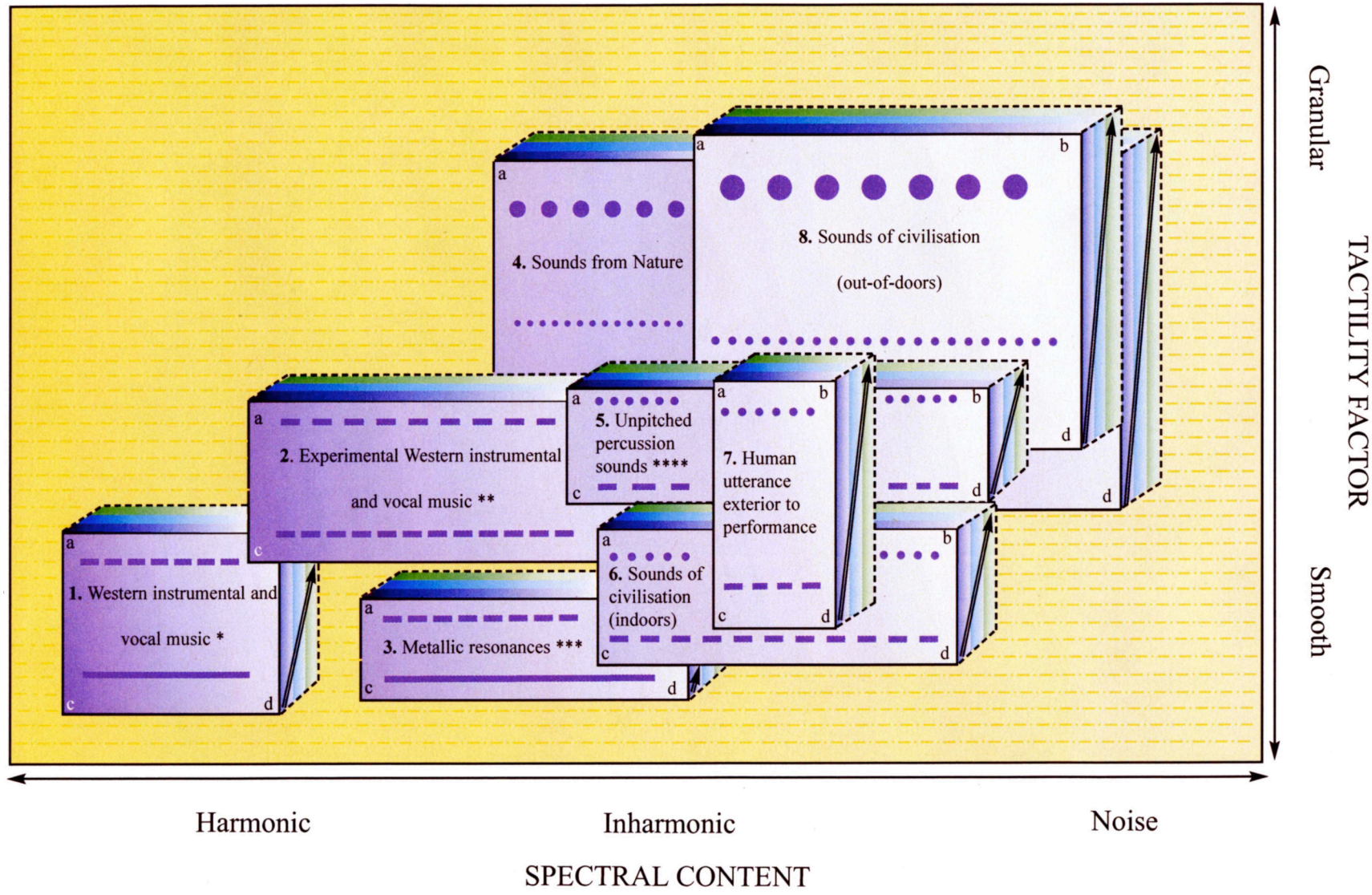


Figure 2-13. Global representation of the eight sound worlds as viewed on the spectral content and tactility factor continua

Figure 2-13 depicts the eight sound worlds simultaneously. The sound worlds, represented by eight rectangles, are positioned on the double continuum in progressively rightward and higher positions on the x and y-axes respectively. Each sound world contains a different range of spectral and microstructural properties. The choice of the position of the rectangles on the double continuum is based on a qualitative and subjective classification of the sound worlds by the author. The yellow, textured background represents the state of 'energy' on the Matter-Energy continuum, which in Figure 2-13 is depicted as a fourth and final category, following the evolution from 'matter' to 'energy' as illustrated in Figure 2-2. Hence, the yellow, textured background lies 'beyond' the green stripe and vertical arrow representing third-order transformation in each sound world, and refers to completely reworked or synthesized spectral and microstructural properties.

Forward-moving and repetitive sounds in the global representation of sound worlds

(i) Forward-moving source-bonded sounding gestures

Let us recall that the term, forward-moving, denotes a sound that evolves over time. In this instance, the sound's tactility factor may also develop. Figure 2-13 illustrates eight different sound worlds that comprise forward-moving, source-bonded sounds as viewed through the spectral content and tactility factor continua. Harmonic spectra tend to possess smoother microstructures, and inharmonicity tends to be associated with granularity. However, as depicted by the blue, green, turquoise and yellow textured areas, there is great latitude for sound exploration and, thus, a vast potential for sonic diversity since spectral content and microstructure can be addressed separately, through real or non-real time cascading transformational processes or through sound synthesis. Sound examples 2.32 – 2.34 illustrate the second approach. Sound 2.32 (track 32) is a source recording of church bells from the Church of the Holy Sepulchre in Jerusalem. In example 2.33 (track 33), the recording was slowed to a third of its original speed. In a second transformation, the slowed recording was filtered to remove transient noise and artefacts. The resulting sound-shape, 2.34 (track 34), possesses a velvety fibre, and its very low-pitched harmonic and inharmonic spectra lose their real-world metallic, resonant character and pointed directivity, and sprawl forward with greater thrust than the original recording. This sound-shape can be heard in *Les Forges de l'Invisible* on channels three and four, from 43" to 1'04", and on channels one and two from 6'42" to 7'29".

(ii) Repetitive source-bonded sounding gestures

The spectra and morphology of a repetitive sound do not evolve. The sound's tactility factor is also unchanging; it may be smooth or may be regularly modulated to any degree. For example, a mechanical sound, such as a kitchen mixer, or a steady state sound occurring in nature, such as a waterfall, has a regular modulatory quality. Figure 2-13 can also be seen to display eight different sound worlds of repetitive source-bonded sounds as viewed through the spectral content and tactility factor continua. These sound worlds include examples of steady state harmonic spectra. However, as we can see, there are many inharmonic and noise-based repetitive sounds in nature and in civilisation. There is, nevertheless, ample room for exploration. For example, it is possible to fragment sustained harmonic spectra, refine the microstructure of steady state inharmonic or noise spectra, or create a new, non-evolving sound-shape.

2.3.2 Defining and eliciting pitch constructs in acousmatic music

Understanding the relationship between acoustics and an audio-frequency spectrum is a starting point for defining pitch. We know that an audio-frequency spectrum is based on acoustical energy and that it refers to the distribution of energy as a function of frequency for a particular sound. In harmonic spectra, all internal frequency components are whole-number multiples of a fundamental frequency and contribute to the overall perception of the fundamental frequency insofar as they are related to it by simple ratios and interlock with it in a precise physical way. We may then infer that what we perceive aurally, and subsequently identify as a pitched sound, is acoustical energy transmitted in the form of harmonic sound spectra.

Because the relationships between internal frequency components in an instrumental or vocal sound are mostly harmonic, instrumental and vocal mediums have been the primary vectors for the conveyance of harmonic spectra. These mediums were considered the underpinning of Western music until the twentieth century, a genre based on harmonic spectra, the laws of which rest on physics (Saunders, 1948: 7).

The term *acousmatic pitch* also refers to a perceptual construction based on harmonic sound spectra. However, the range of possibilities for eliciting pitch in acousmatic music can be extended, poietically, through *degrees* of harmonicity in sound spectra, which, in turn, affect, esthesically, the type of pitch construct a listener might make.[92] Hence, pitch can be seen as a flexible percept. For example, a listener

[92] My poietic concept, 'degrees of harmonicity', owes much to Smalley's esthesic concept of 'note-noise continuum'

may easily create an intervallic pitch construct, where an exact pitch can be heard, when the internal frequency components in a sound impart pitch insofar as they are whole-number multiples of a fundamental frequency. Conversely, a listener may more readily create a relative pitch construct, where exact pitches are no longer audible, when internal frequency components in a sound depart from multiples of a fundamental frequency. Additionally, varying degrees of harmonicity in a sound may drive other perceptual constructs between the extremes of intervallic and relative pitch. Filaments of sound spectra that are completely inharmonic or even noise-based may also contribute to certain types of pitch construct. Hence, perceived pitch can play a significant role in the spectral identity of a sound-shape as conveyed not only through varying degrees of harmonicity, but also through the relationship these spectra have, as a whole, when they co-exist with completely inharmonic or noise-based spectra in a sound.

The relationship between harmonic spectra and pitch/pitch space[93]

Pitch can be perceived through different degrees of harmonicity in two ways: the wealth of source sounds that contain varying amounts and combinations of harmonic spectra, and spectral transformation. For example, if we examine the spectral identity inherent in traditional instrumental sounds, we know that many consist almost entirely of harmonic spectra and, therefore, impart intervallic pitch via different fundamentals (pitches), each of which has a harmonic spectrum. Additionally, certain metallic resonances may contain diverse combinations of harmonic and inharmonic spectral components and, therefore may elicit diverse types of pitch construct. Conversely, relative pitch is but one part of the percept a listener may construct when apprehending an inharmonic spectral aggregate as conveyed by the sound of an orchestral gong.

Harmonic spectra and their alloys can shift in frequency within a sound-shape in a uniform manner, which can be interpreted as a pitch shift. Harmonic spectra can also multiply in spectral space over time, in such a way that they can be perceived to 'stream' from one pitch to multiple pitches. Additionally, a multi-pitched sound-shape can be perceived to evolve towards one pitch as multiple harmonic spectra converge. This effect occurs in example 2.35 (track 35), a sound from *Chat Noir*, where the narrowing of several pitches to one over time, through *portamento*, can be apprehended as a 'spiral-like' pitch evolution. Sound example 2.36 (track 36), an extract from *Chat Noir*, (1'42" – 2'05") illustrates the sound in the context of the work, where it aids in

(Smalley, 1997: 120).

[93] Pitch space is a subset of spectral space, defined in 2.3.

streamlining a pitched sound universe.

The intensity of a sound-shape's pitch may also change in different ways over time. First, certain frequency components inherent in a harmonic spectrum may become louder or softer, which may affect not only the perceived timbre but the way pitch is perceived in reference to other spectral components in the sound, if inharmonic or noise spectra are present. Secondly, through sound transformation, the internal vibrational relationships within a harmonic spectrum can shift out of alignment provoking a state of inharmonicity or noise, or conversely, in the case of noise, evolve to a state of harmonicity. The combination of these factors may contribute to the way in which the listener determines the threshold of pitch or inharmonicity. Hence, a sound can be seen to 'enter' or 'exit' a pitch-space or spaces.

Topology and proportion of harmonic spectra in a sound-shape

How harmonic spectra are manifested in a sounding gesture influences the way in which pitch is perceived. They may dominate the spectral identity of a sound, which, in turn, is perceived as pitched. An example of this occurs when playing a note on a cello with an on-the-string-bowing technique, as illustrated in sound 2.37 (track 37). As previously observed, harmonic and inharmonic spectra may unfold together, as in the sound of a carillon, where pitch may be perceived to be less exact. Noise can also exist with "transient pitch content, […] [for example, as heard in the sound of water] falling in a stream (rather than dripping, flowing or bubbling)" (Wishart, 1994). The sound of this spectral complex is illustrated in example 2.38 (track 38), a source recording of water falling into water in a large metal trough at a dam. Threads of harmonic spectra also may be striated delicately, and continuously, through primarily inharmonic spectra, as evidenced in example 2.39 (track 39), a source recording of the sound of duct tape being pulled away from a metal object. In this case, the ratio of harmonic to inharmonic or noise spectra might be very small. However, even hairline threads of harmonicity can 'colour' a sound-shape. Finally, harmonic spectra can be synthesized, as illustrated by sound 2.40 (track 40).

Projecting a pitch construct onto inharmonic or noise spectra

I propose that listening consciousness can project pitch onto non-pitched sound material creating a 'fused' percept. An example of a possibility for this type of fusion exists in *Ether* at 8'09" – 8'21". Depending on the listener or performance circumstances, the pitched drones between 8'09" and 8'21", at various intensities on all

eight channels, may 'colour' the recording of a spoken Latin mass, which can be heard on channels three and four, in such a way that the Latin mass can appear to be sung.[94] Sound examples 2.41 – 2.44 illustrate this possibility. Sound 2.41 (track 41) is an excerpt of the spoken Latin mass recorded at the Church of the Holy Sepulchre in Jerusalem. Sound 2.42 (track 42) is an excerpt of the drone on channels three and four, simultaneous to the Latin mass. Sound example 2.43 (track 43) is an excerpt of the prominent drone on channels five and six, and, in sound example 2.44 (track 44), the three sound-shapes are superimposed. Hence, although a pitch construct can be deduced from the harmonic spectra in the drones, the listening consciousness might also project the construct onto other spectra, particularly when the latter are inharmonic or noise-based.

Perceiving pitch in diverse sound-shapes

We have seen that some sounds based on natural energy models, such as certain metallic resonances, in addition to certain expressions of fluidity, friction, rotation, and rebound, can contain harmonic spectra and, therefore, can elicit a type of pitch construct in the listener. Further, transformational processes such as spectral tracing, and resonant or comb filters, can enhance any pre-existing harmonic spectra in a sound, or create the impression they exist.[95] From a poietico-esthesic perspective, these sounds may seem to acquire varying intensities of perceptible pitch in a similar manner that colours in a photograph may be intensified or diminished, depending on the desired level of saturation and the expected effect.[96] Further, the new pitch construct can evolve in tandem, or not, with the sound's morphology. Such transformational techniques can produce, for example, a series of pitched, cascading, metallic particles, (sound 2.45, track 45), which occur in *Neon* at 1'17" – 1'21". Example 2.46 (track 46) is another example of the overlay of 'harmonicity' onto a sound based on natural energy models. In this instance, the recording of a glass tipping over and rebounding on a metal countertop was reversed, slowed to less than half its original speed, and was transformed with comb filters and a Doppler effect, the four processes occurring in real-time cascade.[97] The result can be perceived as 'molten', yet subtly pitched, transparent, sound material, which increases in intensity and expectorates glassy, intensely pitched globes in a fashion similar to bubbles of air in molten glass that are

[94] A drone is a continuous or repetitive sound or noise that is perceived to have little or no temporal variation (Truax, 2010).
[95] This list of transformational processes is not exhaustive.
[96] In this case, the composer is the listener.
[97] The transformation was created, digitally, in real time, with the GRM Tools 2.0 stand-alone software.

released during a glass-blowing process. These sounds can be apprehended in *Chat Noir* in several instances between 5'58" and 7'22".

Perceiving pitch within the context of inharmonicity and noise

We have seen the relationship between harmonic spectra and pitch constructs. We have also seen how inharmonic or noise-based spectral components may take on degrees of harmonicity, and how a pitch construct can be projected on an inharmonic or noise-based spectrum. Thus, we may conclude that inharmonic or noise-based spectral components need not be considered separately from harmonic spectral components, or relegated to a certain temporal and expressive range, for example, as noise transients heard in the attacks of notes produced by standard orchestral instruments, or in voiced consonants. Rather, harmonic, inharmonic and noise-based spectral components can cohabit in a sound-shape, develop, and flourish in an environment where they contribute, mutually to the expressive factor of that sound-shape and to each other. Indeed, the existence of these diverse elements in a sound-shape, and the way they can develop together over time can provide a wide range of artistic possibilities.

2.3.3 The propriety of inharmonicity and noise

Inharmonic and *noise spectra* co-exist with harmonic spectra in an audio-frequency spectrum. We know that noise consists of all audible frequencies and involves random changes in frequency and amplitude. Although a state of inharmonicity may be judged by its acoustical and mathematical proximity to noise, I propose, initially, to consider inharmonicity with the same acoustical and mathematical laws that govern harmonic spectra. I suggest this because we can more easily categorise sound-shapes that comprise different combinations of harmonic and inharmonic spectra – which we can hear through diverse pitch constructs – than sound-shapes that constitute different combinations of inharmonic spectra and noise. A brief review of the acoustical foundation for harmonic sound spectra can be a starting point to defining inharmonicity.

In harmonic spectra, all internal frequency components are whole-number multiples of a fundamental frequency, and, therefore, fuse into a single pitch percept. On the contrary, in inharmonic spectra, not all internal frequency components have a simple mathematical relationship with a fundamental frequency because certain components are aperiodic. Hence, they do not contribute to the overall perception of a

fundamental frequency and therefore do not easily fuse into a single pitch percept.

Although inharmonicity and harmonicity differ, as previously discussed, they are not mutually exclusive from a perceptive point of view. Rather, in the same way that degrees of harmonicity can exist and convey different pitch constructs, degrees of inharmonicity can also exist and impart diverse pitch or non-pitch constructs. Therefore, while an acoustical model, such as harmonicity, is initially useful to gauge degrees of inharmonicity, it cannot alone describe the wealth of spectral possibilities inharmonicity offers. We must attempt to appreciate inharmonicity in its own right through its inherent aperiodicity. Further, we may ask what can the acousmatic composer communicate through inharmonicity and what can the listener perceive.

Expression and reception: the odyssey of inharmonicity

As discussed in 2.3.2, instrumental and vocal mediums have been the primary vectors for the conveyance of harmonic spectra. Sonic possibilities broadened, in the instrumental and vocal mediums, as experimental techniques and a more extensive use of percussion began to be folded into the Western orchestral and vocal repertoire at the beginning of the twentieth century. Sonic possibilities also widened as composers sought to create new instruments.[98] Thus, inharmonicity, an acoustic state to which the human ear had always been sensitive and discerning, began to unfold as an end in itself in the perceptual repertoire of the listener. Accordingly, it began to be embraced publicly.

The upsurge of interest in inharmonicity as new spectral territory in composition was not surprising seeing its numerous guises. For example, in regards to harmonic spectra, "The effect of mistuning one spectral component in an otherwise harmonic complex is well known" (Järveläinen, Välimäki, Karjalainen, 2004: 1).[99] As explained in 2.3.2, when multiple spectral components in harmonic spectra are slightly inharmonic, pitch is relative, as can be distinguished, for example, in the sound of metal wind chimes. If we assume there are numerous categories of inharmonicity which elicit different types and strengths of pitch percepts, we can make a similar assumption about the number of categories of inharmonicity that elicit different spectral percepts ranging from relative pitch to noise. One such category of

[98] An outgrowth of the Italian Futurist movement, the first concert entitled the "Art of Noises," which included the use of specially designed noise instruments, *Intonarumori*, was given in June 1913 at the *Teatro Storchi* in Milan (Manning, 2004: 6) (my italics).

[99] Further, as an indication of the importance of inharmonic spectra within a perceived harmonic complex, in tests where musicians and nonmusicians were asked to distinguish between real and synthesized piano tones, E. Donnell Blackham notes: "Synthetic tones that were built up of perfectly harmonic partials were described by the musicians and nonmusicians alike as lacking 'warmth'" (Blackham, 1978: 32).

inharmonicity can be seen to elicit indefinite pitch, as found in the sound of a bass drum, which, from the perspective of harmonicity, "[…] means only that the accuracy of defining its pitch by ear is not sufficient to locate that sound precisely within a western-music chromatic pitch scale" (Rakowski, 2004: 68). However, from the perspective of noise, this type of drum sound also can be interpreted as "[…] band-limited noise - - randomly related frequencies, but restricted within a certain frequency range - - giving a sense of pitch range, or non-specific pitch rather than an identifiable fundamental" (Dobrian, 1997). Finally, inharmonic and noise spectra can co-exist, for example, in the sound of a cymbal crash.

Noise

The most aperiodic examples of inharmonic spectra unfold as noise, which can take a variety of colours, the best known of which are white and pink noise.[100] From an acoustic viewpoint, in its widest possible definition, noise consists of all audible frequencies, involves random changes in frequency and amplitude, and, therefore, is devoid of any mathematical relationships between frequency components. From the listener's viewpoint a sound can be perceived as noise when it contains many different frequencies and is complex to the extent that it does not fuse into, nor can be situated in any type of pitch percept.

Like inharmonicity, different colours of noise can take diverse shapes. For example, noise can be manifested as thin or thick bands in the audio frequency spectrum. It may appear independently or be striated between other spectra that are harmonic or inharmonic. Noise can be transient, sporadic, or ongoing. Finally, it can appear with greatly varying shades of intensity. For example, a very loud and potent example of the most generalised form of noise, white noise, is the thundering sound of a waterfall. Conversely, a soft, refined example of white noise is the sound of light rainfall, where the high-pitched, thin noise band imparts a fragile acoustic universe. Another type, pink noise,[101] is "acoustical energy distributed uniformly by octave throughout the audio spectrum" (Whatis TechTarget, 2008).[102] According to Valerii Vinokour of the Materials Science Division of the Argonne National Laboratory in Illinois, this type of noise appears in many physical circumstances.

[100] White noise is analogous to white light, whereas coloured noise has more energy at some frequencies than others, analogous to coloured light (Rane Professional Audio Reference, 2010).

[101] Pink noise is also referred to as '1/*f* noise'. "[…] There is no exact (rational, finite-order) filter which can produce it from white noise […] because the ideal amplitude response of the filter must be proportional to the irrational function $1/\sqrt{f}$, where *f* denotes frequency in Hz" (Smith, 2010).

[102] (Whatis?com, 2010).

> "One-over-f noise appears almost everywhere, from electronic devices and fatigue in materials to traffic on roads, the distribution of stars in galaxies [e.g. the omnipresent background noise in the universe, generated by the universe's electromagnetic activity], and DNA sequences."[103]

Further, according to Argonne National Laboratory, "Humans and other animals carry a common example in their heartbeats, where 1/f noise can be detected as a deviation from normal pulse" (Argonne National Laboratory, 2010).

Seeing the diverse ways in which noise appears in nature and in civilisation, one could ask what might be the effect, if any, of noise, particularly pink noise, on culture. This question is particularly relevant to music since "The most interesting feature of pink noise is that it is moderately correlated over all time-scales and so, on the average, it should display 'interesting' structure over all time intervals" (Barrow, 2005: 275). In order to address this question, John Barrow notes previous research, where two physicists in the University of California at Berkeley, Richard Voss and John Clarke, analysed diverse recordings of musical works in 1975 to see if the works revealed any spectral similarity to scale-free noises. Voss and Clarke discovered that a large variety of classical compositions were intimately approximated by 1/f pink noise over an extensive range of frequencies. Additionally, synthesized musical works, where both the pitch frequency and the duration of the notes were selected from 1/f statistics, were found attractive (*ibid.*: 275).

Inharmonicity and noise in acousmatic music: an acoustical heritage

In the twentieth and twenty-first centuries, it has become no longer necessary to consider musical composition as approximated by 1/f pink noise. This is because, as noise has been a part of nature and civilisation, it has permeated the fabric of twentieth and twenty-first century music in its own right, for example in the 'organized sound' of Edgard Varèse (Manning, 8: 2004). Other examples of this tendency can be found in the *musique concrète* of Schaeffer, the random stochastic processes of Iannis Xenakis, and granular synthesis (Jensen, 2004).

Although harmonic spectra can be perceived immediately in an acousmatic work due to cultural conditioning, we may consider them as part of a broader spectral picture that includes inharmonicity and noise to an equal degree. This is because our

[103] (Argonne National Laboratory, 2010).

acoustical heritage is not limited to harmonic spectra. It is, therefore, the responsibility and the challenge of the composer to harness the raw power of inharmonicity and noise and convey these spectral states so that they may communicate to an audience. Inharmonicity and noise add depth, richness, intensity, texture, scope, thrust, and expressivity to a musical work in a way that different shades of grey and black may add depth to a painting, photograph, or film. Further, because different types and forms of inharmonicity and noise can be threaded into harmonic spectra, and develop over time, they can assist greatly in titrating the required intensity of harmonic spectra to befit any compositional and, therefore, communicative need.

As we shall see in Chapter 3, inharmonic spectra can span the vast and fertile spectral range between harmonic spectra and noise. They can also unfold alongside or permeate harmonic spectra and noise, often swiftly and with extreme suppleness and subtlety, in the same manner that noise can unfold with or pervade harmonic and inharmonic spectra.

Chapter 3. Structural Attributes

3.1 Introduction

The listening strategy *Structural Attributes* which is founded on Delalande's notion of Taxonomy, also serves as a window through which to analyse the works in the composition folio from a poietic perspective. In structural attributes, energy can be seen to pervade and enable *all* structuring processes through the aural trace. My exploration of structure begins with an observation of the significance of sounding gesture in structure. Discussion begins with the structuring processes offered by small-scale gesture from the perspective of energy models as well as reshaped gestures, and then turns to the syntactic possibilities offered by other small-scale gestures such as incomplete and distorted sounds and the much larger meta-sound. I suggest time also functions as a structuring process through energy because energy drives the manner in which temporality is conveyed in a sounding flow through the aural trace. For example, forward-moving and repetitive types of energy distil into forward-moving or repetitive sound-shapes which the composer can combine within the same topology, or not, to create a nuanced temporal flow.

My belief in the primacy of energy also extends to large-scale structure, where I develop sonic topologies using the principles of energy and matter, notably in my figure-ground relationships, which are conceived through this energetic perspective. Sonic webs, which are essential to my figure-ground relationships, are also conceived through the same energetic perspective. Finally, as we shall see, the absence or attenuation of energy can, additionally, be seen as a structuring process as perceived through silence, stasis-points and inactivity in the sounding flow, energetic voids in the sounding flow and through the omission or severance of a sound-shape or part of a sonic topology.

3.2 The Significance of Sounding Gesture in Structure

In Chapter 2, I proposed that, from an acousmatic perspective, the unfolding of energy into a tangible plane concerns the aural trace left by the morphogenesis of gesture. This idea arose as a result of having examined the parallel between the physical universe's Matter-Energy continuum and the physical and psychological systems inherent in the human being – symbolically represented by three interconnecting continua in the Indo-Tibetan tradition – where I observed that energy pervades all conceivable forms (matter). Further, the possibilities for gesture in acousmatic composition are not limited to the articulation of existing sounding and non-sounding models, gesture being seen as the object. Rather, the creation of any gesture is governed by the subject – the composer's imaginative capacity. This viewpoint allows gesture to be conceived as an expression of the imagination, and it facilitates an unfettered approach for the translation of the composer's ideas into sound.

In acousmatic composition a gesture can be perceived through its tangible counterpart, an aural trace – a sound. Although an isolated entity, a sound can be regarded as the most straightforward proponent of structure and, additionally, the smallest integral building block and expressive element. In Chapter 2, I suggested that a classification of sound-shapes based on their spectromorphological qualities is a prerequisite for composition. The composer determines the final role of a sound by situating it in an acousmatic piece, thereby giving it a contextual purpose and function, which is crucial for the establishment of a structural and metaphorical basis for the piece.

When a sound is placed in an acousmatic context, an interesting dialectic emerges between the sound's initial classification, which can be seen as a reference point, its function in a sonic context, and the way the context reflects back on the original classification. The process of contextualisation can overrule an initial classification and can aid in developing metaphorical value initially attributed to a sound. For example, the sustained *sul ponticello* violoncello source-recording at the beginning of *Ether*, which can be heard in its original form at a low volume on all eight channels, and slightly later in a fragmented form (sound IIa in Figure 6-8), is also woven into the sonic texture on different channels until 4'22". This sound was initially classified as a source-bonded instrumental sound. However, I interpret it as a source-bonded, sustained sung vowel in the musical context. I also perceive the fragmented violoncello sound as rhythmicised, pitched exhalations. Both sounds can thus be

perceived to add an intimate, 'vocal' human presence to the first part of the work. Another example of the way contextualisation can overrule classification occurs at the end of *Ether*. In this case, a transformed, fragmented version of a sustained, pitched, violoncello sound, which has a pulsing bass and high-pitched, halo-like artefacts, occurs on channels 3 and 4 at 10'39" – 11'13" and again at 11'51" – 12'27", as well as on channels 5 and 6 at 11'23" – 11'43" and again at 12'24" – 12'32". Although I classified this sound in my *saccadé* (jerky) folder, its extremely transformed and fragmented nature was not immediately appealing. However, in context, the sound – which can be heard throughout different sections near the end of *Ether* – helps to impart closure of the piece insofar as it communicates the fragmentation of the formal organisation and consequently, the metaphorical discourse of the piece.

Contextualisation can also highlight subtle pertinences germane to the sound that otherwise might be pre-empted by its more salient spectromorphological qualities. An instance of this occurs in *Ether*, where the source-bonded recording of duct tape being pulled away from a metal object (similar to the spectromorphology of sound example 2.39) can be heard on all eight channels at 7'45". While classified as a rough noise-based source sound, this recording serves, convincingly, as a junction between two pitched contexts because it has transient pitch content.

As discussed, the contextualisation of a sound reflects back on the sound's original classification. This is because contextualisation imbues the sound with new meaning, whether the context follows the original classification or not. Further, when re-listening to a contextualised sound in isolation, the sound can bring forth, in my mind, not only the entire section of the piece in which it exists, but the meaning the section conveys.

The dialectic between classification and contextualisation can become more elaborate in an acousmatic work when a sound, or a variation of it, occurs in several discrete instances throughout the work. An example of such a contextualisation in instrumental music, albeit on a larger scale, occurs in Maurice Ravel's orchestration of Modeste Moussorgsky's suite *Pictures at an Exhibition.*[104] In this instance, the theme in the opening *Promenade* re-appears as an interlude between various movements (tableaux) in different tonalities, styles, and registers, accruing structural and metaphoric relevance at each occurrence. The acousmatic composer's awareness of the two-way relationship between a classified and a contextualised sound is a fundamental tool that helps to enlighten and inform the compositional process.

[104] (Boosey & Hawkes).

3.2.1 Small-scale gesture

I regard a *small-scale gesture* as the expression of energy materialised through gesture into a distinct source-bonded, transformed, or synthesised sound. I also see it as an entity that the composer can conceive or further alter, responding to structural needs of the work that arise during the process of contextualisation. The following discussion examines the sounds' spectromorphological pertinences as well as their structural significance in the works in the folio, both of which were established, poietically, using this tripartite approach.

Structure and energy models

Morphologies and motion trajectories inherent in sounds based on *energy models* are not only natural structuring agents, but are also inspiring in diverse ways. For example, the forceful impetus of the attack in a percussion/resonance can announce the beginning of a work. It can cleave a work into sections and subdivide or punctuate sections. Additionally, it can function as an antiphonal element and, therefore, initiate new directions in the course of a work or prepare for the introduction of new material. The resonance part can serve as a foundation out of which other sounds emerge and evolve as the resonance abates. Many percussion/resonances occur in *Ether*. For example, a transformed percussive attack introduces the piece and its ensuing resonance slowly yields to other sound-shapes. Variations of this potent sound transformation, made with filtration, pitch shift and spatialisation transformation techniques, occur at 56", 3'52", 5'02", and 8'39" in the piece, where they announce new material or transitions. Additionally, softer attacks and resonances subdivide these sections.

Swells

The energy model referred to as fluidity serves as a paradigm from which I conceive types of *swells*. These sounds are characterised by brief, internal energy surges that coalesce in a sponge-like form and can protrude above, below or through the existing sounding flow towards the listener. Although swells can range from the source-bonded to the synthetic, they often appear to have no attributable cause. Nevertheless, this indeterminate and highly malleable nature allows a swell to function as a gelatinously pliant type of punctuation that can drape, underpin, or otherwise be embedded in a sound world. Swells can be seen as 'transparent' carriers of structure by virtue of their discrete nature. They can gently push a sonic topology forward in time, help to shape

or steer a musical idea, aid in the definition and development of a musical context, or propel one section into another. Moreover, the extreme elasticity inherent in swells serves not only a wide range of structural functions, but also renders swells particularly apt to sustain metaphorical construction. An example of such a dual purpose occurs in the first movement of *Les Forges de l'Invisible* at 3'58", where a swell can be heard (sound example 3.1 on track 47, from 3'57" to 4'12").[105] From a structural perspective, the upward spectral shift in the swell on channels one and two 'lifts' the multi-channel gestural dialogue, uniformly, to a higher pitch-plane. However, on a metaphorical level, the slight, upward-moving spectral motion could appear as a spatial shift, beyond the substance of the piece, toward a higher altitude. The ensuing sound world in the work, replete with transparent, shimmering, and iterative gestural forms, could, as a result of the swell, be imagined as the sounding equivalent of an elevated and rarefied atmospheric state such as the night sky as witnessed through a telescope.[106]

Swirls and rotations

The form of a *swirl* or a *rotation* is archetypal in human history, hence, the justification for disassociating the following discussion from ones that examine the relationship between structure and energy models.[107] An archetype is defined as a fundamental, and it can take numerous external shapes, and hence have numerous and even contrasting roles. For this reason, I consider swirls and rotations to be multi-functional. They can, like swells, aid in delineating a musical context, elaborate it or nudge one context into another. However, in contrast with swells, rotations and spirals have a more concise spatial and spectral trajectory in lieu of a sudden general energetic onset. Further, the three-dimensionality often found in a swirl or rotation allows it to 'reach' into the foreground and/or background in addition to its trajectory across the stereo axis as it develops over time, giving to it an added thrust. Such finely etched attributes provide swirls and rotations with the impetus to introduce new sections in a work. An example occurs in *Neon* at 4'45", (sound 3.2 on track 48, from 4'42" to 4'49") where a small-scale rotation ushers in a new sound world. In addition, swirls and rotations fulfil not only structural roles that aid context, but can also be lynchpins in figure-ground

[105] Sound examples from the multichannel works in the folio are provided in two formats: (1) two sets of eight flat AIFF mono audio files on the DVD-ROM (one set of files for all multichannel sound examples and one set of files for *Ether* multichannel sound examples, which permits the *Ether* examples to be heard with the *Ether* loudspeaker placement scheme) in which the multichannel sound examples are placed in the order they are discussed in the thesis; and (2) a stereo reduction of the multichannel sound examples on Audio Compact Disc 2 containing the stereo sound examples.

[106] I conceive the structure of a work before and during the compositional act. However, at times the metaphorical value intrinsic to structure only becomes clear retrospective to the compositional act, as it was in this case.

[107] In Jungian psychology, an archetype is an image from the collective unconscious, an inherited memory. Archetypes "[…] emerge in the individual psyche through dreams and visions" (Berry, 2000: 23).

relationships. Furthermore, they can facilitate or inhibit temporal flow, and can also appear in large-scale formats as meta-sounds.[108] Finally, swirls and rotations may have multiple structural functions within the same piece. The extensive flexibility offered by these archetypal figures thus permits structure to be constructed in an organic way.

3.2.2 Reshaped gestures

The viewpoint of the composer

A *reshaping strategy* frequently implies the remodelling of morphological contour in a sound, which may comprise simple, but substantial, adjustments to the dynamic. An example of straightforward reshaping is the suppression of the audible trajectory between two poles in a source recording based on the energy model named 'swaying', a process that prods the source recording to 'resemble' a sound-shape based on the energy model named oscillation.[109] Examples 3.3 and 3.4 (tracks 49 and 50) illustrate this approach. Example 3.3 is a source recording of a marble rolling from one end of a metal bar to the other. In example 3.4, the audible trajectory of the marble is removed, and the clicking sound of the marble at the ends of the bar is retained and duplicated where necessary. Reshaping may also imply a comprehensive redesign of a sound's spectral qualities in addition to its morphology (e.g. extensive filtering of a drone and revising of its morphological silhouette so that the drone evolves over time). This technique unites a repetitive expression of energy, manifested primarily on an interior level as spectral flux, with a forward-moving morphology, creating a versatile hybrid. Within an acousmatic work, such customised sound material can fulfil specific temporal and context-sensitive roles. However, reshaped sounds can also mediate, on another level, between sounds that are forward-moving and repetitive as well as between those that unfold on other registers in the Matter-Energy continuum, insofar as a hybridised sound can embody elements of its source-bonded and ambiguous counterparts.[110] The possibilities for reshaping are not limited to the imitation of existing sounding and non-sounding models: they are governed, as are all other aspects

[108] The structuring processes engendered by meta-sounds will be discussed in 3.2.5.
[109] 'Swaying' is the English counterpart to the French term *balancement* and is based on a bipolar rocking or swaying motion, where, unlike an oscillation, the trajectory between the two poles is audible and is central to the model. The trajectory can be seen as a conduit, the speed of which can be summarily dilated, compressed, or otherwise altered en route. Visual examples of swaying include the movement made by a seesaw or a swing, while an audio-visual example is a marble that slides back and forth from one side of a grooved metal bar to the other. The energy model, oscillation, is also founded on a bipolar rocking or swaying motion. However, the oscillating motion is regular and mechanical, and the trajectory between poles is inaudible. A visual illustration of oscillation is the movement made by a pendulum.
[110] See 2.2.1 for an explanation of the Matter-Energy continuum.

of acousmatic composition, by the composer's imagination.

The listener's perspective

Esthesically, reshaping is understood as a consequence of change. It is apprehended through recurrences of a sound-shape within an acousmatic work, each of which takes a different form. The perceived shift often can be in proportion with the reshaping process, for example subtle or extensive alterations of a sound can often be perceived as such. Other factors, notably sonic context and temporal evolution, may also contribute to perceptual interpretation. Inevitably, the esthesic perception of reshaped sounds begets another question: at which point is a reshaped sound apprehended as being a new sound? Before addressing this issue, the situation of drastic contextual change must be discounted, since a sound-shape may be apprehended as reshaped or even new due, entirely, to a contextual shift. I propose a four-tiered approach regarding the perception of sounding gesture and its surrogates within an acousmatic piece.[111]

(i) Fine alterations to the sound

When the composer makes fine alterations to a sound, (e.g. slight changes to the existing morphology or subtle filtering of the spectra) the listener may recognise the sound, associate it with the source recording or perhaps perceive it as the source recording.

(ii) Substantial spectromorphological[112] design

In the case of a more substantial spectromorphological redesign, the listener might recognise, in the transformation, one or more qualities inherent in the source sound, such as a characteristic of the original morphology or a common spectral attribute. The listener may also imagine one or more of the missing properties by recalling the non-transformed sound.

[111] My intramusical approach to surrogacy examines the level of remoteness perceived in a sound transformation in reference to its parent source recording, when both are in an acousmatic work. It is a continuation of the concept of gestural surrogacy, developed by Smalley, which, in electroacoustic music, examines the level of remoteness perceived in a sound in reference to a supposed source and cause (Smalley, 1997: 112).
[112] (Smalley, 1997: 107).

(iii) Extensive reworking of the sounding gesture

If the composer reworks the sounding gesture extensively, a perceptual link with the original can be maintained through common behavioural and spatial attributes. However, at this level, the perception is fleeting and can be easily disrupted, at which point the listener may or may not consider the reshaped sound as a new one.

(iv) Comprehensive reworking of the sounding gesture

When a composer comprehensively redesigns the spectromorphological attributes in a sound, the esthesic connection between the initial recording and the transformed sound is eradicated. However, the composer's poietic knowledge of the connection is a valuable structuring process, and can function as a binding element. I propose that the reason for this lies in the organic nature of the relationship between a sound and its reworked counterpart which can shape and form the composer's intentions. I also propose that this relationship can influence esthesic reception in a subliminal way because the type of energy the listener brings to the listening act can follow the intention of the composer.[113] Because the common denominator between sound-shapes is energetic similitude, the listener may perceive the organic connection without being fully conscious of it. Numerous examples of this compositional technique exist in *Protopia/Tesseract,* where the source-bonded recording of a train appears at 1'28" and, although largely unrecognisable in later instances, aids in imparting coherence throughout the piece by way of its forward-moving spectromorphological nature and large spatial dimensions. Figure 3-1 exhibits specific structuring processes engendered by a comprehensive reshaping process as applied to the source-bonded train recording. As broached in the beginning of 3.2, structure is allied to metaphor. The lower row in each example, therefore, probes the potential metaphorical value 'behind' the perceived structural construction.[114] Sound examples 3.5 – 3.16 (tracks 51-62) chronicle the six instances in the work, where the recording of the train can be heard, initially, as a source-bonded recording and, later, in ambiguous forms.

[113] The concept whereby energy follows intention owes much to 'morphic resonance', a term invented by Sheldrake, which can be defined as "the influence of previous structures of activity on subsequent similar structures of activity organized by morphic fields." According to Sheldrake, a morphic field is the territory "[…] within and around a morphic unit [e.g. 'a unit of form or organization, such as an atom, molecule, crystal, cell, plant, animal, pattern of instinctive behaviour, social group, element of culture, ecosystem, planet, planetary system, or galaxy'], which organizes its characteristic structure and pattern of activity" (Sheldrake, 2010).

[114] Composers' esthesic perceptions of their works are suffused with poietic knowledge, as was the case in this discussion of *Protopia/Tesseract*.

Instance N° 1	*Example 3.5 (track 51): 23" source recording of a train*
Occurs at	1'28"
Duration in Context	20" (Example 3.6 (track 52): source recording in the context of the work).
Spatial Location	Channels 1 and 2.
Spectro-morphological Characteristics	Source recording of a train as it leaves a station. It is morphologically fluid with the exception of surface artefacts. The sonic interior is a densely packed combination of inharmonic and noise-based spectra, as heard in the friction of metal on metal. The tessitura rises steadily over time.
Structuring Processes	The source recording was amplified and superimposed on itself at regular time intervals. It separates the introduction of the work from the body with its languid but steady, impervious sonic character.
Possible Extra-Musical Metaphoric Value	The slow motion and massive spectral thrust associated with the sound image of a departing train conveys a sense of journey, a severance with a current physical or psychological reality and a willingness to move on.

Instance N° 2	*Example 3.7 (track 53): 8" sound transformation*
Occurs at	3'15"
Duration in Context	15" (Example 3.8 (track 54): sound transformation in the context of the work).
Spatial Location	Channels 3 and 4, repeated in channels 5 and 6.
Spectro-morphological Characteristics	The source recording was transformed with resonant filters and then re-transformed with the Metasynth software to create a pitched, spectrally rich, slow-moving form.
Structuring Processes	The 'energy' in this sounding gesture is similar to that of the source-bonded recording at 1'28". The transformed train recording, which culminates a section, is preceded, accompanied and succeeded by other quieter sound material: a sustained piccolo note, and a sustained granular sound. Although shorter, the transformed train recording serves as a 'switch' to 're-direct' the two other sustained sounds to introduce the upcoming section.
Possible Extra-Musical Metaphoric Value	A listener can luxuriate in and fixate on the spectrally lush and expansive quality of this slow-moving, melodic fragment. However, within the context of the work, its metaphorical value can be appreciable in the way the listening consciousness is gently 'detached from' and later 're-deposited onto' the sustained piccolo and granular sounds, the meaning of which may become distanced from any significance prior to the slow-moving, train recording transformation. The piccolo and granular sounds are now harbingers for the future.

Instance N° 3	*Example 3.9 (track 55): 11" sound transformation*
Occurs at	5'20"
Duration in	25" (Example 3.10 (track 56): sound transformation in the

Context	context of the work).
Spatial Location	Channels 7 and 8.
Spectro-morphological Characteristics	Smooth, 'velvety', low-pitched, transformed sound-shape. Its pitch rises by an augmented 4th via a slow glissando.
Structuring Processes	This sound-shape closes the first movement. Its rich yet uniform spectral attributes and unadorned environment contrast with the preceding nodal and glassy topology.[115]
Possible Extra-Musical Metaphoric Value	The smooth and gradual upward transposition can be perceived, physically, as an upward shift in elevation. Hence, it can prepare the listener for a new perceptual vista.

Instance N° 4	*Example 3.11 (track 57): 6" sound transformation*
Occurs at	7'44"
Duration in Context	10" (Example 3.12 (track 58): sound transformation in the context of the work).
Spatial Location	Channels 5 and 6.
Spectro-morphological Characteristics	The second half of a low-pitched, velvety, muted sound transformation created with frequency shift and resonant filtering. The transformation is superimposed on itself at regular time intervals, thereby creating the impression of an *ostinato*. It is unobtrusive in this context in the piece.
Structuring Processes	The faint *ostinato* creates a 'mobile' spectral root. Hence, it functions as lissom connective sonic tissue that binds a previous 8-channel percussion/resonance to a subsequent, high-pitched granular section.
Possible Extra-Musical Metaphoric Value	The ground moves under the listener's feet. It swells upwards gently and retracts downwards, suggesting an unstable, fluid-like foundation such as one caused by air turbulence and perceived, physically inside a plane.

Instance N° 5	*Example 3.13 (track 59): 11" sound transformation*
Occurs at	8'07"
Duration in Context	17" (Example 3.14 (track 60): sound transformation overlaid with the source-bonded train recording in the context of the work).
Spatial Location	Channels 3 and 4.
Spectro-morphological Characteristics	A potent aggregate created by overlaying a spectrally lush sound-shape, derived by transforming the train recording with a resonant filter, onto the source-bonded train recording.
Structuring Processes	By virtue of its spectral intensity, source-bonded attributes, and pronounced amplitude, this sound transformation functions as an 'over-sized' counterpoint to previous smaller-scale events from 7'53" to 8'. It monopolizes the sonic environment and, singularly, draws the work forward in time.
Possible Extra-Musical Metaphoric Value	The dual spectral nature of this sound is central to metaphorical construction. The listening consciousness is initially 'lifted' upwards, by the ascending melody, yet is also propelled forward

[115] A nodal sound is a spectral "[…] aggregate whose pitch cannot be determined" (Couprie, 1999: 14).

	in time by the locomotive image associated with non-transformed train recording. However, the sensation of physical 'journey' abates when the source-bonded recording fades away, surrendering to the higher-pitched *ostinato*, which 'laps' at the now 'stilled feet' of the listening consciousness.

Instance N° 6	*Example 3.15 (track 61): 14" sound transformation*
Occurs at	10'22"
Duration in Context	14" (Example 3.16 (track 62): sound transformation in the context of the work).
Spatial Location	Channels 3 and 4.
Spectro-morphological Characteristics	The train recording is transformed with resonant filters and is spectrally stretched, which yields a pitched, spectrally rich *ostinato*.
Structuring Processes	The *ostinato* is the mobile and fluid base over which other time-sensitive sound events (e.g. two sets of rotations) develop and build to a climax.
Possible Extra-Musical Metaphoric Value	The smoothly undulating and repeated melodic fragment functions like an incantation, a spell, which prepares and sustains the listening consciousness during the 'circular sonic storm' near the end of the piece.

Figure 3-1. Structuring processes engendered by six reshaped gestures in *Protopia/Tesseract*

3.2.3 Composite gestures and band-limited textures

The *composite gesture* is an outgrowth of the 'composite object', which was originally composed with analogue techniques. It consists of two or more separate sounds or sound fragments that occur in rapid succession, and which the listener may consider as one unit.[116] Alternatively, composite band-limited textures consist of separate, but spectromorphologically similar sound-shapes – often repetitive in nature – that are superimposed and can be perceived to 'stream' in bands.

Composite gestures

Composite gestures can be seen as an uninterrupted sequence of two or more sounds or sound fragments, where the spectromorphologies are different and/or contrasting. In the past, the composer created a composite object with analogue techniques, by splicing small pieces of tape, or by mixing. Current techniques permit composite gestures to be realised with digital audio software. Further, the composer can create three-dimensional composite gestures in a multichannel format by placing sound-shapes on

[116] The term, composite gesture, is derived from the French *objet composite*, a short sound object where different types of elements are combined in succession and form a perceptual whole (Vande Gorne, 2006: 14).

different channels in rapid succession to form a perceptual whole. For example, in *Les Forges de l'Invisible*, at 5'57", a brief but powerful, low-pitched 'roar', on channels three and four, is preceded by a low-pitched, semi-rotation on channels seven and eight, the rotative quality of the sound being achieved with a Doppler effect. This composite gesture (in sound example 3.17 (track 63), 5'55" to 6'05" in the work) may be perceived as one entity, the antiphonal nature of which can be seen as two parts of a larger whole that effectively circumscribes and accentuates a section of the three-dimensional space within the octophonic framework. In contrast, a large-scale illustration of multichannel gestural fusion exists in *Ether* between 8'39" and 9'24" sound example 3.18 (track 64), where a dense section comprising attacks, resonances, friction-based sounds and drones, functions as an eight-channel counterpoint.

Band-limited textures

Band-limited textures are often created with sounds that are morphologically similar and frequently repetitive in nature. They are superimposed or dovetailed, develop as an integrated sounding flow with specific spatial and spectral attributes, give the impression of being woven together and, therefore, may be perceived to 'stream' as a dense or diaphanous band. An example of this sonic association unfolds in the form of an ongoing aggregate of tiny beads and short friction-based sounds, which can be apprehended during the first three minutes of *Neon*. Sound example 3.19 (track 65), 20" – 43" in *Neon*, may convey the sense of semantic unity and complexity imparted by these intertwined sound-shapes, which introduce the work. Swathes of superimposed beads also participate in the sonic landscape in *Neon*, between 4'45" and 6'30". However, in this instance the beads have a larger bore, rendering them spectrally and spatially more present. Another band-limited texture occurs in *Chat Noir*, between 3'11" and 4'21", where accelerated and filtered source recordings of a miniature accordion are superimposed, creating an increasingly dense, yet fleeting, and playful, aural kaleidoscope that embodies the scherzo-like nature of the piece.[117] Within the works in the folio, the most spectrally delineated instance of this type of sonic construction can be heard in the second movement of *Protopia/Tesseract*, from 10'21" until 11'37" (in sound example 3.20 (track 66), an extract from 10'18" to 11'42" in the work). This band-limited texture is composed with two complex sounds.

[117] My fascination with sound leads me to make source recordings in diverse settings. These include nature, urban landscapes and studio-based recordings with sounding bodies, as well as studio and non-studio-based recordings with traditional and non-traditional instruments. I select sounds from the source recordings in view of creating as broad a spectromorphological and spatially diverse group for each piece as possible; they are the foundation for expressivity.

At 10'20", the first, a sylph-like forward-moving spectromorphology becomes audible, yet is stationary, on channels seven and eight. At 10'37", this sound repeats, with slightly different morphological contours, in a dovetailed fashion in other channels in such a way that it 'revolves' in the eight-channel space in a clockwise motion.[118] At 10'43", the second, a similar type of forward-moving sound can be heard on channels one and two. After several seconds, the second sound reappears, with varying morphological shapes, in a dovetailed fashion in other channels in such a way that it 'revolves' in the eight-channel space in a counter-clockwise motion.

3.2.4 Incomplete and distorted sounds

Incomplete and distorted sounds are created and apprehended as being unfinished or deformed. The sensation of non-completion or distortion arises when the sound does not behave according to composer or listener expectations. All sounds reside within the domain of expectancy, but one is aware of expectancy even more dramatically in the case of these sound-shapes. The composer, as well as the listener, initially understands and qualifies the inner logic of these sounds, however fleetingly, which nevertheless deviate from an expected trajectory or behaviour through lack of completion or distortion. Because the departure exceeds the perceptual threshold of 'normality', the listening consciousness shifts the sound from the realm of the 'known' to the one of 'unknown', thereby drawing attention to the concept of expectation.

Similarities between incomplete and distorted sounds

On an overt structural level, incomplete and distorted sounds enhance and steer the sounding flow, punctuate it, and add semantic interest without impeding or stopping it. To what extent a sound is incomplete or distorted has a bearing on the work. This factor operates in tandem with the sound's other spectromorphological attributes, (e.g. spectral content and distribution, morphological complexity, scale, amplitude, etc.) and its presence within the context of a larger topology. However, on another level, the severance of expectancy, a psychological effect resulting from the incomplete and distorted sound-shape, creates new possibilities for the composer and the listener. When expectancy is denied, the composer and listener are free to invent new meaning for the incomplete or distorted sound, which also impacts on any subsequent sound

[118] In *Protopia/Tesseract,* the channels are organised in pairs, from front to rear. Hence, a movement in clock-wise motion, starting with channels 7 and 8, implies that sound material passes in the following channel order: 5, 3, 1, 2, 4, 6, 8 and 7.

material. In this way, incomplete and distorted sounds allow the listening consciousness the opportunity to construct the necessary psychological space in order for the mind to imagine and experience emotion.[119] They give substance to the work and to the listening experience.

Characteristics of incomplete and distorted sounds

(i) Incomplete sounds

Incomplete sounds are often based on energy models, and can be identified as incomplete because their motion trajectories are interrupted (e.g. a non-terminated rotation, a semi-circular or less than semi-circular trajectory, unidirectional 'swaying', or an 'arrested' rebound). Deviation, thus, is based on non-completion. An illustration in the form of a non-terminated rotation occurs in *Chat Noir* at 3'10". From the composer's perspective, the rotation trajectory begins at 3 o'clock, on an imaginary horizontal clock, and travels, initially, 'forward' in space in clockwise motion, and then 'backward' to 12 o'clock. The sound leaves an unfinished segment at the end of its trajectory, if rotation is to be the goal. Without closure, it enhances the existing sound flow. The listener is thus free to imagine the closure or not. Sound example 3.21, (track 67), 3'03" to 3'18" in *Chat Noir*, illustrates the concept. The ramifications of this incomplete sound are discussed from a spatial viewpoint in 6.3.3.

(ii) Distorted sounds

Distorted sounds can also be based on energy models. In this case, the motion trajectory of the sound is complete, yet is deformed. Other types of distortion can apply to the spectra in a sound-shape. Deviation, in this case, arises by exaggerating a spectral or morphological attribute, or both. An example of spectral distortion, in the form of aliasing, occurs in the second movement of *Les Forges de l'Invisible* in channels five and six, from 10'18" to 10'40", and again from 10'49" to 10'56".[120] Sound example 3.22 (track 68) illustrates this form of distortion, which can be heard on channels five and six at 10'18" – 10'40" and unfolds as a sustained, yet highly malleable roar embedded with constant spectral 'spikes'. Sound example 3.23 (track 69), an extract of the work from 10'18" to 10'40", illustrates the sound in the context

[119] Leonard Meyer explored the link between the concept of expectancy and emotion in music in his book, *Emotion and Meaning in Music.* According to Meyer, "[…] the central thesis of the psychological theory of emotions [posits that] emotion or affect is aroused when a tendency to respond is arrested or inhibited" (Meyer, 1956: 14).

[120] In digital sound, aliasing is a type of distortion that produces sound artefacts, where high-frequency components are replicated as low-frequency components, which distorts the replication of the signal. Aliasing occurs when the sound signal is sampled at intervals that are too great to accurately replicate the original signal (Alliance for Telecommunications Industry Solutions, 2010).

of the work. Like incompletion, distortion can open a door to new possibilities for compositional and listening experiences through the severance of expectancy. Indeed, the concept of distortion is a vital and necessary component to any human construction. It usually resides on the opposite side of the concept of beauty, both of which are balanced, delicately, by the fulcrum of human consciousness.

3.2.5 Meta-sounds

A *meta-sound* is a form that is created and that unfolds on an environmental register.[121] It is inspired by the source-bonded sounding gesture, but is not a simple amplification of source-bonded material. Because its spectromorphological properties are entirely reworked and enhanced through multiple stages of transformation, the meta-sound is considered as an 'energy-oriented' sound-shape in the Matter-Energy continuum, in contrast to the 'matter-oriented' source-bonded sound-shape.[122] It is spectrally complex, spatially expansive, and its amplitude is considerable, all of which contribute to its dominance in a sounding flow. In a small context, it can dwarf or mask other sounds. However, in a larger context, it can sustain, re-energise, re-direct or terminate as well as obscure an entire topology. Additionally, the 'wake' or aftermath of a meta-sound is prime spatio-temporal territory in which new sound material can be introduced and develop.

Spectrally transparent, forward-moving meta-sounds

A *spectrally transparent, forward-moving meta-sound* functions as an evolving sonic scaffold. It can serve as a point of culmination or repose for pre-existing sound material as well as a point of reference or change during an ongoing texture. It is also a frame in which other smaller-scale sounds can be initiated and unfold. An example of such a meta-sound occurs in *Neon* at 4'15", in the form of a semi-rotation, which can be heard in sound example 3.24 (track 70), an extract from the work 4'08" – 4'31". As discussed in Chapter 2, this meta-form is derived from a studio-based recording where the tuning pegs inside a grand piano were scraped while the sustain pedal was engaged. Its diaphanous and expansive but languorous nature permits it to function as a lynchpin between two sections.[123]

[121] A meta-sound differs from a meta-environment, which I defined in 2.2.3 as consisting of multiple layers of source-bonded, hybridised, ambiguous, and, occasionally, synthetic gestures that have certain common spectromorphological characteristics.
[122] Refer to 2.2.1 for an explanation of the Matter-Energy continuum.
[123] Refer to 2.2.3 for discussion.

Spectrally opaque meta-sounds

A *spectrally opaque meta-sound* often takes the form of a meta-percussion/resonance. Characteristic of this form is the heightened spectral density and considerable amplitude in the attack, which frequently override other simultaneous sonic activity. As the spectral mass and amplitude decrease during the resonance, this meta-sound becomes transparent, thus permitting other lower-level sonic phenomena to appear or reappear. Another attribute of the spectrally opaque meta-sound, aside from diminution, is its distinct lack of spectromorphological evolution. However, despite a paucity of forward-moving components, it can, like spectrally transparent meta-sounds, serve as a sonic 'hinge' and, therefore, unite two distinct topologies, albeit forcefully. An example of a meta-percussion/resonance occurs in *Protopia/Tesseract* at 1'26". The brief and sudden, powerful source-bonded cannon blast annihilates the sustained, pitched introductory section of the work and establishes less bellicose evidence of civilisation: a source-bonded recording of a train and human utterance.

Another instance of a spectrally opaque meta-sound occurs in *Protopia/Tesseract*, at 7'40", in the form of an eight-channel percussion/resonance, which can be heard in sound example 3.25 (track 71), 7'38" – 7'51" in the work. This composite gesture functions as an explosive release to accumulating structural 'pressure' brought on by a series of gradually intensifying, sustained sounds during the first two minutes of the second movement (5'55" – 7'39"). Each of the four stereo components of the meta-sound comprises superimpositions of transformed violoncello *pizzicati.* The *pizzicati* were each elided with bowed violoncello sounds that were transformed separately. The composite percussion/resonances were subsequently re-transformed before contextualisation. Although the initial impact of the attacks severs the preceding topology, a high-pitched, inharmonic, rhythmic transformation protrudes through the resonance from 7'41" to 7'45", on channels five and six. It introduces a coterie of other subdued, brief, inharmonic sound-shapes that occur at 7'48" on channels seven and eight, at 7'49" on channels five and six, and at 7'51" on channels three and four. On a metaphorical level, the abrupt severance offered by this meta-sound allows momentary space and time for the listening consciousness to 'breathe' and 'gambol' before the onset of another large-scale topology.

The meta-sound with variable spectral density

This form has the virtue of a shifting factor of opacity. In contrast to spectrally transparent or spectrally opaque meta-sounds, the *meta-sound with variable spectral*

density evolves from a state of translucence to opacity, and then evolves back to translucence. A quality that facilitates the two-way spectral shift is the gesture's similarity to pre-existing and ensuing spectromorphologies in a sounding flow. Unlike other meta-sound-types, it is not created from contrasting sound material. Rather, it seems to draw energy from an existing topology, like water that recedes from a beach and is folded into a new wave. The climax of this type of meta-sound is the moment it reaches its maximum spectral density. An example from *Neon* occurs at 8'45".

3.3 Abstract Musical Properties and Acousmatic Form

3.3.1 Spectral content as a structuring process

In order to situate acousmatic pitch and intervallic pitch constructs as structuring processes this section begins with a review of sound spectra, the foundation for pitch. As explained in 2.3, sound spectra can be seen to exist on a double continuum. The continuum on the y-axis addresses the tactility factor, the internal microstructure of sound spectra, which can range from smooth to granular, and which I consider as a basis for describing the type of 'materiality' perceived in a sound. The continuum on the x-axis addresses spectral content from the perspective of harmonicity or noise. On the one extreme is noise, on the other extreme are harmonic spectra that are based on the harmonic series, and in the middle lie diverse types of inharmonic spectra. The surprising fact is that inharmonic spectra and noise can enhance and steer the structuring capacities of pitch and intervallic pitch constructs, and vice versa (pitch and intervallic pitch constructs can enhance and steer the structuring capacities of inharmonicity and noise.)

Acousmatic pitch and intervallic pitch constructs

As discussed in 2.3.2, the term *acousmatic pitch* refers to a perceptual construction based on harmonic sound spectra. We also know that the range of possibilities for eliciting pitch in acousmatic music can be extended, poietically, through degrees of harmonicity in sound spectra, which, in turn, can affect, esthesically, the type of pitch construct listeners might construe according to their perspective. In this way, pitch can operate as a flexible percept. This is because perceived pitch can play a significant role in the spectral identity of a sound-shape as conveyed not only through varying degrees of harmonicity, but also through the relationship these spectral components have, as a whole, when they co-exist with inharmonic or noise-based spectral components in a sound. Acousmatic pitch thus can be a perception of real or local pitch or a gradation of pitch-noise.

On an initial level, we know that pitch can contribute to a sound whose shape is based on natural energy models (e.g. percussion resonance, friction, fluidity, rotation, rebound), and the way it evolves and changes. Further, we also know that in acousmatic music harmonic spectra are not necessarily dominant. Rather, threading harmonic spectral components into a spectromorphology can convey pitch and harmony to varying degrees. These pitch elements can disperse, converge, overtake

other spectra, or recede. Additionally, harmonic spectra can outline, highlight, root, or suspend essentially inharmonic and noise-based sounding gestures.

Inharmonic and noise-based spectra can cohabit with pitched spectra in a sound-shape, and, therefore, unfold and flourish in an environment where they mutually contribute to the expressive aspect of that sound-shape and to each other. Indeed, the existence of pitched, inharmonic and noise-based elements in a sound-shape, and the way they can develop together over time can be very sensual. Pitch becomes liberated from a definition and function centred on the sounding possibilities provided by traditional instrumental and vocal sound. The existence of inharmonicity and noise can contribute to a perceived importance of pitch a context where inharmonicity and noise are more dominant. Further, if pitch is conveyed through an unusual sound-shape it extends the possible gestural forms in which pitch can be expressed. This means that pitch and harmony can function in new ways, and accrue new meanings.

Inharmonicity and noise

As discussed in 2.3, not all internal frequency components in inharmonic spectra have a mathematical relationship to a fundamental frequency, though individual frequencies can be periodic. Hence, *inharmonicity* can be seen as a question of degree. Further, as discussed in 2.3, *noise* comprises all audible frequencies, involves random changes in frequency and amplitude, and has constant energy per unit bandwidth that is independent of the central frequency of the band (Van Nostrand, 1968: 1197). Inharmonic and noise-based spectra have a structural role and add a sensual and poignant aspect to the work. This is due to two factors: (1) the tactility factor of inharmonic and noise-based spectra which is frequently granular, a quality that can seem to render the sound-shape like a material object and therefore, accessible to touch; and (2) the inclusion of noise and inharmonic spectral components with harmonic spectral components in an acousmatic work which, as noted, can highlight the perceived importance of pitch by way of comparison. They extend the possibility of expressivity. Only through the combined forces of harmonic, inharmonic and noise-based spectra can music attain its true expressive potential. I shall now examine the relationship between perceived acousmatic pitch, harmony, inharmonicity and noise, and acousmatic form in parts of selected works in the composition folio.

Selected works in the folio from the perspective of spectral content

(i) Ether

In *Ether*, intervallic relationships serve as a skeletal structure for the first 6' of the piece. However, the pitches involved are often separated by an octave or more, which disengages the sense of pitch centre and the perception of traditional intervallic relationships. In this way, inharmonic and noise-based spectra are not subsumed in harmonic spectra. Instead, harmonic relationships are developed, re-iterated and/or sustained through *klangfarbenmelodie*, sound material that often has a similar pitch but different timbre, a technique that disassociates pitch from a specific timbre and allows for greater compositional freedom. Further, pitch is often conveyed through varying degrees of inharmonicity. Finally, in contrast to the fixed quality of harmonic spectra, the inharmonic and noise-based spectra seem to elude a 'gravitational pull' towards a harmonic resolution more easily and 'pass through' the dense spectral mass inherent in other sound shapes. An example of this type of spectral structuring process can be apprehended in the passage in *Ether*, from 2'30" to 5'18" (sound example 3.26, track 72), where pitch is conveyed through harmonic spectra and varying degrees of inharmonicity. For example, at 2'45" a pitched (G#4) quasi-vocal ethereal sound, like 'pitched, human breathing', which is rhythmically articulated with a rapid stringed instrument type of bowing, appears on channels 7 and 8 and occasionally on channels 1 and 2.[124] This sound-shape continues until 3'52" with different levels of intensity. It is underpinned by a timbrally rich, brassy, pitched sound (F 3) at 2'46" on channels 3 and 4. At 2'49" a percussion resonance (G3) can be heard, albeit briefly, on channels 7 and 8. The percussive attack followed by an upward glissando that begins the piece reappears at 3'52" on channels 5 and 6 (A3). However, in this third instance, the sound-shape does not glissando up to an E4 but to a D4. The 'pitched, human breathing' sound, noted at the beginning of the sound example, returns briefly at 3'46" in channels 3 and 4, and a soft, pitched (G4) sustained sound is briefly heard in channels 5 and 6 from 4'11" to 4'19". At 4'24" the reversed part of a metallic resonance (G flat 3) can be heard on channels 5 and 6. At 5'02" the attack part of the percussion resonance occurs on channels 5 and 6. A very high-pitched sustained sound (D 6) can be heard throughout part of the section, 4'05" – 5'18" on channels 1 and 4, where it can be apprehended as a spectral canopy.

[124] Several sounds in this section appear at the beginning of *Ether*, the first minute of which is analysed in Chapter 6 from a spatial perspective. As discussed in Chapter 6, the spatial organisation at the beginning of *Ether* is based on a double spiral which is conveyed through loudspeakers placed in a setup that can be described as a cruciform overlaid with a square (see Figure 6-7). However, after the second minute of the piece the double spiral slowly gives way to spatial organisation through stereo pairing, albeit as conveyed through the unusual loudspeaker setup.

(ii) Les Forges de l'Invisible

In *Les Forges de l'Invisible* inharmonic and noise-based spectra are frequently embedded in sounds containing harmonic spectral components, allowing relationships to occur between harmonic spectra that could not otherwise exist. For example, instances of simultaneous harmonic spectra are vitalised by virtue of the connectivity and diversity offered by various degrees of inharmonic and noise-based spectra. Additionally, relationships between various registers of inharmonicity and noise are enhanced through harmonic spectra. This is because, within my works and particularly in *Les Forges de l'Invisible*, the relationships harmonic spectra have with other harmonic spectra are often conditioned and qualified by the types of inharmonic and noise spectra in the same topology and vice versa. For example, different degrees of inharmonicity help to separate sounds that occupy identical, similar, or contiguous pitch spaces in the second movement of *Les Forges de l'Invisible.* Additionally inharmonicity can appear to engender pitch motion, and it can serve to bind spectral space in instances where a harmonic topology can, otherwise, seem spread out.

3.3.2 The tactility factor as a structuring process

As discussed in 2.3.1, the *tactility factor* is based on Schaeffer's notion of grain. It can be seen as the internal fibre or the microstructure of sound spectra. Although all sounds possess an internal fibre, its presence is often only evident when a sound is or becomes iterated, granulated, or very smooth. When the internal fibre is not perceived to be exceptionally smooth or granulated, we often shift focus to other sonic properties, notably spectral content. However, inharmonicity and granularity are not inseparable insofar as noise can appear in the delicate, small-grained, high-pitched pattering of small raindrops. Similarly, while a smooth tactility factor is often associated with the propagation of harmonic spectra, the conveyance of pitch is not wedded to a smooth microstructure, as harmonic spectra can be granular.

Protopia/Tesseract from the perspective of the tactility factor

The tactility factor in the first movement of *Protopia/Tesseract* as a whole ranges from the granular to the smooth. Microstructure is expressed through rough, raucous human utterance, beady inharmonic sounds, the violent percussive attack of a cannon, incisive source-bonded piccolo sounds, granulations, pithy nodal sounds, velvety, pitched

sounds, cicadas, and rain, among others. Sounds with extreme and contrasting tactility factors are often placed in simultaneous or contiguous topologies, a situation that highlights their innate differences and invites the listener to observe their individual pertinences. The decision to choose sounds with a wide range of tactility factors was made to reflect the unlimited human and environmental possibilities I associate with a *protopia*, (original place), a term I created that combines two Greek terms, *'proto'*, (original) and *'topos'* (place).[125] In contrast, the tactility factor in the second movement is somewhat more homogenized, a trait that I developed to impart the compression of space and time.

[125] Refer to Appendix 2 for the complete programme notes for *Protopia/Tesseract.*

3.4 Time

3.4.1 Introduction

According to Susanne Langer, "Music ... suspends ordinary time and offers itself as an ideal substitute and equivalent" (Langer in Kramer, 1988: 3). I shall look at the structural importance of sections of my works where there is a high quotient of forward-moving energy, which can be understood as a manifestation of linear time, a term devised by Jonathan Kramer (Kramer, 1988: 20). Afterwards, the discussion will turn to sonic contexts that are self-propagating and lack forward-moving energy that Kramer defines as vertical time (Kramer, 1988: 55), otherwise known as suspended time, which has another structural significance. Finally, the discussion will turn to unusual temporal contexts, where I shall highlight areas in my works that have a bi-polar, uneven, or hybridised temporal flow.

3.4.2 Linear time

According to Jonathan Kramer, *linear time* is "the temporal continuum created by a succession [of] events in which earlier events imply later ones and later ones are consequences of earlier ones" (my italics) (Kramer, 20: 1988). In other words, linear time signifies temporal impetus or forward-moving motion. Examples of linear time exist in all the works in the folio. For example, although the temporal flow in *Neon* is not completely unified, the overall impression of the forward moving motion from 1" to 3'07" and again from 6'35" to 8', can be perceived to be unified because the factor of temporal 'disagreement' is not as prominent as the sensation of forward-moving momentum to one goal, in these cases, the crack at 3'07" and the percussion resonance at 7'26", respectively.

3.4.3 Temporal multiplicity

Temporal multiplicity is a variation of the Kramer's concept of multiply-directed time. Multiply-directed time refers to a situation where the direction of motion is so frequently interrupted by discontinuities that the sense of time seems to be re-ordered (Kramer, 46: 1988). Having reflected on the suppleness of the temporal continuum within my own music, I suggest temporal multiplicity includes the characteristics of Kramer's multiply-directed time but can also be extended to temporal divergences as

perceived simultaneously in a sounding flow. For example, instances of temporal multiplicity abound in *Chat Noir*, where the superposition of sounds each with its own temporal flow was one of the main structuring processes in the work.

3.4.4 Vertical or suspended time

Vertical time is characterised by a lack of temporal articulation and impetus (my italics) (Kramer, 55: 1988). One of the ways vertical time is produced is through repetition. In acousmatic music, vertical time can be expressed in the form of granulations, iterations, and *crépitements*, which include repeated material and therefore can be perceived as self-propagating. These types of sounds may manifest little or no sense of spectral or spatial trajectory over time, and hence, we may say that temporal flow becomes arrested. Vertical time can appear in several guises.

Vertical time produced by repetition

An example of vertical time produced by repetition occurs in *Chat Noir* at 7'22" which can be heard in sound example 3.27 (track 73), 7'12" – 7'43" in the work. Following a section that is forward-moving, the violent cut away to large-bore granulations at 7'22" (10" – 30" in the sound example), may be perceived to propel the listener over a virtual ledge. This is because the listener may expect the forward-moving motion of the previous passage to continue. Instead, it is momentarily, but suddenly, restrained, although not completely impeded, due to the continuation of the previous passage that 'protrudes' through the 'wall' of granulations after several seconds. This example demonstrates that when instances of vertical time occur in a piece which is, largely constructed with linear time, a sense of linearity can still prevail albeit it is attenuated.

Brief instances of vertical time produced by sustained, pitched material

Examples of this type of vertical or suspended time appear in *Les Forges de l'Invisible* (movement 1) at 4' – 4'10". This is a short, quiet section, which contains, primarily, one sustained, high-pitched sound, which may impart the sense of atemporality. Another instance of suspended time can be perceived from 3'08" to 3'15" in *Neon*, where the listener can have the impression of temporal release due to the almost inaudible high-pitched sustained sound that immediately follows the crack at 3'07".

3.4.5 Unusual temporal contexts

Unusual temporal contexts are those with a bi-polar, uneven, or hybridised forward-moving energy flow. They appear often in my work and have considerable structural relevance. The concepts below illustrate these types.

Swaying/swinging

Although *swaying/swinging* is an energy model, it is employed in the works in the folio in a structural fashion because it is bi-directional. A 'return' of the energy trajectory exists despite the initial temporal push forward. The swaying/swinging trajectory can create a sense of atemporality or temporal impedance within a forward moving sounding flow created by other sounding elements.

Rotation

The double bi-polar form of the energy model *rotation* can restrict temporal flow, particularly because its trajectory into and out of 'distant' space, which creates a spatial stasis due to repeated motion within the same orbit, takes the emphasis off linearity.

Hybridised temporal contexts

The superposition of linear sonic contexts onto vertical contexts, or vice versa, creates a particularly elastic temporal flow. If the composer enhances one or the other of the linear or vertical elements in the discourse, temporal flow can be subtly accentuated, enabled, hindered, or arrested. Examples include:

(i) Protopia/Tesseract (second movement, 10'20" – 11'34")

Repeated, pitched drones on channels 3 and 4 (which give the impression of temporal arrest) are superposed on sound material that moves in clockwise and counter clock-wise rotations over all eight channels. Although the rotations become faster and louder over time, the volume of the drone also increases. This temporal juxtaposition is employed as a structuring process.

(ii) Les Forges de l'Invisible (first movement, 4' – 4'52")

A calliope figure, which comprises a series of short, rapid, repeated pitched sounds in channels 7 and 8, is superposed with other material that evolves in channels 1 to 6.

3.5 Figure-Ground Relationships

3.5.1 Definition

Figure-ground relationships provide a constant interaction between the foreground and the background in the temporal flow in my works. In such relationships, background material can coalesce in energy and mass and push, nudge, or fling sounds into the foreground. Conversely, foreground material can develop and blot out the background. Furthermore, there is an interconnection between grounds and voids.[126] A ground can, like the void, function as the 'area' around a sound, the 'area' after a sound, the 'fulcrum' between a sound and silence, or between a sound and other sounds. Like the void, the ground is as important as the sound itself. Figure-ground relationships aid in the formation of metaphorical images because almost all sensorial reception happens in the framework of figure-ground relationships in the context of time. Specific instances of figure-ground relationships are highlighted below.

Background material in figure-ground relationships

Neon contains an example of a figure-ground relationship (4'45" – 5'), where background material coalesces in energy and mass and flings sounds into the foreground. In this case, the thrust provided by the ground creates a foreground frame in which figure material can be introduced and developed.

Interaction between foreground and background

An example of a figure-ground relationship, where the foreground and the background are interconnected through space over time, can be perceived in *Neon*, from 5' to 6'30".

Foreground giving way to background

In a variation of a figure-ground relationship, an entire foreground can give way to an entire background as the foreground recedes from frontal space, an example of which exists in *Ether* between 9'16" and 9'21".

[126] Voids are moments in a sonic context that are distinguished by a palpable lack of energy. They are discussed in 3.6.3.

Figure-ground relationship with a rotation

A figure-ground relationship can occur with a single sound element that impregnates itself as a binding element between the figure and the ground. For instance, the double bi-polar form of the rotation energy model can 'contact' the ground and thrust it to the fore and, equally, 'contact' the fore to thrust it back to the ground. One example of such a figure-ground relationship can be found in *Neon* at 4'30".

3.5.2 Sonic webs

Sonic webs consist of sheer swathes or woven filigrees of transparent and/or translucent sound materials which sit on the fulcrum between figures and grounds and that can 'reach out' toward a figure or 'stretch' back into a ground. Sonic webs are very interconnected and are an essential part of figure-ground relationships. They can provide sound material that precedes, builds up to, and participates in, an important structural event. Sonic webs can also subtly recede into the background to act as a 'ground' for the event and serve as an 'absorbing place' in the wake of the event. In the latter case, the web operates as the 'frame' around the sonic 'detritus' that follows the event, whether the detritus comprises the end of a reverberated sound or the last part of a percussion resonance, etc. A sonic web can also create the 'ground' for a sound event, which can, in turn, destroy the web but the destruction can yield a new sonic context in a new space for a new web to be built. Further, sonic webs can provide a context for a figure when participating with a ground, and a context for a ground when participating with a figure. Webs can be in spectral, spatial and temporal agreement with other simultaneous sound material, or not, or they can weave in and out of this type of agreement. Finally, large-scale rotations and spiral forms are often a component of sonic webs because they can expand spatial parameters and create relationships between material in the foreground and background that is segregated spatially. Specific instances of sonic webs are highlighted below:

Interconnectedness

In addition to its function as an extensive topology, which was discussed in 2.2.3, the meta-environment from 1'30" to 3'10" in *Neon* is also a sonic web. This example illustrates the *interconnectedness* provided by a sonic web which consists of individual strands of sounds.

Absorbing place

A sonic web may act as an *absorbing place* for energy. For example, the 'breathing' sound and ensuing drone, both of which can be heard several times on different channels between 9'16" and 9'44" in *Ether,* are accompanied by a ongoing sonic web consisting of pitched, fragmented material. The web 'absorbs' the energy/motion trajectory conveyed by the 'breathing' sound and sustains the spatial dimensions of the sonic universe throughout the antiphonal exchange between the 'breathing' sound and the drone.

Discrete sound material

A sonic web, which is created from spectrally *discrete sound material*, is constructed in downward moving spectral layers at the beginning of *Chat Noir* and is deconstructed by layers at the end of the work.

Transitional passage

An example of a sonic web that acts as a *transitional passage* between sections can be heard in *Ether* (8' – 8'40") (sound example 3.28, track 74), where human utterance, pitched drones, softly tolling bells and sinuous pitched material create a rather quiet, diaphanous transition between two high-energy sections.

Ongoing background

A sonic web can arise as an *ongoing background* that thickens and develops into a foreground, changes spectromorphological parameters, increases in density and size and develops temporal thrust. Examples can be heard in *Neon* (3'08" – 4'30") and *Les Forges de l'Invisible* (4' – 4'52").

3.6 Silence, Stasis-Points, Inactivity, Voids and Omission

Silence, stasis-points/inactivity, voids and *omission* are not sounds but concepts that create structural and perceptual 'allowances' in a spatio-temporal frame. These concepts are allied to the energy flow of a work in such a way that the energy flow, at times, can be expressed in one of these five guises. In my music, structural allowance is frequently concerned with the often non-linear or very weakly linear sound event or events that follow a temporally charged section. A section that contains such a 'dip' in energy flow infuses the structural and metaphorical significance of an upcoming sonic context. Furthermore, this same 'dip' can aid in perceptual constructions, notably, structural recall, by allowing the time and space for the listening consciousness to imbue the preceding section with a specific structural and metaphorical significance while the temporal flow moves forward.

3.6.1 Silence

Silence is a perceived elimination of the sounding flow. The structural and metaphorical pertinence of silence is as profound as the sounding flow. For example, temporality can be borne from silence or, conversely, it can continue through silence, if silence follows a sounding flow. Additionally, once the impression of silence and atemporality is established in the listener's mind, it can continue for some time *during* a new sonic context.

3.6.2 Stasis-points and inactivity

In contrast to silence, *stasis-points* and *inactivity* refer to a part of a sounding flow that does not contain a temporal thrust. These constructions are not an antithesis of a highly energised and forward-moving section of the sounding flow; instead, a stasis point or a place of inactivity refers to a non-evolving point in a sounding flow. We can think of them as 'resting points' although they are not necessarily quiet. An example of a stasis-point occurs from 13'12" to 13'31" (sound example 3.29, track 75) in the second movement of *Les Forges de l'Invisible*. This section is dominated by a series of metal *crépitements* and a sustained, pitched, spectrally rich sound on channels 7 and 8 (at 3" in the sound example) that billows forward over the listener from the rear but which, once established, is gesturally inert.

3.6.3 Voids

Voids are moments in a sounding flow that are characterised by a distinctive lack of energy. In contrast to stasis-points and inactivity, voids are antithetical to motion and they frequently follow particularly intense sections in a piece. Their non-developmental character and their structural function, which opposes momentum, operate in tandem to create a situation where the listening imagination is 'free' to engage in structural recall or can anticipate future events.

3.6.4 Omission

Omission occurs when the listener perceives that an element, which was previously introduced, is absent from the sounding flow and structure. Omission comprises incomplete gestures but goes further to embrace the concept of absence on a larger spectral and structural scale. The omitted element can occur later in the work or perhaps not at all, leaving the listener free to invent it.

Chapter 4. Self-Orientation

Self-Orientation has its roots in the reception behaviour, empathy, devised by Delalande. As I explained in 1.4.3, according to Delalande, the listener who engages in this strategy "[…] is attentive to sensations, which are spontaneously described as the 'physiological' product of the sound. These types of commentary firstly focus on the level of feeling" (Delalande, 1998: 37). Delalande notes that listeners tend to describe the events in the music as if they are subjected to these events themselves, and they also focus attention on the present moment and avoid establishing connections with the musical discourse before that instant, thereby eschewing a taxonomic approach (*ibid.*: 37-38). He suggests that instead, listeners prefer to construct metaphors, a process that occurs in two stages (*ibid.*: 39).

The first stage consists of descriptive metaphors of the object[127] that resemble *typo-morphological*[128] descriptions of sounds. However, the metaphors are explained subjectively (*ibid.*: 39). For example, upon listening to Henry's *Sommeil,* Delalande notes that Listener A described the sound world in the following terms, "[…] muted blow; impact; very dull; […]" (*ibid.*: 39). Delalande suggests that these metaphors which intend to characterise the morphology of the sound are expressed in words that imply actions, thereby clarifying the sonic properties or the manner in which these sounds function. Sounds are not only described, "[…] they act on each other, and, in a symbolic way, also act on the listener". [Listener A's response epitomizes this tendency]. "One is dominated by the impact; blows in the stomach; violence of impact" (*ibid.*: 39).

During the second stage, Delalande proposes that the metaphors of the object are organised into narrative images, which illuminate relations and communicate metaphors for the object more precisely (*ibid.*: 39). Listener A notes, "[…] It is like a kind of … karate in slow motion (…) like the demonstration of a martial art. Like the demonstration – very formal – of imaginary blows thrust at you by a wooden sabre

[127] As noted in 1.2, Delalande considers the object to be the physical signal (Delalande, 1998: 15).

[128] 'Typo-morphology' is the translation of *typo-morphologie*, a Schaefferian term that refers to stages of sound classification. Dack and North's translation of Chion's text, which summarises Schaeffer's ideas, is followed by Chion's original text: "Typo-morphology is the initial phase of the programme of musical research, which groups together as complementary the two procedures of typology and morphology […] Thus, typo-morphology is a *descriptive inventory which precedes musical activity.* The three tasks of typo-morphology are therefore: *identification, classification, description* […] Typology takes care of the first two; morphology, the third" (Chion's italics) (Chion, 1983: 113, Trans. Dack and North, 2009). «*La typo-morphologie est la phase initiale du programme de la recherche musicale qui regroupe, comme complémentaires, les deux opérations de la typologie et de la morphologie […] Ainsi, la typo-morphologie est-elle un* inventaire descriptif préalable au musical. *Les trois tâches de la typo-morphologie sont […]* identifier, classer, décrire. *[…] La typologie se charge des deux premières; la morphologie de la troisième»* (Chion, 1983: 113).

[…]" (*ibid*.: 39). Delalande concludes that "Metaphorical description is a way for listeners to deepen the object/subject relationship, which is translated in terms of sensation – such a deepening of sensation is the real purpose of this listening behaviour" (*ibid*.: 40). From this base, I develop my theory in 4.1.

4.1 Development of 'Empathy' into Self-Orientation

The findings from my listening experiment exhibit an array of listener responses that impart a wide domain of personal reflection. For example, dispassionate remarks abounded, and other personal reactions to the music appeared to be 'non-physiological' in nature. Additionally, sometimes listeners seemed to centre on topics that were external to the piece or themselves. I have, therefore, extended Delalande's concept of empathy in order to include a broader range of listening behaviours that comprises neutral, contemplative, and 'non-physiological' reactions as well as reactions that centre on topics external to the piece and the listener.

4.1.1 Definition

Self-orientation is a reception behaviour where perception is focussed inward toward the listener as opposed to outward on sonic properties or structural attributes. Listeners can engage in discussion about sonic properties or structural attributes, but these discussions appear to illuminate listeners' feelings, physiological sensations, and thoughts rather than the structure of the piece or its sonic universe. For example, listeners can engage their own emotional and physiological responses *to* the sounding flow and, more broadly, to the listening experience. I label these reactions *physiological sensation* or *emotion.* Self-orientation also refers to more neutral observations listeners can make about their own personal reactions such as contemplation or intellectual reflection, which I label *evaluation*.

Although physiological sensation and emotion can be construed as evaluation and vice versa, and can coexist in a listener response, I have made an initial distinction among the three branches of this reception behaviour for the purpose of analysis. These branches also can be seen as 'generalised' objects – according to the Subject-Object continuum in the three interconnecting continua established by Tarab Tulku Rinpoche discussed in 2.2.1 – in which more precise objects can arise. I shall attempt to classify the precise objects for three reasons: (1) the fine nuances listeners make when creating a perceptual construct help to steer their perceptual construct; (2) the nuances reflect the vast yet refined capacity of the listening imagination; and (3) although words are approximate, it is useful to develop a vocabulary for this variable field of perceptual constructs.

4.1.2 Overt reflexivity and the 'inner/outer object'

Evidence from my listening experiment suggests that some listeners responded to the music by engaging in self-oriented reception behaviours that were *overtly reflexive*. In other words, listeners sought to develop conscious connections between the sounding flow and their sensations, emotions or thoughts, with the aid of typo-morphological description, in a way characteristic of the reception behaviour, empathy, proposed by Delalande. It can be argued that any reception behaviour is inherently reflexive because the behaviour (the object) arises from the listener (the subject). Therefore, when any object, however seemingly remote, radiates outward from the Body/Mind of the subject it refers back to the subject by its very nature. Nevertheless, this type of behaviour can be separated from behaviours that are overtly reflexive, for example those in which listeners *consciously* develop a relationship between themselves and the music in response to the music. This type of reflexive behaviour is illustrated in Figure 4-1, where the listener responses are duplicated from Figure 1-2 in Chapter 1, but with a more detailed classification scheme.

In Figure 4-1, the first column refers to the subject, the listener. The second column refers to the three branches of self-orientation – also referred to as Object 1 – that can be regarded as three fields of perception in which precise objects can emerge. The third and fourth columns refer to objects in the form of verbal expressions arising from one of the three branches of self-orientation. The third column contains an example of an *inner object*, (1a), representing the listener's perception that the 'architecture' of the listening experience emanates from 'inside' the listener, while the fourth column contains an example of a seemingly *outer object*, (1b), representing the listener's perception that the architecture of the listening experience appears to occur 'outside' the listener, in this case in the music, to which the listener reacts. However, in the same way that any reception behaviour is inherently reflexive because the behaviour (the object) arises from the listener (the subject), *all objects are inherently inner,* although they can appear to have variable degrees of remoteness from the subject and, therefore, appear as outer objects. Yet, as central to the subject as these expressions are, and as similar as they may appear, I suggest that inner and outer objects are not synonymous. Rather, they are subtly different on a conceptual level in the sense that the listener's perception 'places' the object within the listener, or exterior to the listener. For example, as illustrated in Figure 4-1, the confusion City University Listener K appears to express in response to *Bois* is distinguishable from the 'objective' need City University Listener B appears to articulate in response to the second

movement of *Deux aperçus du jardin qui s'éveille*. Hence, the subtle differences in the surface verbal expressions, the most exterior and visible reception behaviour, echo subtly different perceptive modes, and, therefore, different postures towards the music.

Subject	*Self-Orientation Branches/ Object 1*	*Object 1a 'Inner Object'*	*Object 1b 'Outer Object'*	*Piece*
The listener	Physiological Sensation	"[…] We have the impression of being in a stomach […]", *Académie de Musique de Soignies* Listener C (Anderson, 2001: 47).	"[…] Attacks you […]", City University Listener A (*ibid.*: 47).	*The Gates of H*
The listener	Emotion	"[…] I feel I am supposed to listen for some kind of symbolism […] I feel confused as how to listen […]", City University Listener K (*ibid.*: 30).	"[…] It is too threatening and violent […]", City University Listener B (*ibid.*: 30).	*Bois*
The listener	Evaluation	"[…] I needed a different kind of structure […]", City University Listener B (*ibid.*: 26).	"[…] Playful, humorous […]", City University Listener I (*ibid.*: 26).	Second movement of *Deux aperçus du jardin qui s'éveille*

Figure 4-1. 'Inner/outer' objects in the three branches of self-orientation

4.1.3 Expansion of self-orientation beyond overt reflexivity

As discussed in 4.1.2, listeners can develop conscious connections between the music and their physiological sensations, emotions, or thoughts in a way that is overtly reflexive. However, other listeners appear to describe physiological sensations and emotions as well as thoughts and opinions about the music without consciously articulating or developing connections between the music and themselves. Further, several listeners occasionally broached topics that seemed to be external to the music and themselves. One may then inquire what other strategies are available to the listener in a self-oriented reception behaviour.

To address this question, it is helpful to return to the concept of overt

reflexivity. We know that any reception behaviour is inherently reflexive because the behaviour (the object) arises from the listener (the subject) and refers back to the subject by its nature. Nevertheless, listeners can develop the relationship between themselves and the music in a conscious, interactive, fashion or not. I have observed that when listeners focus less on establishing conscious connections between the music and themselves, overt reflexivity is attenuated. I have also observed that a decrease in overt reflexivity is manifested in the tendency for listeners either to comment *either* on the music without reference to themselves *or* on their physiological sensations or emotions without reference to the music, or for listeners to broach topics that are both external to the music and themselves.

These different kinds of self-oriented reception behaviours can also be seen through the lens of Smalley's concept of 'intrinsic-extrinsic threads', previously discussed in 1.4.3. To paraphrase Smalley, the concept of intrinsic-extrinsic threads can be defined, on the one hand, as the attributes and relationships the listener perceives to be inherent in a piece, and on the other hand as the relationships or experiences spawned by the listening experience that the listener perceives to be external to the piece (Smalley. 1997: 110). I suggest labelling listener discussion of emotions and physiological sensations as *first-level* 'extrinsic'[129] thinking, building on Smalley's concept. This is because emotions and physiological sensations are part of a wider set of listener responses that can be brought forward by the listening experience and yet seem to be external to the piece, even if the responses might be perceived to be catalysed by the piece. I suggest labelling listener discussion of topics that 'appear' to be external to the piece *and* to listeners' emotions or physiological sensations (e.g. images based on fantasy or surrealism) as *second-level* 'extrinsic' thinking. As we shall see, listeners can intertwine intrinsic responses with one or both types of 'extrinsic' responses and all three can appear to reinforce each other to varying degrees. Listeners can also opt to combine first and second-level 'extrinsic' thinking, or they may centre exclusively on one or the other. The following discussions centre on a range of self-oriented listener responses from the dual perspectives of reflexivity – or a lack thereof – and intrinsic/'extrinsic' topics.

[129] I place inverted commas around the term, extrinsic, because all topics arise from the subject, the self, however remote they may be from the human condition.

Typo-morphological description and the overtly reflexive relationship: combined intrinsic and first-level 'extrinsic' topics

As discussed in the beginning of 4.1.2, listeners occasionally use typo-morphological terms to describe the sounds in the pieces as a way of creating overtly reflexive relationships between the sounds and themselves. This strategy appears in the remarks from two listeners from the *Académie de Musique de Soignies* in response to Roy's *Crystal Music*. Listener H's remarks can be seen in the framework of an 'empathic' or reflexive relationship – or as a combined intrinsic and first-level 'extrinsic' topic – that develops primarily in the form of an inner object: "We have the impression of finding ourselves in a draught-proofed, suffocating and at the same time mysterious milieu. Certain high-pitched sounds add anguish" (Anderson, 2001: 40).[130] This contrasts with the characteristics of a reflexive relationship in the form of an outer object – which also can be viewed as a combined intrinsic and first level 'extrinsic' topic – as relayed by Listener E: "All filled with little sounds. Melodious music. It makes me think of a dream that transforms into a nightmare. I have the impression of being in a city. I have the impression that it rains on [a window] pane" (*ibid.*: 39).[131]

Beyond overt reflexivity

(i) General descriptions/opinions of the music as an end: intrinsic topics

This alternative behaviour, where listeners centre *only* on qualities that are *intrinsic* to the music and do not develop conscious connections between the music and themselves, appears in the following observations from *Académie de Musique de Soignies* Listener K in response to Roy's *Crystal Music*: "[…] Disturbing but superb landscape. All the sounds gather together in a strange harmony […]" (Anderson, 2001: 34).[132] The same strategy appears in response to *Crystal Music* in the following reactions from two listeners at City University (*ibid.*: 35). Listener B observed that the piece was "[…] easier for a non-ea person to grasp, at least in the opening section which was quite calm and peaceful […]", and Listener K noted, "[…] my attention is directed at the inherent beauty which the sounds possess […]" (*ibid.*: 35).

[130] My translation of the response from *Académie de Musique de Soignies* Listener H: *«On a l'impression de se trouver dans un milieu calfeutré, étouffé et en même temps, mystérieuse [sic]. Certains sons aigus ajoutent de l'angoisse».*
[131] My translation of the response from *Académie de Musique de Soignies* Listener E: *«Tout plein de petits bruits. Une musique mélodieux [sic]. Cela me fait penser à un rêve qui se transforme en cauchemar. J'ai l'impression d'être dans une ville. J'ai l'impression qu'il pleut sur vitre [sic]».*
[132] My translation of the response from *Académie de Musique de Soignies* Listener K: *«Inquiétant mais superbe paysage. Tout son se rassemblent [sic] en un harmonie étrange».*

(ii) General descriptions/opinions of physiological sensations, emotions, and evaluations as ends: first-level 'extrinsic' topics

Occasionally listeners evaluated the music in the listening experiment, or they described emotions or physiological sensations they perceived without precisely referring to the stimulus. For example, emotional overtones appear in the evaluation of Vande Gorne's *Bois* by City University Listener B: "[…] On an intuitive level I dislike this, it is too threatening, violent, – very 'masculine', structured […]" (Anderson, 2001: 30). The boundaries between intrinsic and *first-level 'extrinsic' discussion* are more vague in this type of listening strategy. However, I have chosen to qualify this type of response from the viewpoint of the listener's emotions, otherwise viewed as a first-level 'extrinsic' topic. This is because while the listener's response is in the form of an outer object (or intrinsic topic) insofar as it centres on the music, the discursive terms are emotional in nature and may serve to better illuminate the listener's emotions on hearing the music rather than the music itself, although the this process may also illuminate the character of the music indirectly.

(iii) General descriptions/opinions of the music and external topics: combined intrinsic and second-level 'extrinsic' topics

Listeners occasionally referred to typo-morphological descriptions of sounds or general descriptions of the sound world while centering on topics that appeared to be 'extrinsic' to the self and the piece, as if the articulation of the perception of the sounds or sound world was central to the development of the 'extrinsic' topic. An example, which combines an intrinsic topic with a *second-level 'extrinsic' topic*, can be seen in the succinct response to the second of Lejeune's *Deux aperçus du jardin qui s'éveille* by *Académie de Musique de Soignies* Listener C: "A haunted house. A cartoon. […] A montage. […] I liked it a lot" (Anderson, 2001: 26).[133] The same combined strategy, albeit more detailed, appears in response to *The Gates of H* in the following remarks from City University Listener A: "[…] temporal balance (!), regularity in periodicity, choral evidence, chamber resembles cathedral, lifts to upper reaches of the space (!), (as if mystery of other world that might exist above congregation) […]" (*ibid.*: 48).

[133] My translation of the response from *Académie de Musique de Soignies* Listener C: *«Un château hanté. Un dessin animé. […] Un montage. […] J'ai bien aimé».*

(iv) Direct metaphorisation of external topics: second-level 'extrinsic' topics

Finally, several listeners elaborated on second-level 'extrinsic' topics without the aid of typo-morphological description, or they provided scant typo-morphological description that may have served to catalyse, develop, or sustain the metaphorisation. The second-level 'extrinsic' topics include physical states and activity as well as those of a literary, theatrical, social, religious or mediatic nature.[134] The listener responses in Figure 4-2 support the notion of a wide-ranging scope of possible reactions. They are duplicated from Figure 1-3 in Chapter 1.

Reference	*Example*	*Piece*
Physical states or activity	Drawings of what appear as a detonating device and an explosion, by International School of Brussels Listener B (Anderson, 2001: 43).	*Crystal Music*
Literary/Theatrical Topics	"[…] Classical drama, Greek chorus […]", as noted by City University Listener C (*ibid.*: 47).	*The Gates of H*
Religious or Social Issues	Drawing of what appears as the Devil in Hell is accompanied by written remarks, "Represents Hell. High-pitched voices = people who die in the fire. Low-pitched voice = the devil. Morbid ambience; sombre […]" by *Académie de Musique de Soignies* Listener L (*ibid.*: 48).	*The Gates of H*
Mediatic Images	Drawings of what can be interpreted as Darth Vador's mask and a light sabre, by International School of Brussels Listener N (*ibid.*: 40).	*Crystal Music*

Figure 4-2. Second-level 'extrinsic' topics

It is notable that listeners employed a broad spectrum of linguistically descriptive and visually illustrative means to articulate the topics in Figure 4-2, all of which appeared to be remote from the human condition and the acousmatic work in question, but which the listening experience brought forward. In such cases, a sound or the sounding flow in an acousmatic work can prompt the listener to engage in 'extrinsic' thinking, which can appear to evolve independently with little or no reference to the sounding flow. This is illustrated by listener remarks in (1) 4.1.3 section *(ii) General descriptions/opinions of physiological sensations, emotions, and*

[134] This list is not exhaustive.

evaluations as ends: first-level 'extrinsic' topics; and (2) 4.1.3 section *(iv) Direct metaphorisation of external topics: second-level 'extrinsic' topics* in Figure 4-2. However, this strategy, which I often use while composing albeit subconsciously, can also illuminate the listening experience and, in turn, listeners' perception of the piece as well as their perception of themselves, or it can impart meaning to another listener experience that is 'extrinsic' to the piece.

In 1.3.2, I suggested that *evocation* could become the basis for a secondary perceptual construction, which can unfold as an intrinsic or 'extrinsic' topic. The process of evocation can frequently begin – or be intertwined – with the typo-morphological description or qualification of a sound or sound world, hence justifying the initial alliance of evocation with the reception behaviour *sonic properties* in Chapter 1. However, when listeners apprehend the sonic property or sound world, the initial perceptual construction seems to be a catalyst for them to develop a secondary perceptual construction. In this way evocation allows for diverse avenues of thought and reflection to occur and develop. I also suggested that listeners could shift the *function* or *behaviour* of a sonic property, sound world, or structure in the piece to a secondary perceptual construction of an intrinsic or 'extrinsic' nature.[135] The complete series of perceptual vectors, the perceptual forms catalysed by the vectors, and the resulting objects will be chronicled in 4.2.

[135] In this usage, the term 'behaviour' refers to the manner in which the sound unfolds over time and differs from the term and concept of reception behaviour.

4.2 Establishing Intrinsic/'Extrinsic' Meaning in Self-Orientation

Listeners' capacity to engage in different types of *intrinsic/'extrinsic'* thinking expands the choice of possibilities when constructing percepts. We may then ask how music can communicate and elicit such vastly different topics. Langer reflects on a quotation from Hans Mersmann, who proposed that music can express opposites simultaneously, by suggesting that musical forms have an ambivalence of content which helps to impart human feeling (Langer, 1942: 243).

> "The real power of music lies in the fact that it can be 'true' to the life of feeling in a way that language cannot; for its significant forms have that *ambivalence* of content which words cannot have. This is, I think, what Hans Mersmann meant, when he wrote: 'The possibility of expressing opposites simultaneously gives the most intricate reaches of expressiveness to music as such, and carries it, in this respect, far beyond the limits of the other arts'" (Mersmann, 1935: 33-47 in Langer, 1942: 243). "Music is revealing, where words are obscuring, because it can have not only a content, but a transient play of contents. It can articulate feelings without being wedded to them" (Langer, 1942: 243-244, Langer's italics).

If words cannot be true to the life of feeling in the same way as music because words lack the ambivalence of content musical forms are purported to have, a similar concern can be extended to thoughts and images which may also have a bifurcated, ambivalent or otherwise complex content that words cannot accurately express. Listeners are accustomed to use words to express feelings that they perceive to arise from the listening experience because language is a standard medium for communication, however incomplete or approximate it may be, for the conveyance of feeling. This communicative issue can be extended to thoughts and images, by the same logic, insofar as the complex thoughts and images I have observed the listeners to have may also have a transient play of content that is, perhaps, insufficiently translated by their words. Therefore, the ambivalence of content inherent in musical forms can also be perceived to engender thoughts and images on the part of listeners in addition to feelings.

For example, the transient play of content that Langer suggests music has is palpable in the form of Mersmann's 'simultaneous opposites' as illustrated by two listener responses – in the form of thoughts and images – to Brümmer's *The Gates of H.*

As discussed in 4.1.2 (iii), City University Listener A noted, "[…] temporal balance (!), regularity in periodicity, choral evidence, chamber resembles cathedral, lifts to upper reaches of the space (!), (as if mystery of other world that might exist above congregation) […]" (Anderson, 2001: 48). While listening to the same extract, albeit in different acoustical circumstances, *Académie de Musique de Soignies* Listener L drew a picture of what can be interpreted as the Devil in Hell, accompanied by the remark "Represents Hell. High-pitched voices are of people who die in the fire. Low-pitched voice is the devil. Morbid ambience; sombre. Good structure of sounds" as noted in 4.1.3 (iv), in Figure 4-2 (*ibid.*: 48).

In this example, the music does not appear to express opposites simultaneously to one listener, but rather conveys separate halves of a set of opposites to two listeners. These findings, it seems, do not completely corroborate my proposal. However, if we look beyond the surface, we can see, first, that the listener responses comprise thoughts and images, thereby implying that music can bring forward thoughts and images as well as feelings. Further, one listener can perceive, simultaneously, opposites that two listeners can perceive separately, although I also suggest that often listeners are not consciously aware of perceiving opposites as separate elements. Instead, they may tend to perceive an entity in which opposites co-exist.

Words can possess an ambivalence of content, on a limited scale, insofar as they can impart somewhat different meanings. For example, words that are derived from Latin or ancient Greek can often be perceived to have subtly different meanings in different languages. For example, the Latin word, *canere*, meaning 'to sing', later developed into the Romanian verb, *canta*, meaning 'to sing', which is used to denote the playing of a musical instrument as well as singing, and as well as the Spanish verb, *cantar*, meaning 'to sing' or 'to call out'. However, words rarely impart opposite meanings, whilst, as Mersmann suggested, music can. Given this thought, it is notable that Brümmer relied on a letter from the alphabet and not an entire word in the title of his piece, *The Gates of H*, quite possibly because he intended the piece to have an ambivalence of content that allows for the simultaneous expression and interpretation of Heaven and Hell. This may explain why City University Listener A perceived one meaning in the music and *Académie de Musique de Soignies* Listener L perceived an opposite meaning, a salient point, since, as noted in 1.3.1, the titles of the pieces and the composers' names were announced at the end of the listening experiment. Nevertheless, however revealing the listener's esthesic response may be, the composer's poietic approach can be more enlightening since composers are usually aware of the strategy they put into place, although the success of the piece relies on the

composer's strategy being perceived by the listeners. As a testimony of this idea, not only is my trilogy – *L'éveil, Chat Noir,* and *Neon* – based on opposites, as discussed in 2.1, but the title, *The Gates of H*, is a sign that Brümmer, too, capitalises on the ambivalence of music and the coexistence of opposites.

Finally, Langer's notion that "[…] [music's] significant forms have that *ambivalence* of content which words cannot have […]" (Langer, 1942: 243), can be expanded to include other kinds of complexity in addition to the simultaneous expression and perception of opposites. Musical form and its subsequent play of content can be expressed and perceived to converge, diverge, crisscross, intertwine repeatedly like skeins, or otherwise unfold in a parallel manner with variable or fixed degrees of separation. Like the notion of ambivalence, these types of form and content also can be expressed and perceived simultaneously; they can appear to possess different levels of communicative power, and they can be perceived to evolve with varying speeds. In the following section, I shall aim to chronicle the various phases through which the listener may pass in order to construct intrinsic/'extrinsic' meaning.

4.2.1 The sound as the catalyst

During the listening experience, the sounding flow in an acousmatic piece physically collides with the listener. As discussed in 4.1.2, the listener may consciously or unconsciously experience this situation to be a catalyst for thoughts and perceptions about the piece (intrinsic topics), or thoughts and perceptions external to the piece ('extrinsic' topics). We know 'extrinsic' topics concern, on one level, the listener's emotions and physiological sensations and, on another level, the listener's thoughts, and perceptions that seem to be remote from the Body-Mind. However, the ephemeral nature of the sounding flow and the transient play of content it frequently seems to possess can also appear to propel the listener's prior life experience – including memories, images, and accompanying psychological imprints – into the perceptual foreground. The sounding flow, therefore, can appear to engender an evolving intersection of objects in the listener's mind – a *mobile perceptual hub* – comprising the listener's conscious and unconscious apprehension of the sounding flow, the intrinsic and 'extrinsic' topics that may arise while listening, and the life experience the listener brings to the listening experience. The following discussion probes one part of this perceptual hub – how listeners construct intrinsic and 'extrinsic' topics.

4.2.2 Perceptual vectors: 'mental tunnels'

This section addresses the vector through which elements in an acousmatic piece can appear to *evoke* thoughts or perceptions exterior to the piece ('extrinsic' topics) and other vectors through which such elements can be perceived to change *function*, *behaviour* or *meaning* in a way that listeners consider to be different from the elements' 'objective' spectromorphological and/or spatio-temporal contexts. These vectors are referred to as the *transfer* of function, behaviour, and meaning. The four *perceptual vectors*, which can be described, alternatively, as *mental tunnels*, can be seen to engender first-level 'extrinsic' topics, notably listener thoughts and perceptions involving physiological sensations and emotions, as well as second-level 'extrinsic' topics, experienced as external to the self and the piece. However, the vectors can also be perceived to facilitate listener thoughts and perceptions that centre on intrinsic topics, which relate to the piece, for example those involving sound and structure. Although the terms 'evocation' and 'transfer of function' were introduced in 1.3.2, and were later mentioned in 1.4.1 and 1.4.3, they are classified and discussed as perceptual vectors here.

The impetus behind the listener's use of perceptual vectors resides in the human need to make sense of a piece, an incentive moulded by life experience that can be viewed as a subjective filter, the strength of which will vary depending on circumstances. Although from the perspective of Indo-Tibetan tradition, the object is created by the subject and, therefore, true 'objective' listening does not exist, I suggest, nonetheless, that listeners can agree on what they perceive as ascertainable elements in a piece. This type of 'objectivity' can be seen as subjectivity with a common ground, or as a series of commonly agreed-upon objects. Examples of commonly agreed-upon objects can include the beginning and the end of the piece as represented by the inception and cessation of the sonic universe, salient structural moments in the sounding flow, such as sudden dynamic or textural changes, as well as any accidental or random external disruption, such as the rustle of clothing or the automated clicks of a central air-conditioning unit. The vectors act as mental tunnels that do not possess significance, but that can 'direct' or 'steer' the nature of developing significance. For example, listeners seem to shift their thoughts and perceptions to first and second-level 'extrinsic' topics when elements in the sounding flow are perceived to evoke such responses. However, listeners can shift their thoughts and perceptions among intrinsic *and* 'extrinsic' topics through the vectors when elements in the sounding flow are perceived to change function, behaviour or meaning.

One way to observe perceptual vectors is through the relationships listeners construct between elements in music that they perceive to repeat, or not, and the intrinsic/'extrinsic' topics they devise. For example, a listener's repeated thoughts of a church when apprehending the recording of a tolling bell illustrates how the 'objective' meaning of a repeated element in the sounding flow can be observed to transfer, repeatedly, to another meaning in the listener's mind. However, when apprehending the recording of a tolling bell the listener could also shift thoughts to a variety of first or second-level 'extrinsic' topics, for instance the emotions perceived while attending a church service in the past, or a memorable sermon, the scent of incense or alter flowers, etc. Conversely, the content of the intrinsic/'extrinsic' topic resulting from the transfer process may remain invariable in the listener's mind over time when the listener perceives the element in the sounding flow to vary. For instance, a listener can shift thoughts, repeatedly, to that of a church while perceiving the recording of a tolling bell to become hybridised or ambiguous in nature. Finally, although an element's perceived purpose in the sounding flow can remain 'non-transferred' in the listener's mind during multiple repetitions, the element can brusquely evoke 'extrinsic' topics or its purpose otherwise be perceived to undergo a transfer of behaviour, function or meaning during, or at the end of, the series of repetitions. A visual analogue of the latter example of this process can be seen when a stone is flung across a lake and skips on the water's surface numerous times before sinking. The repeated skips of the stone on the water's surface are analogous to the repetition of the element in the sounding flow over time and its 'non-transferred' purpose, and the moment the stone sinks is analogous to the onset of a transfer process.

In my experience, some elements in the sounding flow are not perceived to catalyse perceptual vectors insofar as they do not evoke thoughts or perceptions, nor do they invoke transfer processes. Yet the elements whose purposes are *not* perceived to transfer outside of their 'objective' spectromorphological and/or spatio-temporal contexts – or are perhaps unconsciously perceived – can influence the manner in which the other elements *are* transferred. Following, I suggest that the listener can construct different transfer processes simultaneously. The unconscious perceptions and processes can rise to the threshold of the listener's consciousness in the same way that the conscious perceptions and processes can sink below the threshold. Additionally, the transfer processes can occur independently of each other, over time, or otherwise interact, merge and engender or negate each other.

We have seen that the apprehension of acousmatic sound can appear to catalyse the formation of intrinsic *and* 'extrinsic' topics through perceptual vectors. In addition,

the intrinsic and 'extrinsic' topics occasioned by the listening experience and accompanying vectorial activity can reflect back upon and further influence listeners' perceptions of the sounding flow as it unfurls, as well as listeners' perceptions of themselves and the world as they see it. I have found it important to distinguish between the four vectors. Therefore, I shall give a brief overview of the vectors from the poietico-esthesic viewpoint of the acousmatic composer.

Evocation

In 1.3.2, I suggested that *evocation* is a process whereby listeners can 'disengage' from a self-oriented reception behaviour in which they focus either on the piece or on themselves and instead engage in what is explained in 4.1.2 as second-level 'extrinsic' thinking, e.g. topics that appear to be 'extrinsic' to the listener and the piece. The process of evocation can frequently begin – or be intertwined – with typo-morphological description or qualification of a sound or sound world, hence justifying the alliance of evocation with the reception behaviour *sonic properties*. However, as noted in 1.3.2, the listener's *contemplation* of the sound or sound world appears to serve as the basis for a secondary perceptual construction. Thus, evocation comprises a two-step process that is frequently conscious and expressed. It is a driving force behind the reception behaviour, 'Combined Intrinsic and Second-Level 'Extrinsic' Topics' discussed in 4.1.3 (iii), where listeners refer to typo-morphological descriptions of sounds or descriptions of the sound world while centering on topics that appear to be 'extrinsic' to the self and the piece. However, as we shall see, evocations are not limited to second-level 'extrinsic' topics.

The state of 'perceptual disengagement' supported by evocation allows evocation to be an effective vector through which a wide variety of self-oriented reception behaviours can be conceived. These can include recognisable and tangible second-level 'extrinsic' topics, for instance, listener thoughts and images that centre on entities in nature, such as a topiary garden or a waterfall, or on civilisation as manifested through images of individual people or a busy city sidewalk. Evocation can also be perceived to engender non-tangible second-level 'extrinsic' topics such as temperature, colour, odour, and ambience as well as second-level 'extrinsic' topics of an imaginary sort. Finally, the state of perceptual disengagement supported by evocation can be perceived to catalyse first-level 'extrinsic' topics, in other words perceptions that centre on the listener. These perceptions can often unfold in non-tangible forms, for instance as memories and moods.

A characteristic of evocation is its perceived capacity to catalyse entire scenes in the listening consciousness, for example the images of the hangar and factory as conceived by *Académie de Musique de Soignies* Listener E in response to the source-bonded recording of a door in Vande Gorne's *Bois.* Conversely, the sound world in which a prominent low-pitched granulation, that descends by a minor 3rd in channels 3 and 4 between 11'45" and 11'56" in *Les Forges de l'Invisible*, from (sound example 4.1, track 76), is perceived by the composer to evoke the sense of descending a spiral staircase chiselled out of granite. Thus, we can see that evocation appears to enable the listener to create a mismatch of dimensions and/or complexity between the initial typo-morphological or spectromorphological description of the element or sound world and the first or second-level 'extrinsic' topic it is perceived to evoke.

Transfer of behaviour

An example of *transfer of behaviour* can be perceived from 2'21" to 3'09" in *Neon* (which occurs in sound example 4.2, track 77), where the motion of the waves, consisting of source recordings of real waves and sounds that are created to function as waves, is mimicked to a certain extent in other accompanying sounds which have higher and lower spectral registers than waves. The wave-like forms with a higher spectral register move more quickly. They are more transparent, diaphanous, and to the composer, behave, as spume might sound if spume sounded. The wave-like sounds with a lower spectral register move more slowly, are more opaque, and to the composer, behave, as cold deep-sea currents if cold deep-sea currents sounded. There is a subtle transfer of meaning through this transfer of behaviour, but it is important to say that these sounds do not signify the sea to me although they behave as I could imagine spume and deep-sea currents could sound and therefore can be considered to be an extension of how the sea sounds.

Such a description illustrates the premise I made in 1.3.2, that a listener can transfer characteristics of an existing sonic property or sound world in a piece to an entity that can be perceived or imagined to be exterior to the piece and the listener. This is one facet of the vector of behavioural transfer, which can be described in the following terms. Transfer of behaviour can occur when a sound is perceived to behave like or more remotely sounds as if it behaves like another sound in the piece, or a 'sounding' second-level 'extrinsic' topic conceived by the listener. Further, the behaviour of a sound in a piece can also be transferred by the listener to non-sounding or even imaginary second-level 'extrinsic' topics.

Hence, while the transfer of behaviour is perceived to begin with a pre-existing sound or sound world in the piece, the transfer process does not appear to depend on a pre-existing sounding model, within or outside of the work, as a target for the behaviour to be projected onto, in order for the process to be activated. This is not to say that transfers of behaviour are only aleatoric, as certain sonic properties and structural attributes in a work may facilitate the possibility for a transfer. For example, in *Neon,* the source recordings of real waves and the sounds that are created to function as waves may facilitate the 'sonorisation' of spume and deep-sea currents via sounds which have higher and lower spectral registers, thereby engendering an extension of the sound of the sea. However, when the behaviour of a sound in the work is transferred, intrinsically, to another sound in the work, the listener may perceive that while the second sound *can* behave as the first, it does not necessarily signify, denote or function as the first.

Thus, we can see that the transfer of behaviour is a particularly supple vector. It allows the listener mentally to 'substitute' one sound for another in a piece through the portal of similitude, although the listening consciousness can be committed to the 'substitution' with varying degrees. The transfer of behaviour also allows the listener to conceive the extension of sounding concepts, as illustrated in *Neon*, as well as to sonorise non-sounding concepts and create new ones by virtue of projecting existing behaviours onto the concepts that represent the extension, sonorisation, or the imaginary.

Transfer of function

A *transfer of function* could be perceived to occur in an acousmatic piece when, for example, a repeated mechanical sound, such as the source-bonded recording of a moving mill wheel, can operate for the listener as the sound of a paddle wheel, and thus be the basis for an imaginary journey on a paddleboat down a river. In this type of functional transferral, a sound appears to operate as a sounding or non-sounding concept outside of the work in a secondary perceptual construction in other words, a second-level 'extrinsic' topic. The transfer can seem to be arbitrary. However, there is often a relationship between the spectromorphological properties of the sound whose function is transferred and the sound's 'appropriated' function. This relationship can be based on isomorphism, representation, resemblance, symbolism, or metaphor, the terms of which are discussed in 4.2.3.

A second type of transfer can be perceived to occur when one sound functions

for the listener like another sound in the piece. The spectromorphology of the sound onto which the function is projected might be slightly or significantly different from that of the sound whose function is 'displaced'. Transfer of function can often appear to happen in chronological order; for example, the function of a sound can be projected onto another sound later in the piece. However, the reverse can also be true insofar as the function of a sound that is apprehended earlier in a piece can be derived from a sound that is somewhat different spectromorphologically, and is heard later.

An example of transfer of function that occurs both in chronological and reverse chronological order is perceived, by the composer, in *Ether*, from 1'01" to 2'56" (illustrated in sound example 4.3, track 78, a section of *Ether* from 56" to 2'58"), where eleven percussion/resonances that are derived from two source recordings, and are interspersed between 1'01" and 2'49", appear to function for each other. The first, a spectrally muted percussion/resonance that conveys the pitch D4, occurs at 1'01", 1'04", 1'22", 1'27" and 1'33" (5", 8", 26", 31" and 37" in the sound example). The second, a source-bonded percussion/resonance, which conveys the pitch G3, can be heard at 1'08", 1'13", 1'27", 1'36", 1'50", and again at 2'49" (12", 17", 31", 40", 54", and 1'53" in the sound example). The sonic properties of the source-bonded percussion/resonance, notably its more defined attack, spectral transparency, and the pulses in its resonance, serve as reference points that facilitate the, albeit spectrally muted, percussion/resonance to function as a source-bonded percussion resonance. Conversely, certain sonic properties and sonic contexts aid the source-bonded percussion/resonance to function as its hybridised counterpart. These include:

(i) The naturally 'rounded' attack in the source-bonded percussion/resonance;
(ii) The further rounding of the attack at 1'13" and 1'27";
(iii) A pitched, transformed sound that precedes the source-bonded percussion/resonance at 1'36" and 2'49";
(iv) High-pitched inharmonic iterations which are superposed onto the source-bonded percussion/resonance at 1'50" and 2'49";
(v) The appearance of a sustained, pitched (G4), transformed sound from 2'15" to 2'29" and from 2'35" to 2'40".

Transfer of meaning

In the first movement of *Les Forges de l'Invisible*, short, bowed, source-bonded violoncello sounds that descend by the interval of a Major 3rd, are interspersed in the

sonic fabric at 1'20", 2'15" and at 3'56". The sounds, which occur at 5" and at 59" in sound example 4.4 (track 79), an extract from 1'16" to 2'19" in the work, signify birdcalls for me. Although these sounds, to a lesser extent, behave and function as birdcalls, the transfer process is dominated by a shift of meaning as opposed to being dominated by a shift of function or behaviour. The sounds 'signify' birdcalls even if I know that they are not birdcalls.

A *transfer of meaning* can thus be perceived to occur when the listener assigns an alternative significance to a sound. In the same way as the assigning of meaning is an arbitrary decision on the part of the listener, so is the transfer of meaning, which can take innumerable forms. For example, a transfer of meaning can occur with hybrid or ambiguous sounds insofar as a listener might say, in response to hearing a sustained, pitched, ambiguous sound, that it 'signifies' the colour green or 'a warm day'. However, a transfer of meaning can often involve source-bonded sounds and occur when the listener shifts a commonly agreed-upon significance of a source-bonded sound to a significance in a secondary perceptual construction. In this case, there often is a spectromorphologically isomorphic relationship between the source-bonded sound in the piece and the 'new' meaning as exemplified by the brief violoncello sounds in *Les Forges de l'Invisible*, which signify birdcalls to the composer.

The acousmatic context can also affect the transfer process. For example, if a source-bonded recording of a violoncello is apprehended in a sonic context that is hybridised or ambiguous, the listener may be tempted to transfer the meaning of the source-bonded violoncello to a second-level 'extrinsic' topic that has real world connotations in order mentally to preserve a sense of reality in an otherwise 'unreal' sonic environment. However, the opposite may also be true. If a slightly hybridised sound of a violoncello can be heard within a sonic context that is perceived to be dominated by source-bonded sounds, the listener may transfer the meaning of the hybridised sound to a second-level 'extrinsic' topic of an imaginary sort in order to reserve a place for the 'unknown' in the listening consciousness.

Perceptual vectors: parallel, independent, and incomplete processes

I suggest the listener is able to retain the 'perceptual space' for parallel and independent vectorial processes, and that this mental capacity fosters the subtle activities of the listening imagination. For instance, the listener may transfer the meaning of a sound, or transfer the behaviour and/or function of a sound, which results in a perceived transfer of meaning *through* the vectors of behavioural or functional transfer. Seen

from another perspective, a transfer of meaning that is characterised by a perceived spectromorphologically isomorphic relationship between a sound in the piece and a 'second' meaning, can imply parallel transfers of behaviour and function, albeit at a lesser intensity and with variable levels of consciousness. However, a transfer of meaning does not necessarily implicate the vectors of behavioural and functional transfer since listeners can project a secondary significance onto a sound that does not appear to be catalysed by the perceived spectromorphological qualities of the sound. Conversely, while a transfer of function and behaviour can imply a transfer of meaning, the signification of the sound can stay intact in the listener's mind while the sound appears to gain an alternative function or behaviour. Finally, an incomplete transfer of behaviour, function, or meaning may occur when the process of transferral is perceived to be incomplete, uncertain, or is suddenly arrested. In this case, listeners may revert from, or repeatedly move between, their perception of the secondary behaviour, function, or signification they assigned to a sound, to the first.

4.2.3 Perceptual forms

We have seen how self-oriented reception behaviours encompass a wide variety of perceptions, some of which appear to be centred on the piece, while others appear to be centred on the listener or other topics external to the piece and the listener. Many perceptions arise through perceptual vectors. Other perceptions do not appear to develop through perceptual vectors, in which case the significances of elements in the sounding flow do not appear to transfer out of their observed aetiologies within the spatio-temporal context of the piece. However, all perceptions take a *form* as they unfold before they materialise into a final 'precise' object, such as an intrinsic or 'extrinsic' topic, whether the perception unfolds through a perceptual vector or not. Like the perceptual vector, the perceptual form can be seen as a type of 'generalised' object, from the viewpoint of the Subject-Object continuum.

Although it is not possible to predict the types of perceptions that may arise in listeners' minds, composers can attempt to 'steer' the listening experience by way of compositional methods. Two methods, previously discussed in 2.1, which I use, specifically foster the poietic preparation of significances. They include the initial act of repeatedly listening to sounds in order to qualify them morphologically as prescribed by reduced listening, and the subsequent placement of sounds into sonic contexts after their morphological qualification. The process of reduced listening aids the composer

in disassociating sounds from their real or imagined sources and accompanying significances, and associating the sounds with other significances. The composer can then strive to build the context of the piece in function of the sounds' new significances. A goal of further research will be to examine how the composer and listener mediate, poietico-esthesically, between the broad base of implied and received significances, several forms of which are briefly described here.

Icon

In order to discuss the relationship between an *icon* and music, it is helpful first to define the term from the perspective of Charles Sanders Peirce, who views an *icon* as a:

> "sign which refers to the Object that it denotes merely by virtue of characters of its own, and which it possesses, just the same, whether any such Object actually exists or not. […] Anything whatever, be it quality, existent individual, or law, is an Icon of anything, in so far as it is *like that thing* and used as a sign of it" (Peirce, 2.247 in Cumming, 2000: 87, Cumming's italics).[136]

In analysing Peirce's definition, Naomi Cumming makes the following observation: "Resonances of *possibility* should be heard in the first clause, where Peirce denies the need for an actual object, to which an icon is similar" (Cumming, 2000: 87, Cumming's italics). This position is also shared by Jean Fisette, who additionally draws a parallel between Langer and Peirce:

> "'That which is divulged in regards to the spirit must be logically possible' (Peirce 4.531 in Fisette, 1999: 52); this is what the icon does and what strictly defines the virtual: *divulging the possibilities.* Langer's text is very close by, because, here again, the music responds in a manner that is perfectly accurate in regards to this function of the icon (Fisette, 1999: 52, Fisette's italics): '[…] *make things conceivable* rather than to store up propositions'" (Langer, 1942: 244, in Fisette, 1999: 52, Langer's italics).[137]

To understand the importance of 'possibility' within the Peircean icon, it is

[136] Peirce's notion of the term 'object' differs from Schaeffer's sound-object as well as the term 'object' as seen from the viewpoint of Indo-Tibetan philosophy.

[137] My translation of Fisette's text: *«'[…] ce qui est affiché devant le regard de l'esprit doit être logiquement possible'; c'est là que fait l'icône et qui définit strictement le virtuel:* afficher des possibilités. *Le texte de Langer est très proche car, encore ici, la musique répond d'une façon parfaitement juste à cette fonction de l'icône: '[…] rendre les* choses concevables *plutôt que de les enfermer dans des propositions'».*

useful to examine the foundation of his thinking, which Fisette observes is based on the Greek *eikône*, denoting 'image', or *imago* in Latin. While the visual concept of the icon, which relates to art history and visual semiotics, was most likely based on the Greek verb, *eikô*, meaning to resemble or to appear, Fisette notes that it is difficult for an image – in this case, a visual representation – to correspond to the traits that define the icon. Fisette suggests this is because a physical object exists, or is felt in advance to exist, behind the image. Thus, a visual icon supposes a discrimination between the sign and its object that is based on a relationship of similitude and has a quality of stability, which does not correspond to the unusual objects and mythical characters we fabricate in our collective dreams (Fisette, 1999: 49). To circumvent this difficulty, Peirce proposes that the icon does not denote a representation, but a simple presence, for which he proposed the term, *presentment* (Peirce 1.313 in Fisette, 1999: 50, Fisette's italics). Thus, Fisette notes "The icon is anterior to the concept of representation; it is more primary, because it does not presuppose anything other than itself […]" (Fisette, 1999: 50).[138] I suggest this is why the icon can be regarded as the most flexible and nuanced of perceptual forms in music, a view also held by Fisette, who notes that "[…] in the two cases of music and the icon, it is the character of the unspecified, as for the content carried, that proves to be predominant […]" (Fisette, 1999: 52).[139] Following this logic, the character of the unspecified can be transmitted by the icon through music, and, therefore, aid to create the transient play of content that Langer suggests music has, as exemplified by the simultaneous expression and interpretation of Heaven and Hell in Brümmer's *The Gates of H* in 4.2.

Isomorphic and non-isomorphic representation (non-iconic)

A representation can be understood as "an image, likeness, or reproduction of a thing" (Oxford, 1996: 861). *Isomorphic and non-isomorphic representation* can be understood as a relationship, based on exact or non-exact formal proportions between a thing and its depiction. In acousmatic terms, isomorphic and non-isomorphic representation can be perceived to occur when a spectromorphology appears to represent, isomorphically or non-isomorphically, an extra-musical entity that can be sounding or non-sounding. A simple example of this type of perceptual form can be observed in the relationship the listener creates between the trajectory of the energy

[138] My translation of Fisette's text: *«L'icône est antérieure à la représentation; elle est plus primaire, car elle ne présuppose rien d'autre qu'elle-même […]»*
[139] My translation of Fisette's text: *«[…] dans les deux cas de la musique et de l'icône, c'est le caractère de l'indétermination, quant au contenu porté, qui s'avère prédominant […]»*

model ‘rebound’ perceived in a source-bonded recording of a bouncing ping-pong ball, and a previous experience the listener had with the model ‘rebound’ while bouncing a basketball. A more complex example of isomorphic representation may be perceived in a sonic landscape that is studded with short, rapidly moving, spectrally impoverished, transparent sound objects in the spatial foreground which contrast with a non-evolving, pitched background. The sonic landscape may be considered by the listener as isomorphically representative of a physical situation where one walks to a distant house in whiteout weather conditions produced by a blizzard.

Symbol

In ancient Greek, the term, *symbol*, was frequently used to denote a convention or a contract (Peirce, 1998: 9). Further, Peirce adds, “Aristotle calls a noun a ‘symbol’, that is, a conventional sign. [Peirce gives the following examples:] Any ordinary word, as ‘give,’ ‘bird,’ ‘marriage,’ is an example of a symbol. *It is applicable to whatever may be found to realize the idea connected with the word;* it does not, in itself, identify those things” (Peirce, 1998: 9, Peirce’s italics). Thus, a symbol can be seen as a type of connection between two things through which something new arises. For example, a road sign with a single inverted triangle can be a symbol for drivers to yield in the same way that small triangles placed on geographical maps can be symbols for mountains. In both cases, the instruction to yield, and the physical entity of the mountain are conveyed through representative triangles that serve as symbols. Without the implied connection, the triangles would not possess a symbolic value.

The symbol can be a very powerful sign in electroacoustic music. According to Young symbols in acousmatic music, are often expressed through recognisable sounds. This is because, although recognisable sounds can be, and often are, understood in terms of source and cause, they often carry a wider association. For example, the sound of a door in an acousmatic piece may have symbolic value for a listener insofar as the sound of the door may be perceived as door, yet also symbolize the movement between interior and exterior (Young, 1996: 79-80).

Resemblance

A *resemblance* is a likeness or similarity to something, and it is often perceived through behavioural similarity. For instance, one sound can appear to resemble another when it is observed by the listener to have a similar behaviour as another sound or a concept exterior to the piece. Further, I suggest that inherent to resemblance is a conscious

perceptual dichotomy between one sound and another sound or concept that it appears to resemble. This is because while the listener may accept that one sound resembles another sound or extra-musical concept, the sound may not be perceived to signify, denote, function as or represent the other sound or concept. An example of behavioural resemblance can be perceived in the second movement of *Protopia/Tesseract* at 9'24" – 9'55" (channels 1 and 2), where a series of short, rapidly moving pitched sounds in the form of melodic seconds, are perceived by the composer to resemble those of a calliope. Finally, resemblance is not limited to formal or behavioural similitude. Relationships based on resemblance also can be textural, spectromorphological, or spatial.

Reference

I suggest the perceptual form *reference* occurs when an element in an acousmatic work is perceived by the listener to correspond or relate to an intrinsic or extrinsic topic in lieu of denoting the topic via iconic or isomorphic representation or symbolism. A palpable psychological distance is created in the mind of the listener between the element in the sounding flow and the topic to which it refers. From a poietic viewpoint, a reference can be conceived in the following manner. A sound denoted as 'orchestral seashell' in the first movement of *Les Forges de l'Invisible,* at 4'27" in channels 1 and 2 (sound example 4.5 (track 80), from 4'21" to 4'36" in the work, where the 'orchestral seashell' can be heard at 5" in the example), is conceived entirely from friction-based sound particles that were created when seashells were hand held and ground against each other. 'Orchestral seashell' has spectral and acoustic properties inherent to the original source sound of the shells, and therefore, refers to the source sound through its 'sonic roots'. However, the new sound is not intended to represent or resemble the sound a seashell might be imagined to make, because it *refers* to the original seashell recording through commonly shared sonic matter, not morphological form. The morphological form, which is inspired from the source recording, instead is based on a slow 'gathering while flinging' motion and is intended to convey the sense of spatial freedom found on a beach, where seashells, sand and water can be gathered and flung with abandon.

Remote perceptual links/free association

Remote perceptual links and/or *free association* can seem to occur when listeners conceive weak perceptual links, or do not conceive any links, between the sounding flow of an acousmatic piece and their perceptions while listening. An example of

apparent free association can be observed when a listener thinks of, and describes, the colour violet in response to hearing a source-bonded sound that has the energy-motion trajectory of a rotation, or describes the odour of a forest in response to hearing a sonic web. However, in these instances, the listener may have associated a perceived velvety, smooth morphology heard in the rotation with the tactile sensation of caressing a piece of velvet that happened to be violet. The listener could also imagine a sonic web to be an aural example of a forest, in particular the web-like canopy created by fragrant, deciduous trees. These are examples of synesthesia, where impressions that arise in one sense, for instance, sight and touch, are transferred, cognitively, to another sense, in this case hearing. Thus, free associations may instead be remote perceptual links.

The sound image/intended message

Iconic and isomorphic representation, as well as symbolism, reference, and resemblance, conceived by the composer, can provoke or steer the various types of meaning and/or signification received by the listener. The strength of an idea imparted, in acousmatic music, is particularly dependent on the level of clarity or transparency of the relationship between the sound image and the intended message.

4.3 Self-Orientation and the Works in the Folio

4.3.1 Three stages of the poietic process

This section examines the reception behaviour *self-orientation* from a poietic viewpoint. Discussion centres on three areas: (1) the initial awareness the acousmatic composer may have of an external stimulus, which can serve as the inspiration for a piece; (2) the relationship the composer develops with the stimulus; and (3) the role the stimulus can have in the creation of the piece. In this way, self-orientation can be regarded as a steering agent in the compositional process, a useful point since composers' perceptions of external stimuli are hardly separable from their reactions to the stimuli. Further, composers' reactions to stimuli feed the other three strategies – sonic properties, structural attributes, and imaginary realms – from a poietic viewpoint, because composers do not usually separate their intellectual, emotional, physiological, and imaginative experiences from their conception of the form of an acousmatic piece and its sounding flow.

4.3.2 Discussion of the three-staged poietic process in two works

Chat Noir

The possibility of expressing opposites in acousmatic music is a perpetual source of inspiration for me. Hence, the concept of psychological opposites, as proposed by Robert Johnson in *Owning Your Own Shadow: Understanding the Dark Side of the Psyche* (1991), was particularly intriguing. Figure 4-3 illustrates my relationship with Johnson's concept of the shadow through three stages of the poietic process in *Chat Noir.*

Input	***Relationship to input***	***Output***
The input is the concept of the shadow as presented by Johnson in *Owning Your Own Shadow: Understanding the Dark Side of the Psyche* (Johnson,	The shadow refers to that which has not been assimilated sufficiently into consciousness. It is the abhorred part of the human spirit. However, certain positive characteristics of our personalities also are banished to the shadow because they do not fit in	In *Chat Noir*, the shadow is conceived as unbridled energy expressed in the form of turbulent, non-developing, atemporal, sounds. I describe them as 'tumbleweed' sounds because they sweep across the stereo axis as tumbleweeds could sweep across one's path in a desert. They portray the undeveloped and uncultivated shadow character personified by the cat in *Chat Noir*, and they contrast strongly with the other character personified in the work, the

1991).	that large smoothing process which we call culture (Johnson, 1991: 4-6).	young being, who does develop and who is represented, loosely, by linear, temporal, sound material.

Figure 4-3. Three stages of the poietic process in *Chat Noir*

Neon

Neon concerns the reconciliation of psychological opposites, as inspired by Johnson's text, on the scale of the environmental in acousmatic sound. Figure 4-4 illustrates my relationship with Johnson's concept of reconciliation through three stages of the poietic process in *Neon.*

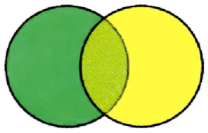
Input	***Relationship to input***	***Output***
The input is the concept of the mandorla, the place in human consciousness where light and dark touch. This concept is also taken from the book *Owning Your Own Shadow: Understanding the Dark Side of the Psyche.*	Physically, the mandorla is an almond-shaped section created when two circles partially overlap, as illustrated in the design below.  The mandorla is also a symbol denoting the overlap of opposites, a place where they may be reconciled (Johnson, 1991: 98-99).	As discussed in 2.2.3, the sounding gestures in *Neon* are constructed to work together to impart a central theme: the elevation of a microcosm of non-sounding phenomena, consisting of contrasted thoughts and feelings we experience in the human consciousness to a macrocosm that is incarnated, and whose opposing forces are reconciled, through simultaneous strata of acousmatic sound. Key to this construction was a series of open-air source recordings I made, which featured what I experienced as the 'uninhabited' expansiveness of nature, and the magnitude of its opposing forces. I then sonorised, simultaneously, such opposite entities in the exterior, physical world as slow-moving, deep-sea currents and spume to impart the collision and reconciliation of opposites in the human consciousness.

Figure 4-4. Three stages of the poietic process in *Neon*

Double continuum

In view of the multitude of different ways acousmatic works can be interpreted by the composer and the listener within the scope of self-orientation, I created a double continuum comprising the axes ''Plurivocity'/'Univocity' of Thoughts, Physiological Sensations and Emotions', and 'Clarity/Obscurity of the Concept Represented'. Through the double continuum, illustrated in Figure 4-5, I attempt to represent the relationship between the quantity of esthesic responses accrued during the listening

experience and the factor of transparency through which the concepts in the piece are perceived.

Definitions of terms

(i) 'Univocity'

I created the term, 'univocity', to denote the existence of one thought, physiological sensation, or emotion the listener might express within the context of an entire acousmatic work, a precise section in a work, or during an instant in the sounding flow.

(ii) 'Plurivocity'

I devised the term, 'plurivocity' to signify the existence of several thoughts, physiological sensations, or emotions the listener might express within the context of an entire acousmatic work, a precise section in a work, or during an instant in the sounding flow.

(iii) Clarity

In this context, the term, clarity refers to the highest level of transparency through which the concepts in the work are perceived.

(iv) Obscurity

Within the double continuum, obscurity can be intended to indicate the highest level of opacity through which the concepts in the work are perceived, in other words, a quality that can make perception difficult for the listener.

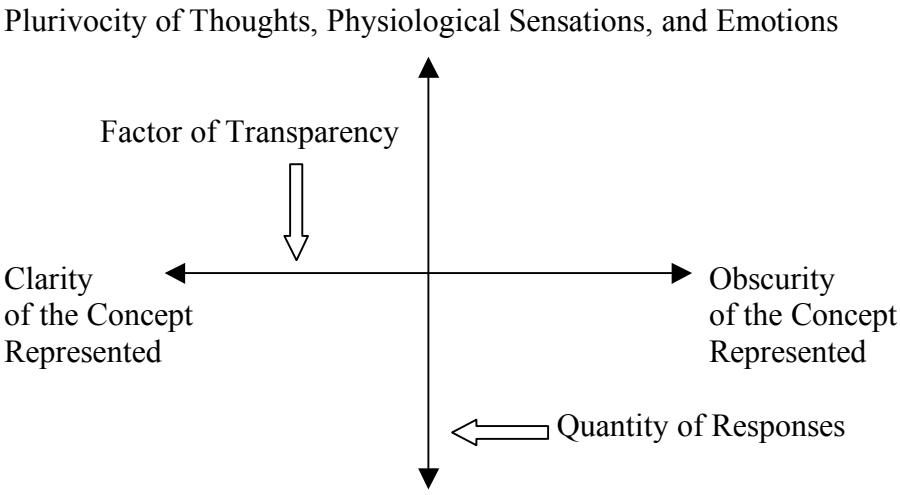


Figure 4-5. Plurivocity/univocity and clarity/obscurity double continuum

Information regarding the continuum

(i) Esthesic responses and the factor of transparency

The relationship between the quantity of responses a listener may have during a specific part of a listening experience and the factor of transparency through which the concepts of the piece are perceived illuminates one aspect of the listening experience. It also reflects the efficiency of the composer's poietic intent.

(ii) Temporal evolution of the work and listener responses

While listening to a piece, the listener may experience one or more physiological sensations, emotions, or thoughts, which may develop in isolation, in a cluster, or which may appear and/or disappear as illustrated by the continuum, ''Plurivocity'/'Univocity' of Thoughts, Physiological Sensations and Emotions'. The number of responses the listener may have in reaction to the sounding flow can be perceived to occur and change according to the state of mind of the listener, as the piece unfolds in time.

(iii) Temporal evolution of the work and the clarity/obscurity of the concepts represented

The factor of transparency through which the concept or concepts perceived to be imparted by the music may be different for the listener at different stages during the listening experience.

(iv) Clarity/obscurity from the poietic viewpoint

One could dismiss the value of obscurity from the poietic viewpoint, since one could argue that composers would always strive for clarity in the intention and reception of their ideas. However, at times composers' concepts are indeed obscure, and are intended to be perceived as such, or are simply complex, in which case the success of the piece depends on the composer transmitting concepts through an appropriate factor of transparency. In other words, obscurity, too, paradoxically needs to be delivered clearly.

(v) Importance of temporality

It is important to take several readings of listener reactions during specific parts of a piece, or during an entire piece. In this way, we can see the evolution of the number of physiological sensations, emotions, or thoughts listeners may have in tandem with the

factor of transparency with which the concepts of the piece are seen to be perceived.

A poietico-esthesic viewpoint: Sections of two works as represented on the double continuum

(i) Chat Noir

The extract of *Chat Noir,* from 3'10" to 3'48", (sound example 4.6, track 81), illustrates the growing opposition between the two central characters depicted in the work through intensifying temporal multiplicity in the sounding flow. I perceive the intensifying temporal multiplicity in three discrete subsections (3'10" – 3'22", 3'23" – 3'40", and 3'41" – 3'48") (0" – 12", 13" – 30" and 31" – 38" in the sound example), during which the concept on which I based the section becomes increasingly clear to me and the number of thoughts, physiological sensations, and emotions I perceive slowly multiplies in response to the increasingly dense musical texture. The ranges of my responses to the subsections are illustrated in the form of blue ellipses as represented on the double continuum in Figures 4-6 – 4-8.

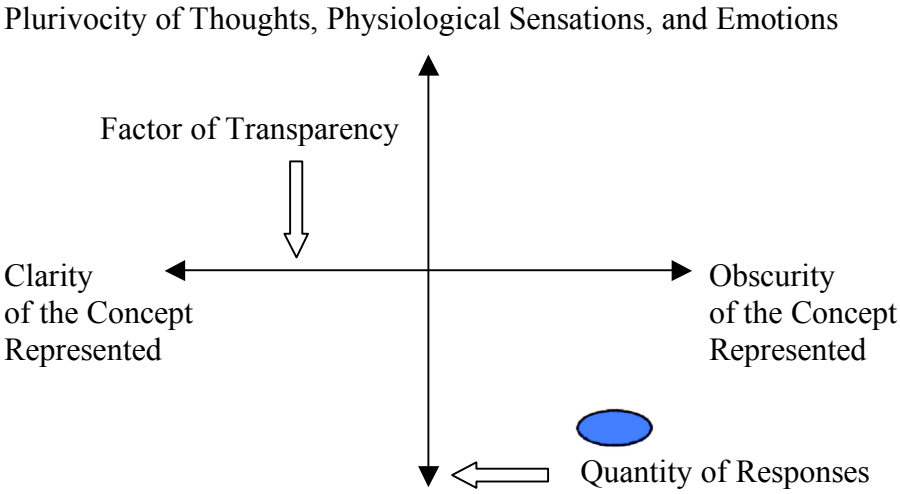


Figure 4-6. *Chat Noir*: 3'10" – 3'22" from a poietic perspective through the plurivocity/univocity and clarity/obscurity double continuum

The ellipse in Figure 4-6 represents the relative obscurity with which I perceive the concept of opposition at the beginning of the section. The idea of temporal multiplicity does not yet appear to be developed, and the few, aborted thoughts I have are like fleeting shards of glass that revolve in kaleidoscopic motion in a weightless

environment.

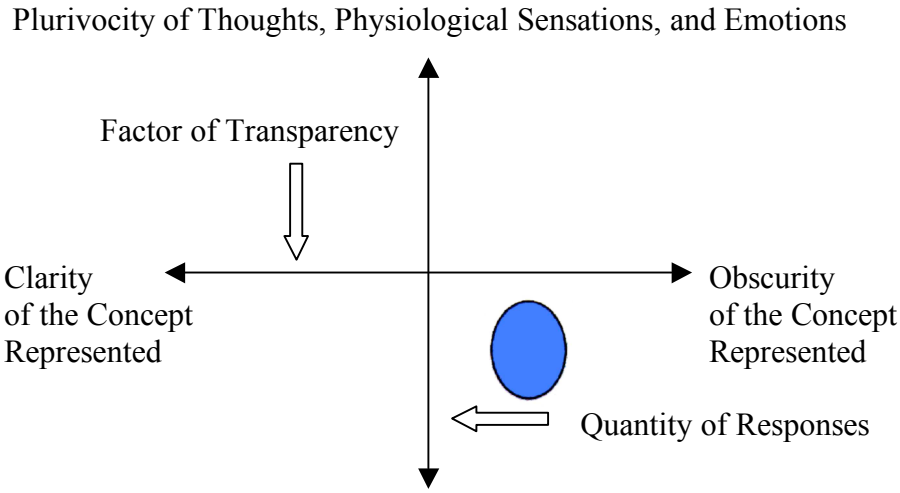


Figure 4-7. *Chat Noir*: 3'23" – 3'40" from a poietic perspective as seen through the plurivocity/univocity and clarity/obscurity double continuum

The ellipse in Figure 4-7 illustrates the growing clarity with which I perceive the concept of opposition as conveyed through temporal multiplicity. My thoughts begin to be more numerous, since I pause to consider the various sounds individually, yet without consciously making connections between the sounding flow and the exterior world.

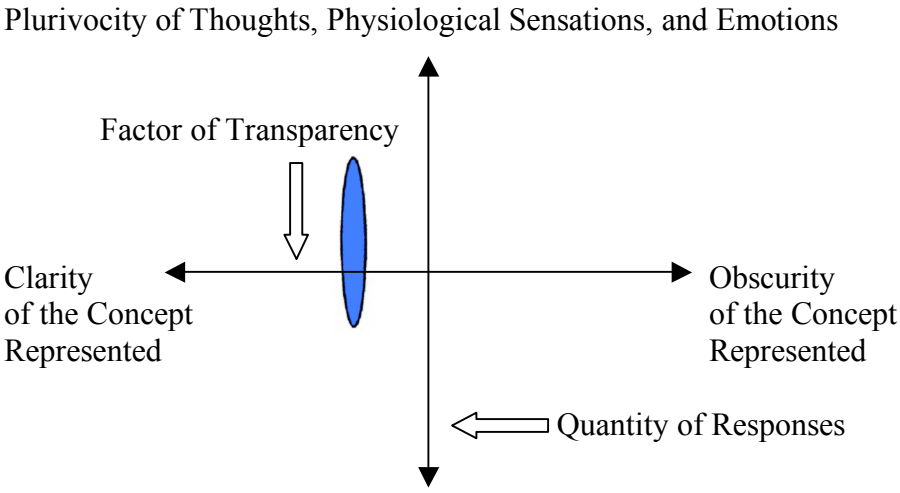


Figure 4-8. *Chat Noir*: 3'41" – 3'48" from a poietic perspective through the plurivocity/univocity and clarity/obscurity double continuum

The ellipse in Figure 4-8 depicts the increasing clarity with which I perceive the concept of temporal multiplicity. My thoughts multiply – some of which diversify into emotion – in response to the increasingly complex sonic environment, and I begin to associate the different temporalities perceived in the sounding flow with the cavalcade of daily responsibilities in the exterior world, each with different temporal demands.

(ii) Neon

The extract in *Neon*, from 2'49" to 3'15", (sound example 4.7, track 82) represents the meeting and reconciliation of opposites on an environmental scale as expressed in sound. I perceive the sonic context in four discrete subsections (2'49" – 2'56", 2'57" – 3'06", 3'07" – 3'09" and 3'10" – 3'15") (0" – 8", 9" – 18" and 19" – 21" and 22" – 27" in the sound example), during which the concept of opposition and reconciliation, on which I based the section, is clear or opaque to me depending on the subsection. Although the sonic texture becomes increasingly dense and is shorn off, abruptly, at 3'07", the quantity of my thoughts, physiological sensations, and emotions is relatively modest. The range of my responses to the subsections are illustrated in the form of blue ellipses as represented on the double continuum in Figures 4-9 – 4-12.

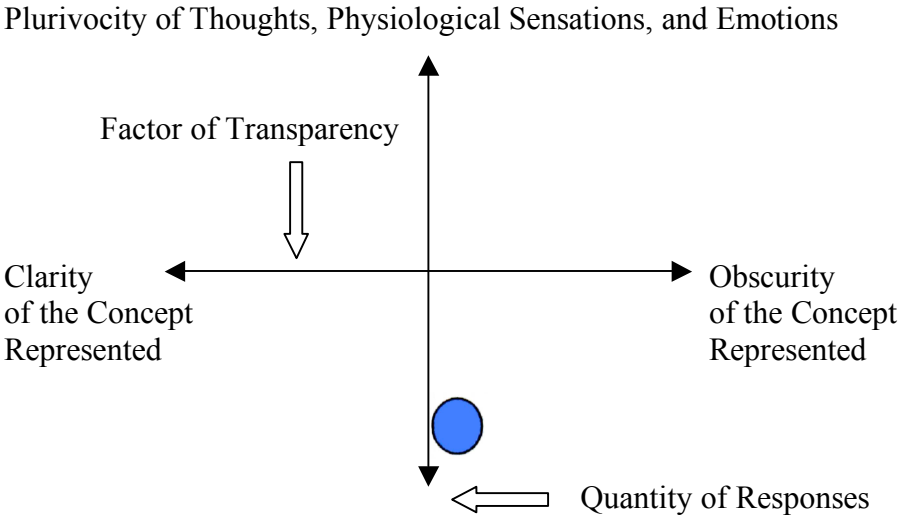


Figure 4-9. *Neon*: 2'49" – 2'56" from a poietic perspective through the plurivocity/univocity and clarity/obscurity double continuum

The ellipse in Figure 4-9 is almost equidistant between obscurity and clarity, reflecting the uncertainty, at the beginning of the section, with which I perceive the meeting of opposites that are represented. The sounding flow is dense and riveting and I simply

absorb it.

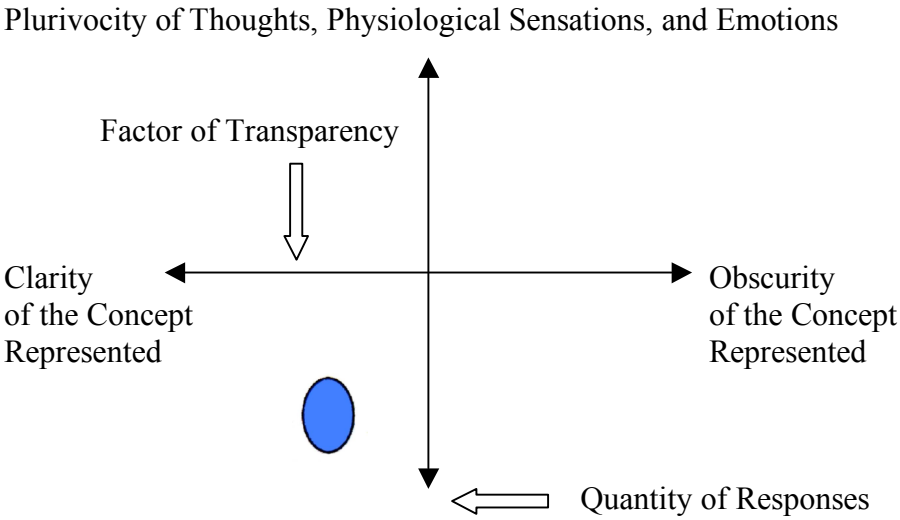


Figure 4-10. *Neon*: 2'57" – 3'06" from a poietic perspective through the plurivocity/univocity and clarity/obscurity double continuum

The ellipse in Figure 4-10 illustrates the growing clarity with which I perceive the concept of opposition. The sound world becomes denser and more tempestuous as increasing layers of audible spectra billow over each other. My responses increase and become physiological in nature as I feel alternatively swept and pushed forward in space and time.

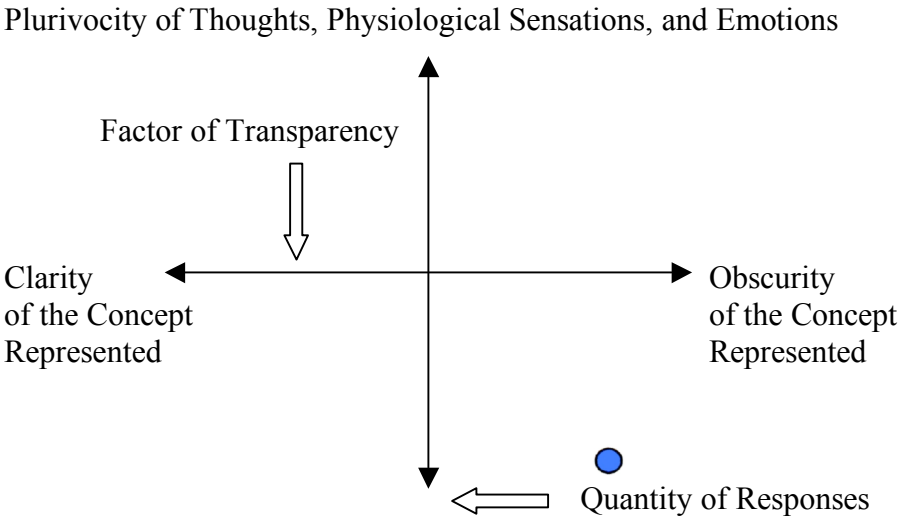


Figure 4-11. *Neon*: 3'07" – 3'09" from a poietic perspective through the plurivocity/univocity and clarity/obscurity double continuum

Figure 4-11 represents my response to the crack at 3'07", which sheers off the preceding sound world, and the high-pitched sustained sound at 3'08". Having felt alternatively swept and pushed forward during the preceding section, the violent cessation of sonic activity flings me backwards, leaving me stunned and motionless.

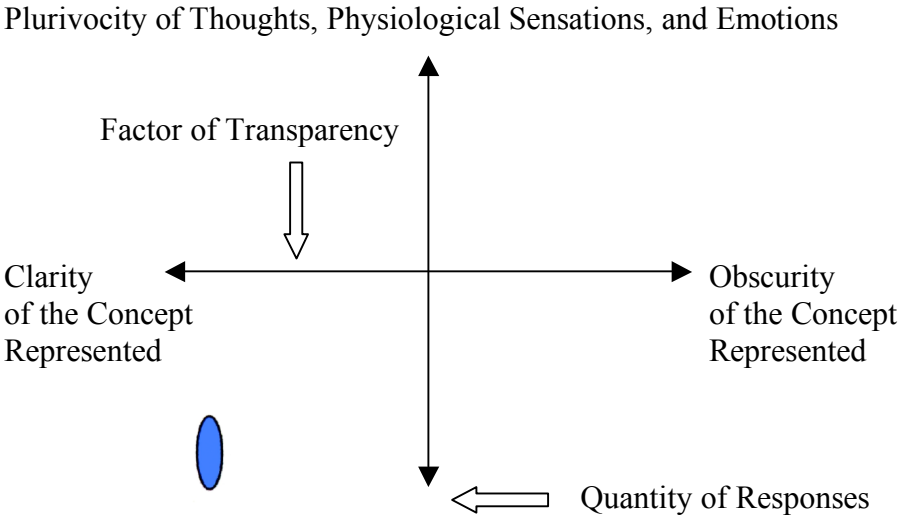


Figure 4-12. *Neon*: 3'10" – 3'15" from a poietic perspective through the plurivocity/univocity and clarity/obscurity double continuum

The ellipse in Figure 4-12 depicts the increasing clarity with which I perceive the concept of opposition, which I now sense moves towards the concept of reconciliation. The calm, undulating sound world allows me to place the previous, tempestuous, sound world into context.

Possible outcomes from the poietico-esthesic viewpoint

(i) I may have more responses to my music when I perceive my compositional concepts to be obscure because I could perceive the concepts to represent anything or, at the moment of the reading, nothing, and I try out different strategies in order to understand them.

(ii) I may have fewer responses to my music when I perceive my compositional concepts to be transparent because they are easier to grasp, or because I feel at ease.

(iii) I may have fewer responses to my music when I perceive my compositional concepts to be obscure because I allow the music to unfold; I merge with it without

trying to understand it. I may also not know how to react, or prefer, simply, to absorb the piece.

(iv) I may have more responses to my music when I perceive my compositional concepts to be transparent because the concepts could represent many things, particularly if I perceive the concepts to be complex.

Chapter 5. Imaginary Realms

5.1 Introduction

Developing a discussion that would be as objective as possible is particularly important in this chapter because the composer too makes an esthesic analysis of the actual process of listening – in this case, based on composer's own imagination – which is always coloured by poietic knowledge. The intention of this chapter is to probe the imagination as catalysed by the listening experience, in order to illuminate potential manifestations of imagination in the poietic as well as in the esthesic process. It is by no means an exhaustive psychological study of imagination.

My investigation begins with an examination of the process of imagination and then explores the various guises images may take. These include Delalande's figurativisation, which, as noted in 1.2.3, "[…] relies on a contrast between sonic configurations which are associated with the living being and other configurations which have a contextual function […]" (Delalande, 1998: 47). This type of listening strategy is exemplified by the following listener response to Henry's *Sommeil*: "It is something that awaits you, waiting in ambush behind a bush, a sleeping monster or dragon; you look over the bush and you discover it" (*ibid*.: 49).

Although my idea of *Imaginary Realms* owes much to Delalande's figurativisation, it allows for a wider perspective of figurativisation which does not depend on the contrast between sonic configurations linked to the living being and other configurations that have a contextual function.

The reception behaviour 'imaginary realms' also include listening strategies where the listener can exercise imagination as an end in itself, for example as fiction, fantasy, and surrealism, among others. I suggest such strategies differ from the listener's use of imaginative terms to express perceptions about the sound world, structure, or physiological sensations, emotions and thoughts – as we have seen in previous chapters – because they do not serve sonic properties, structural attributes, or self-orientation: they serve the imaginary in all its forms. This is not to discount the importance of sonic properties and structural attributes apprehended in acousmatic music, or the listener's self-oriented responses. On the contrary, these perceptions may aid to catalyse images in the listening consciousness and the manner in which they unfold, whether the images are deployed entirely in the imagination or whether they are

alloyed with references to the real world. Lelio Camilleri and Denis Smalley attest to the flexibility with which acousmatic music can be perceived to support both reality and the imaginary: "[…] in acousmatic music […] in the invisible, spatial play of 'sound-images', there is often an ambiguous entwining of allusion to the real world, and an imaginative distancing from its realities" (Camilleri and Smalley, 1998: 7).

5.2 From Imagination to the Image

Durand proposed that Western thought has had an enduring heritage of ontologically underrating the image and the process of imagination. The consequence of the immense campaign of ideas, that began with Socrates and continued to develop until the twentieth century, is that it isolates and denigrates all that it considers as a departure from reason. Classic psychology, as demonstrated by Jean-Paul Sartre, confused the notion of the image with the mnemonic double created by perception, which furnishes the mind with cerebral models that are copies of objective things (Durand, 1992: 15-16). This issue is addressed in Gaston Bachelard's explanation of imagination, where images formed through perception can serve as a useful base for imagination:

> "'Far from being the faculty to 'form images' imagination is a dynamic force that 'deforms' pragmatic copies furnished by perception' … 'our sensitivity serves as a medium between the world of objects[140] and that of dreams…' of which '… the archetypology exposes the system of schemes, archetypes, symbols, myths…'" (Bachelard in Durand in Bayle, 2003: 82).[141]

In this two-staged view of imagination, 'pragmatic copies' refers to a series of commonly agreed-upon objects in the form of initial images that are not distorted through the act of perception, to be distinguished from the images as later deformed by imagination. By suggesting that imagination can occur when our sensitivity mediates between objects and dreams, Bachelard implies that we create a tripartite relationship between the images we perceive, our personal sensitivities, and the images we distort, a construction that I consider to be suitably complex to support the extremes and subtleties of the imaginative process. The mental capacity to recall memories can also influence how the listener imagines. Finally, the range of sonic combinations in an acousmatic work are a favourable territory for listeners to engage with memories and a re-imagined past, and to combine them with the present, whether real or imagined.

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[140] Although Bachelard's use of the term, object, is similar to the Indo-Tibetan usage insofar as it refers to a perceived entity, in the Indo-Tibetan context the object is part of the Subject-Object continuum, as discussed in 2.2.1.

[141] This Bachelard quote appears in his work, *On Poetic Imagination and Reverie,* in the following guise: "[…] Imagination is always considered to be the faculty of *forming* images. But it is rather the faculty of *deforming* the images offered by perception, of freeing ourselves from the immediate images; it is especially the faculty of *changing* images" (Bachelard, 1962: 19, Trans. Gaudin, 1987) (Bachelard's italics). I prefer my translation of Bachelard's French text, which Bayle quotes from Gilbert Durand: *«'Bien loin d'être faculté de 'former des images' l'imagination est puissance dynamique qui 'déforme' des copies pragmatiques fournies par la perception' … 'notre sensibilité sert de médium entre le monde des objets et celui des songes…' dont '… l'archétypologie expose le système des schèmes, archétypes, symboles, mythes…'».*

5.2.1 Figurativisation

As I suggested, imagination can produce various types of images, notably, figurativisation, fiction, fantasy, and surrealism, which in the study of reception behaviours, are to be viewed as listening strategies. We know that if listeners engage in *figurativisation*, they attempt to discover the figurative in the music and consider that various sounds imply something that moves, as if alive. When adopting this listening strategy, listeners also search for a contrast between sonic forms that are associated with the living being and other forms that have a contextual purpose (Delalande, 1998: 47). As noted in 1.4.4, this type of approach appears among the findings from the listening experiment in International School of Brussels Listener P's response to the second of the *Deux aperçus du jardin qui s'éveille*. The response, shown in Figure 5-1, is an illustration of part of a forest where trees frame an open-air space filled with frolicking animals. The illustration is accompanied by the following descriptive text: "I think that this music is a tropical rainforest with many bird [sic], insects and creatures in it. The creatures are furry and have high-pitched voices. There are different noises made by these creatures in the forest" (Anderson, 2001: 28). Although description prevails over narrativity, the lines around the insects depicting movement and the description of high-pitched voices in the accompanying text impart a gentle temporal flow.

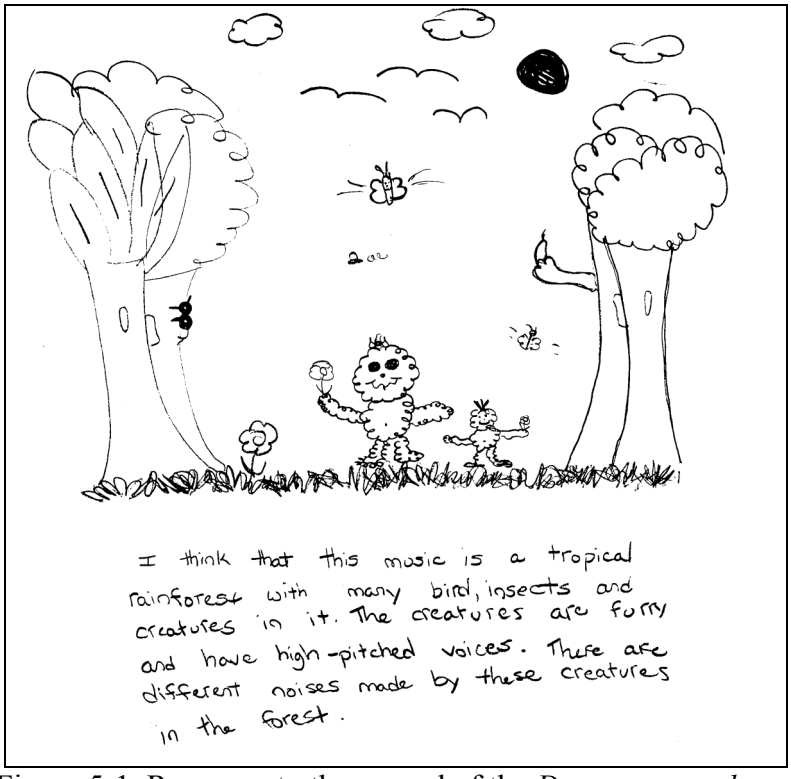


Figure 5-1. Response to the second of the *Deux aperçus du jardin qui s'éveille* by International School of Brussels Listener P

Figurativisation can be broadened to convey the figurative without necessarily relying on a contrast between sonic forms that are linked to the living being and other forms that have a contextual function. This wider perspective of figurativisation appears in Figure 5-2, the response to *The Gates of H* by International School of Brussels Listener N in the form of a drawing (*ibid.*: 45). Although the castle, sword, and shield seem to function as a decor for the person in the tableau, the illustrations of the ghost and the machine gun firing at a target do not appear to function in the same decor. Further, if the ghost and machine gun are regarded as independent objects, they both appear to lack contexts and the status of living beings.

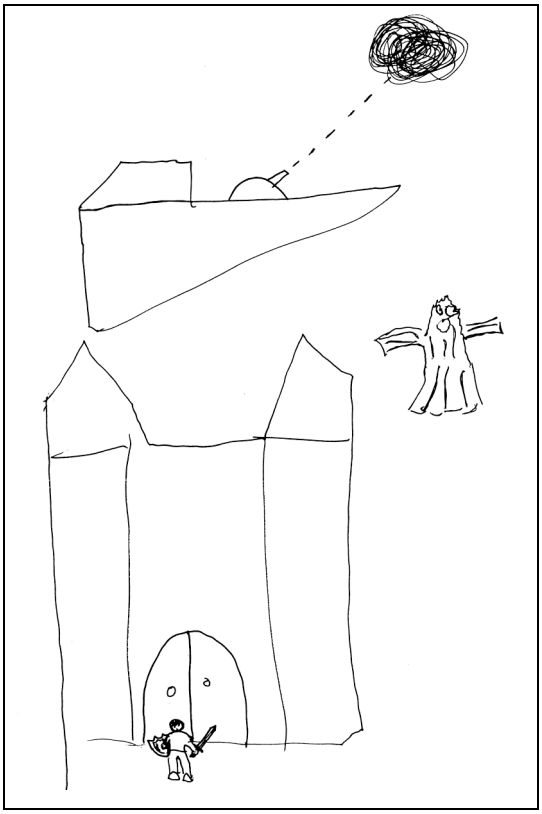


Figure 5-2. Response to the *The Gates of H*
by International School of Brussels Listener N

5.2.2 Fiction

Other listening strategies exist, in addition to figurativisation, where the listener can exercise imagination as an end in itself, notably as fiction, fantasy and surrealism. In *fiction*, imagination unfolds as invented ideas, events and people that conform largely to the laws of nature and civilisation in such a way that they can be believable in our current world. Nevertheless, fiction can be permeated with fantastic or surreal images or, conversely, be constructed from or include real ideas, events and people, while in science fiction, seemingly plausible themes can only occur in an environment that is

dominated by scientific and/or technological progress.

Although fiction is often associated with literature, it is also employed in other arts which rely on time as a medium for communication, for example, drama, dance, cinema and music. An example of fiction can be seen in Figure 5-3, a drawing by *Académie de Musique de Soignies* Listener L in response to *The Gates of H,* of what presumably is the Devil in Hell, accompanied by written remarks: "Represents Hell. High-pitched voices = people who die in the fire. Low-pitched voice = the devil. Morbid ambience; sombre. Good structure of sounds" (*ibid.*: 48).

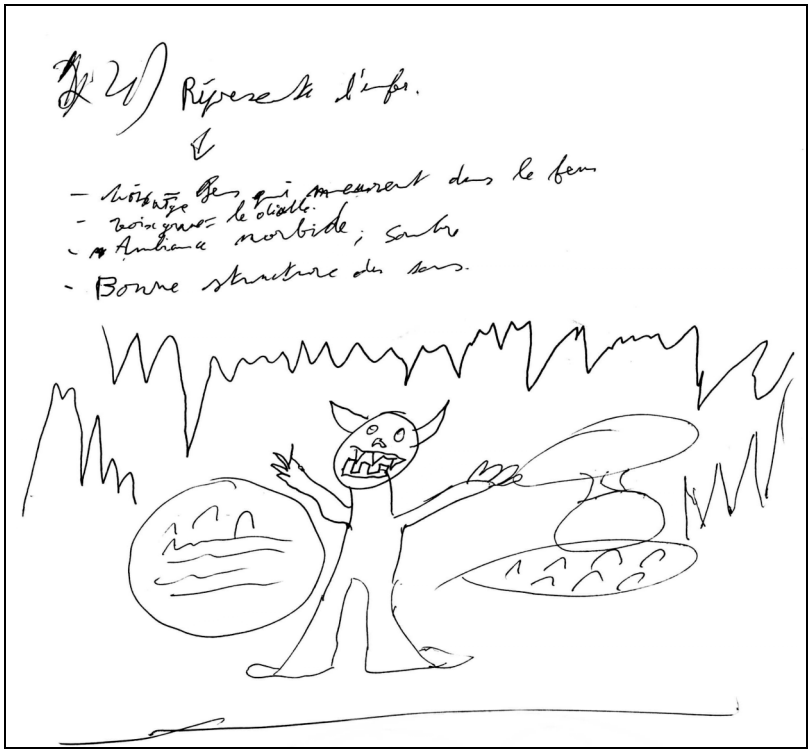


Figure 5-3. Response to *The Gates of H* by *Académie de Soignies* Listener L

This reaction from Listener L is also discussed in Chapter 4 (Figure 4-2) as an example of a self-oriented response in the form of a second-level extrinsic topic that is 'extrinsic' to the self and the piece. As noted in Chapter 4, when listeners alight on second-level extrinsic topics to convey their responses to music, these topics can arise as images of commonly agreed-upon objects. The objects unfold in the form of physical states or activity, literary or theatrical topics, religious or social issues, or mediatic images, among others, as in the case of Listener L, who refers to the Devil in Hell. However, while unaware of the title of Brümmer's work, Listener L invents a story about the Devil in Hell that conforms to the laws of nature and civilisation in such a way as to be believable, if we assume the Devil and Hell exist. This example also

illustrates how the more profound stages of self-orientation, notably the direct metaphorisation of external topics in the form of second-level 'extrinsic' topics, can appear to spawn and mingle with listening strategies in imaginary realms. Indeed, overlaps between the more profound stages of self-orientation and imaginary realms are inevitable.

Some characteristics of science fiction, notably an environment dominated by technology, can be seen in the response to *Crystal Music* by International School of Brussels Listener D, (Figure 5-4), who made a drawing of a spaceship with a satellite dish and the North American continent, also equipped with a satellite dish. Radio signals appear to transmit from the spaceship to the North American continent (*ibid.*: 35). The drawing of the spaceship, the radio waves, and the Earth is plausible, although it embraces the technological. Further, while the drawing may imply the presence of living beings, they are not visible, and neither is a decor, which broaches the idea that science fiction perhaps also can be conveyed without necessarily depending on a juxtaposition between sonic constructions linked to the living being, and other constructions that have a contextual purpose.

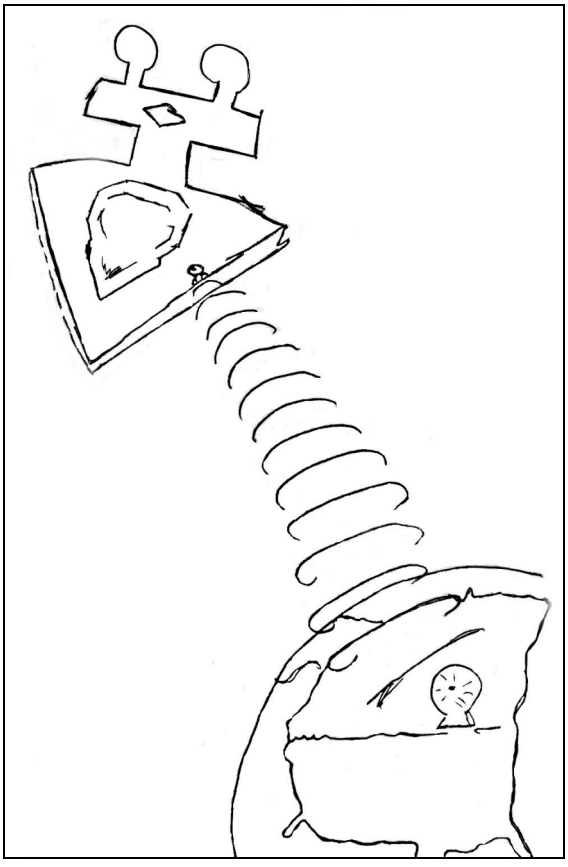


Figure 5-4. Response to *Crystal Music* by International School of Brussels Listener D

5.2.3 Fantasy

A third component of imaginary realms comprises *fantasy*, which contrasts with fiction and science fiction insofar as invented images are especially extravagant or visionary (Oxford, 353: 1996). In fantasy, logic based on laws of nature and civilisation is supplanted by an internal coherence that is often based on magic. Environments and events can be seen as impossible or absurd, yet are credible on their own terms through the internal structure offered by fantasy. An artistic, cinematic, and literary genre, fantasy is exemplified by the children's novel, *A Wrinkle in Time*, by Madeleine L'Engle, which was the inspiration for *Protopia/Tesseract*. The central theme in *A Wrinkle in Time*, which is expressed through fantasy in the form of space-time travel, revolves around the challenge we face to remain human in the age of cybernetics (Moss in L'Engle, 1962: 217). The importance of fantasy as a vehicle for the human psyche is also put forward by Durand who, through the perspective of Western heritage, describes the power of fantasy to override the spirit of rational Puritanism and the campaign for truth by handing the exclusive objectivist a dialectical avenger (Durand, 1992: 495). We may conclude that rather than dismiss the extravagant or visionary images offered to us through fantasy we may embrace this mental faculty, which Gilbert Durand suggests, is an essential component of the human spirit:

> "In this function of fantasy resides this 'supplement of the soul' that contemporary anguish looks for anarchically on the ruins of determinism, because it is the function of fantasy which adds to dead objectivity the assimilating interest of utility, which adds to utility the satisfaction of pleasure, which adds to pleasure the luxury of aesthetic emotion […]" (Durand, 1992: 500).[142]

If we accept the validity of fantasy, we may appreciate Ingvar Nordin's reaction to *Les Forges de l'Invisible*, which can be viewed as a set of two images based on fantasy:

> "After a while […] a louder, slower state of mind ponders its bearing, like a dinosaur swinging its head high up in the air under a prehistoric moon, somewhere deep inside our hereditary memory bank. The dew surfaces of thin bands of serpentine sonics reflect a pale starlight […]" (Nordin, 2005).[143]

[142] My translation of Durand's text: *«En cette fonction fantastique réside ce ' supplément d'âme' que l'angoisse contemporaine cherche anarchiquement sur les ruines de déterminismes, car c'est la fonction fantastique qui ajoute à l'objectivité morte l'intérêt assimilateur de l'utilité, qui ajoute à l'utilité la satisfaction de l'agréable, qui ajoute à l'agréable le luxe de l'émotion esthétique […]».*

[143] Review of *Les Forges de l'Invisible,* recorded on the *Sonicity* compact disc produced at City University (Nordin, 2010).

Nordin separates the intellect from the body and furnishes it with corporeal characteristics, for example, the quality to be 'loud' and the capacity to 'consider its physical position', images which can be viewed as technically impossible. He then describes this physical entity through the embodiment of a dinosaur that swings its head high up in the air under a prehistoric moon, implying the prehistoric image is part of our collective consciousness. Further, in an instance where fantasy begets fantasy, the image described in Nordin's remark, "The dew surfaces of thin bands of serpentine sonics reflect a pale starlight […]", invites the composer, in this case the listener, to visualise the image of Saturn's rings as comprising thin bands of sound and dew.

An example of fantasy also appears in the drawing by International School of Brussels Listener D (Figure 5-5), in response to *The Gates of H*. The ominous drawing consists of a meteor, labelled 'Past,' which is careening through space towards a planet on which the city, 'Future,' in flames, is the sole element (*ibid.*: 48).

Figure 5-5. Response to *The Gates of H* by International School of Brussels Listener D

The lines around the meteor, which depict movement, also express the passage of time. However, the speed of the meteor seems to contrast with the much larger planet, which lacks the same lines. The fire ravaging the city, 'Future', appears as a rampantly

destructive force, but this situation is dwarfed by the impending collision of the meteor, imparting the message that the past destroys the future.

5.2.4 Surrealism

The fourth component of imaginary realms is *surrealism*, derived from the artistic and literary movement that aspires to express the subconscious mind, notably through the irrational juxtaposition of images (Oxford, 1996: 1042). While surrealism shares many attributes with fantasy such as extravagant and visionary inventiveness, a common trait that engenders a frequent overlap of the two genres, the notion of internal formal coherence, while common in fantasy, is deliberately avoided in surrealism.[144]

Although transmitted through a different medium, a similar process of emancipation can be associated with the composition and perception of acousmatic music, where elements that appear to be juxtaposed, unexpected, or irrational are often joyfully, playfully or dramatically entwined in the sonic landscape. These elements can carry particular weight in an acousmatic environment, where listeners often inured to the convention of a perceptual setting that associates the visual with the auditory, are invited to embrace them as part of a broader, yet invisible sound world. The presentation of these frequently contrasting sonic events can be perceived to induce an equally contrasting set of images in the listener, an example of which is visible in International School of Brussels Listener O's response to *Crystal Music* (Figure 5-6). While the living being and context in the drawing could be considered as an expression of figurativisation, and the extravagant nature of the setting as fantastic, I suggest this drawing exemplifies surrealism as illustrated by the radically different and unusually evenly-sized images placed side by side. In the background, the sun and several clouds, which are permeated with lightning streaks and rain, frame a rolling sea. The middle ground is dominated by an apparent land plateau, which partially obscures an unusually large head, and is embellished with a giant set of fingers that protrude from a topographical slit in the plateau. A road is visible in the foreground at the base of the plateau. The following narrative accompanies the illustration: "A drop on the end of a cliff. A [sic] earthquake hits and slits the land in half. Then a monster pops out of the see [sic] and you see him over the cliff. Rain hits" (Anderson, 2001: 37). We can see

[144] Herbert Read notes the term, surrealism, was first used by Guillaume Apollinaire in 1917 [Paris] to characterise his own play, *Les mamelles de Tirésias (drama* [sic] *surréaliste en deux actes et un prologue)*. André Breton and Philippe Soupault later adopted the term in 1919 to describe a technique of spontaneous writing that made use of symbolic imagery in dreams. The movement was originally, and inherently, a literary and poetic one, although inspired by Dadaism and Marc Chagall. In reality "[…] painting and sculpture were to be conceived as essentially plastic transformations of poetry" (Read, 1986: 128-129,132).

that all the elements are plausible, for example the sun, clouds, rain, storm, sea, lightning, cliff, road, and earthquake, with the exception of the monster. However, their juxtaposition makes for a surrealistic tableau, changing even the status of the monster from that of fantasy to that of surrealism.

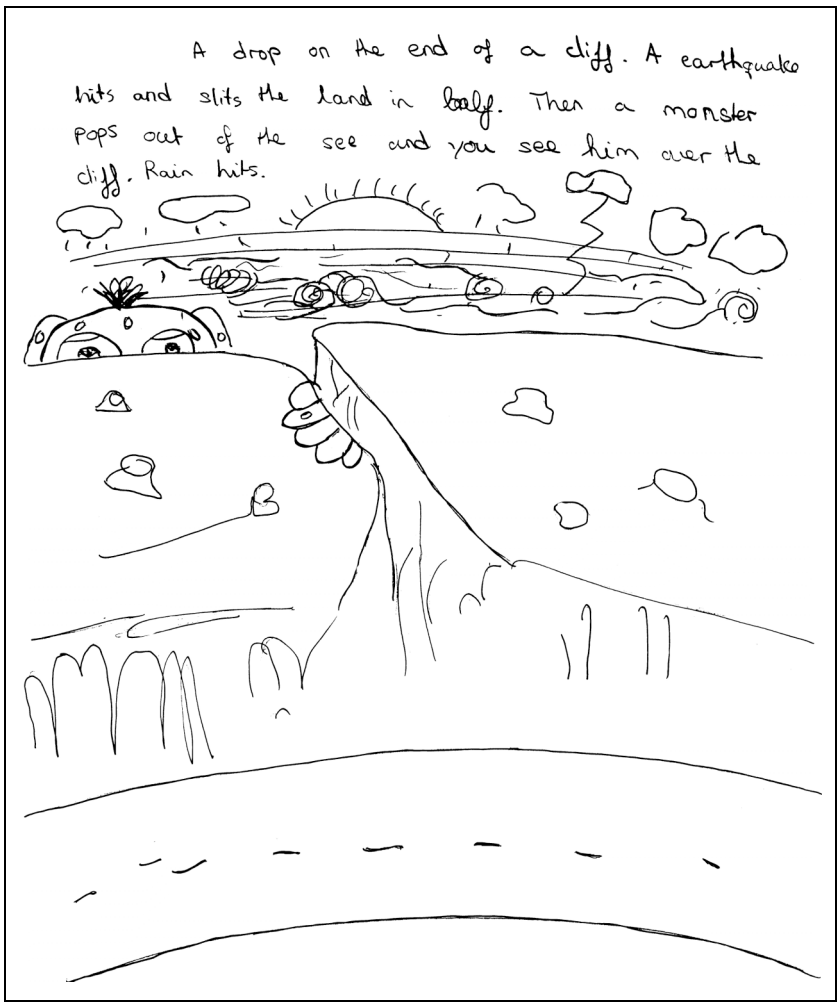


Figure 5-6. Response to *Crystal Music* by International School of Brussels Listener O

5.3 Time and the Development of the Image

In this section, I shall examine Kramer's concepts of 'absolute' time as measured chronometrically, and 'musical' time as apprehended in music, as well as 'subjective' time, which I suggest is the composer and listener's personal interpretation of time. I shall then focus on the relationship between the temporal flow of selected sounds and sonic contexts in my works and the temporal (and non-temporal) components of images that come to my mind. Discussion will centre on the inception, formation, development, and finalisation of the images as opposed to their content, with the presumption that both absolute and subjective time experienced before the listening act impinge upon the image-making process during musical time. This adds credence to my observation that the development of images in subjective time is often linked, but not necessarily congruent, with the passage of absolute or musical time, as images are seen to have their own temporal development.

5.3.1 Definition of terms/Relationship to the listening experience

Absolute time

According to Judy Lochhead, "*Absolute time* […] is Newtonian time: a linear succession of now-moments" (Lochhead in Kramer, 1988: 151) (my italics). Absolute time can be viewed as a commonly agreed-upon reality that is objective and quantifiable, and can be measured, linearly, in seconds, minutes, hours, etc.

Musical time

In its widest definition, music is an art form expressed through the medium of sound which unfolds in time. However, the time perceived through music can differ drastically from absolute time. According to Langer, *musical time* can be perceived as "virtual time", distinguishable from absolute time, which Langer considers as "the sequence of actual happenings" (Langer in Kramer, 1988: 3) (my italics). Further, Kramer proposes that, in music,

> "We *simultaneously* experience musical time and ordinary, or 'absolute,' time. Because musical time differs pointedly from the time of daily existence, experiencing them both at once violates logic's law of contradiction. But time can be many things, and it can be them at once" (Kramer, 3: 1988) (Kramer's italics).

Subjective time

I suggest subjective time is the listener's personal experience or personal filter of time. Kramer observes "[…] *subjective time* is *different from*, not less reliable or accurate than, clock time" (*ibid.*: 337) (my italics) (Kramer's italics). Kramer also observes that, when listening to music, we defer to an external time, which does not depict the impartiality of absolute time, but the artist's disciplined yet subjective view of the irrational. Further, in music we experience the subjective time proposed by the composer without alienating ourselves from the time experiences we benefit jointly from with other people (*ibid.*: 165). Thus, the listener's sense of subjective time does not eradicate musical time; rather the listener perceives musical time through a subjective filter. However, both the music and the listener exist physically in the common reality of absolute time.

The listening experience: absolute, musical, and subjective time

Musical time, which is shaped through the subjectivity of the composer, unfolds within the context of absolute time, and is apprehended through the subjectivity of the listener. From the perspective of Indo-Tibetan philosophy, the subjective time of the composer can be viewed as an object that is expressed in musical time (object), which unfolds in the commonly agreed-upon reality (object) known as absolute time, and is interpreted as another object in the subjective time of the listener.

5.3.2 The relationship between time and the development of the image

From the perspective of the listener, absolute, musical, and subjective time can be perceived to function in parallel and contribute to, or impinge upon the formation of images during the listening experience. In this section, I shall attempt to illustrate the effect these three types of temporal flow may have on the listening imagination separately as well as together.

Absolute time and the listening imagination

(i) Introduction

Images rarely develop in congruence with absolute time during the listening experience. Instead, absolute time can impinge upon the listening experience and the listener's subjective way of forming images. For instance, a listener can deliberately or

inadvertently look at a watch or clock during the performance of a piece to see how much time has elapsed during the performance. From my perspective these acts would tend to impede the formation of the image during the listening experience.

(ii) Example of the perception of absolute time on the formation of the image

The following very hypothetical example is designed to illustrate this idea: a listener imagines the African bush at dusk while listening to a sonic landscape that is dominated by many types of source-bonded and hybridised sounds of insects, such as crickets and cicadas. The momentary intrusion of absolute time in the listening experience could unconsciously foster the sense of the passage of time in the image through the appearance of time-based thoughts, such as the need to prepare a meal or set up camp in the bush before dark. However, the intrusion of absolute time might surface through visual or aural references to absolute time within the image of the African bush. These may arise, for example, as the image or the sound of the listener's watch as worn in the bush, or through a non sequitur image or sound, such as cogs in a Western European clock tower, which may seem to be fleeting or seem to remain in the background of the bush image in a surreal way.

(iii) Alternative ways absolute time can be perceived to intrude upon the image

The intrusion of absolute time may seem to arrest or shatter an image, thereby allowing the listener to focus entirely on the perception of musical time which, in turn, may be seem to catalyse a new image. However, on a conscious level, the listener may stop perceiving musical time when perceiving absolute time even while continuing to hear the music. In this case, the perception of absolute time may serve, for example, as a reminder to the listener of upcoming responsibilities, which can distract the listener from the music and impinge upon the process of imagination. Further, I suggest the intrusion of absolute time on musical time can bring forward emotions when the esteem the listener has for the music is inversely proportional to the esteem for upcoming responsibilities. These emotions can be amplified if the listener needs to leave the listening space before the end of the piece. Thus, although we perceive absolute time through our subjective filter, we can see how the consequences of perceiving absolute time can appear to influence the listening experience and the images we create when perceiving musical time.

Musical time and the listening imagination

(i) Introduction

Musical time is created through the lens of the composer's subjectivity and unfolds in the frame of absolute time. As Kramer noted, "Music *is* temporal: abstract sonorous shapes moving through yet simultaneously creating time" (Kramer 2:1988) (Kramer's italics). Paradoxically, while in most cases musical time differs from absolute time, musical time relies on the quantifiable characteristics of absolute time to convey this disparity. In the listening imagination, images can, and often do, develop in congruence with musical time. This can be especially true if the listener's subjective experience of time corresponds to that of the composer as expressed through diverse temporal constructions in the music.

(ii) Example of the relationship between musical time and the listening imagination

The following poietico-esthesic narrative, which crystallised several months after the completion of *Chat Noir*, illustrates the effect the perception of musical time can have on the listening imagination. The timings are placed in the explanation of the image to help the reader associate sections of the image with sections of the piece, which can be heard in entirety on audio compact disc 1 (track 1). *Chat Noir* is inspired by the concept of psychological opposites as put forward by Johnson, who suggests that a conflict exists in the human mind as a result of the desire to banish the shadow, the dark element of the psyche (Johnson, 1991: 4-6). This theme is illustrated in *Chat Noir* in the form of opposition between turbulent, atemporal, sounds and linear, temporal, sounds. The ambiguous and electronic sonic vista is intended, poietically, to represent the psychological conflict. At the same time, the temporal dichotomy of the sounding flow and the extensive use of granular and noise-based sounds also transports me to the physical realm of outer space in my imagination through the transfer of function and the transfer of meaning.[145] In my journey, the 'tumbleweed sound' (the shadow) at 48" and throughout much of the piece, represents the repetitive paths of the orbits of planets, and the sound's inherent clicks signify the turning of the planets on their axes. The narrowing of several pitches to one, through *portamento*, occurs at 1'43" – 2'09". As discussed in 2.3.2, this sound-shape – which can be apprehended as a 'spiral-like' pitch evolution where multiple harmonic spectra converge – represents a 'horizontal' gravity force that pulls me, sideways, towards a planet. The fleeting sonic universes,

[145] Although *Chat Noir* strives to convey the psychological conflict created by the shadow through the opposition of temporalities, my desire to transpose the intangibility of this concept to a physical arena of environmental proportions foreshadows *Neon*.

between 2'09" and 5'06", represent human activity on the planet, appearing and disappearing in and out of audible range as I revolve around the planet in its atmosphere, where I can hear the occasional roar of other planets that move past me in outer space. I sink further into the planet's atmosphere at 5'07", and thus the human activity appears to be louder. However, the roar of the other planets becomes proportionally louder, as if they, too, sink into the planet's atmosphere with me. At 5'59", I tumble through the lower atmosphere to the ground, but rebound upward several times because the surface is rubber and finally, without landing on the surface, fall through the crust and geological layers of the planet to its core, at 7'22", where I arrive, immobile, at 7'45". At 8'01", the horizontal gravity force, in reverse, pulls me out from the centre of the planet and propels me back into the space, sideways, where I sit and listen to the planets go by until they disappear.

Subjective time and the listening imagination

(i) Introduction

As we saw before, subjective time is the listener's personal experience of time. In the following discussion, I shall examine the relationship between subjective time and the listening imagination, and how this relationship may develop congruently with the perception of musical time, or not.

(ii) Example of the relationship between subjective time and the listening imagination

Although the image the listener forms during the listening experience develops in subjective time, I suggest the musical time perceived in a piece can correlate with the subjective experience of time carried by the image, for example, as I experienced while listening to the completed version of *Chat Noir*. Despite this correlation, I do not consider the subjective time in my images to be of the same duration as the musical time in *Chat Noir*. The following response to *The Gates of H* by International School of Brussels Listener P, which comprises a drawing of a submarine and fish, does not appear to illustrate the same correlation between musical time and subjective time, as revealed in the accompanying text: "I think that this music represents a submarine going underwater very slowly and encountering scary fish. Some fish are scary and try to attack the boat" (Anderson, 2001: 46). Noticeable in this response is the lack of any reference to musical time and the way it is perceived to influence the way the image develops. Instead, the subjective time of the image appears to unfold in parallel with, yet detached from, musical time.

(iii) Anterior instances of subjective time, and the listening imagination

Listeners may frequently bring anterior instances of subjective time, such as memories and their associated images, to the listening experience. This phenomenon, in turn, may influence the listener's conception of subjective time and its associated images while apprehending musical time. For example, while listening to a concert of acousmatic music, a listener may recall a seemingly endless twenty-minute walk in snow to arrive at the concert hall. This imprint may stimulate the listener to conceive subjective time in slow motion, replete with visual images of the slow-motion exhalation of human breath, in the form of a giant cloud, in the out-of-doors on a frigid night. Further, the listener may perceive musical time to bring forward anterior instances of subjective time and their associated images, which in turn may affect the listener's conception of subjective time and its associated images.

(iv) Delayed, arrested and retrospective images, subjective time, and the listening imagination

Subjective time and its associated images may not be perceived by the listener to develop proportionally to, or congruently with, musical time. Rather, the listener may become aware of subjective time and any images during the piece. In this instance, the development of the image is delayed. However, the length and type of musical time that accrues between the first moment the listener becomes consciously aware of subjective time, and its associated yet nascent image, influences later subjective images that may be more defined. Further, in some cases, while listening to musical time, the listener may not perceive subjective time, and any related image, to evolve. Finally, the listener may perceive subjective time and create an image within that subjective time that, while spawned by the intake of musical time, occurs after the piece has finished.

5.4 Imagination from a Poietic Viewpoint

This section centres on several images that came to mind when composing two acousmatic works in the folio. The relationship between my imagination and the poietic process is probed in tables in Figures 5-7 and 5-8.

5.4.1 Describing the poietico-esthesic image

Column 1: the sound or sonic context

Column 1 concerns the sound or sonic context which is the basis for the image.

Column 2: spectromorphological characteristics in sounds that serve as a basis for the transfer of meaning, function or behaviour

In Column 2, I attempt to identify the process where the meaning, function or behaviour of a sound or sonic context is transferred from the audible context in the piece to another sounding or non-sounding image. Thus, the target of the transfer process may lie within or outside the scope of the work. An attempt is made to identify which sounds catalyse the transfer.

Column 3: description of the images perceived

Column 3 contains the description of the image.

Column 4: description of the development of the image over time

Column 4 concerns the discussion of the development of the image in time (absolute, musical, or subjective).

Column 5: identification of the perceptual form of image components

In column 5 I attempt to identify the perceptual form of image components.

Column 6: classification of the image: figurativisation, fiction, fantasy, or surrealism

In column 6 the image is classified as figurativisation, fiction, fantasy or surrealism.

5.4.2 Examples

Ether: 9'16"–9'43"					
Column 1	***Column 2***	***Column 3***	***Column 4***	***Column 5***	***Column 6***
Sound or Sonic Context *Ether*: 9'16" – 9'44" (Sound example 5.1, track 83).	*Spectromorphological characteristics in sounds that serve as a basis for the transfer of meaning, function or behaviour* The transfer of meaning of two sounds is the basis for this image. 1. 'Inhalation/exhalation', a sounding gesture comprising a bowed, non-pitched, violoncello sound articulated at 2" and 22" on channels 3 and 4, at 10" on channels 5 and 6 and at 16" on channels 7 and 8 in sound example 5.2, (9'18" and 9'38" on channels 3 and 4, 9'26" on channels 5 and 6 and 9'32" on channels 7 and 8 in the piece). 2. A multi-pitched drone that surges to the foreground immediately after each 'exhalation' at 5" on channels 5 and 6, at 13" on channels 3 and 4, at 18" on channels 1 and 2 and at 25" on channels 7 and 8 in the sound example (9'21" on channels 5 and 6, 9'29" on channels 3 and 4, 9'34" on channels 1 and 2 and 9'41" on channels 7 and 8 in the piece).	*Description of the images perceived* The image is of a garden on a sunny day in springtime, as seen from two different sets of compass points: (the North and South axis, and the East and West axis). I can 'hear' the preparation the plants make for spring, in the form of gigantic 'inhalations', where energy is drawn up from the earth to imbue the flowers with enough power so they can burst with iridescent pollen which twinkles diaphanously in the air.	*Description of the development of the images over time* The same image repeats, systematically, in my mind, over a period of approximately 30", the 'musical time' of this excerpt, during which the image changes direction, following the passage of musical time. This is because the 'inhalation/ exhalation' and drone sounds appear on different sets of channels over time. Thus, I perceive the garden from the axes as created by two different sets of compass points, which give me the impression that the garden is three-dimensional and, therefore, is 'alive'.	*Identification of the perceptual form of image components* The visual image of energy as it is 'drawn up' through the plant and expelled through the flower is an isomorphic representation of the human process of breathing. The visual image of the pollen released by the flowers is an isomorphic representation of pollen as conveyed by the drone, which has many tiny repetitive sound particles that can be likened to the flow of pollen particles in the air and the sound of small insects. However, the iridescent quality of the 'sounding version' of the pollen, created by the spectrally rich drone, is a free association.	*Classification of the image: figurativisation, fiction, fantasy, or surrealism* Fantasy.

Figure 5-7. Imagination from a poietic viewpoint: *Ether*: 9'16"–9'43"

Les Forges de l'Invisible: 4'56"– 6'32"

Column 1	***Column 2***	***Column 3***	***Column 4***	***Column 5***	***Column 6***
Sound or Sonic Context *Les Forges de l'Invisible*: 4'56" – 6'33" (Sound example 5.2, track 84).	*Spectromorphological characteristics in sounds that serve as a basis for the transfer of meaning, function or behaviour* A prominent, long, noise-based sound occurs at the beginning of sound example 5.3 (4'56" in the piece). It diversifies into different types of noise-based sounds, which appear on different channels as the section develops. By virtue of its extreme malleability and lack of spectromorphological and temporal thrust, the noise-based sound world behaves as a primordial physical atmosphere. The meaning of the primordial atmosphere is thus derived through a transfer of behaviour of the sound world.	*Description of the images perceived* A prehistoric mist under a partial solar eclipse that masks large mammalian shapes.[146]	*Description of the development of the images over time* The image first takes the form of a prehistoric mist that also serves as a 'call' of the wild. The image then diversifies to include shapes of living beings.	*Identification of the perceptual form of image components* The image is forged through 'reference'. Although it would be difficult to convey a prehistoric world through iconic or isomorphic representation or symbolism because of the lack of direct human experience with the physical prototypes of that era, we could refer to visual images and archaeological remains and thus 'recreate' the physical, three-dimensional prehistoric environment via sound. The unrefined qualities in the noise-based sonic context refer to the prehistoric environment through what is thought to be commonly shared sonic (and imagined physical) matter, not morphological form.	*Classification of the image: figurativisation, fiction, fantasy, or surrealism* Figurativisation, although the image lacks a specific decor other than the mist.

Figure 5-8. Imagination from a poietic viewpoint: *Les Forges de l'Invisible*: 4'56"– 6'32"

[146] Although my perception of this section of *Les Forges de l'Invisible* predates Nordin's review, it was encouraging to see that this poetically imbedded 'prehistoric' image was received.

Chapter 6. Space: The Common Denominator

6.1 Introduction

Before addressing specific ideas about space, I shall introduce the subject through a concept approached in Chapter 2. Silent, invisible, intangible, and yet omnipresent in any construction, these are some of the salient qualities inherent in space, which, on the scale of the physical universe, is the "unlimited expanse in which everything is located".[147] Space and its attending qualities is also perceptible in the physical universe's matter-energy continuum and in the physical and conceptual systems inherent in the human being, which comprise three relationships – Matter-Energy, Body-Mind, and Subject-Object.[148] As we shall see in 6.1, each relationship, whether anchored in a physical or in a psychological reality, or both, exists in space.

We may open the discussion on space by re-examining the elements in the energy-matter continuum, energy being the basis for matter and its pervading force. Energy and matter integrate and identify with space to the extent that it is difficult to understand or define either term without including the notion of space. Seen from an opposite perspective, space becomes 'tangible' and alive through energy and matter. The Milky Way galaxy can provide a metaphor for this perspective because its spatial frame is discernable due to the vast array of energetic and material forms in diverse locations. For example, the entire range of radiant energies is present in the galaxy, where material forms include primarily gaseous entities such as stars and, to a lesser degree, solid entities such as planets, moons, and asteroids. However, less overt, yet pervasive throughout the galaxy, and, therefore, one probable indicator of spatial expanse, is the interstellar medium, which "consists of gas and dust existing over a wide range of physical conditions [and] is powered by energy emitted from stars".[149]

My personal sensitivity to the pervasiveness of space is grounded in a general interest in dialectics that slowly evolved to become a major force behind my work. For example, the relationship between the physical universe and the human being – insofar as the human dimension can be regarded as a microcosm of the environment and, conversely, the environment can be regarded as a macrocosm of that which is human – developed into a wellspring of ideas for my composition and research. I found, in

[147] (wordnet.princeton.edu, 2010).
[148] The three interconnecting continua are illustrated in 2.2.1.
[149] (Penn State University, Eberly College of Science, Department of Astronomy & Astrophysics, 2010).

Johnson's writings, the echo of my own questionings in terms of the paradox of opposition on a human psychological level.[150] Hence, the concept of the dialectic radiated across the trilogy of my acousmatic works, *L'éveil, Chat Noir,* and *Neon,* composed between 1997 – 2001. As noted in Chapter 2, the concept of reduction in proportion from the environmental to the human level is an idea developed in *L'éveil*, in which the paradox of opposition found in the environment is assimilated by the human being. *Chat Noir* explores this paradox on a human psychological level, whereas in *Neon* the microcosm of human consciousness is elevated to an environmental scale.

However, deliberate rumination about the dialectic between the physical universe and the human being over the four-year period during which the trilogy was composed yielded an unanticipated return. While creating the meta-sounds and meta-environments for *Neon*, I became aware of a dual spatial dialectic: space provides a frame for, and therefore gives rise to, instantly and eternally malleable forms, and is, additionally, simultaneously present in boundlessness and intimacy. Bachelard had earlier expressed a similar view about the second spatial dialectic as perceived from a human viewpoint, which he defines as 'intimate immensity':

> "Immensity is within ourselves. It is attached to a sort of expansion of being that life curbs and caution arrests, but which starts again when we are alone. As soon as we become motionless, we are elsewhere; we are dreaming in a world that is immense" (Bachelard, 1994: 184).

If the concept of immensity resides within the human imagination, we can understand how space can be imagined from the scale of that which is human and intimate to the scale of that which is boundless. A re-examination of the principles of sounding gesture in acousmatic music corroborates this viewpoint about the capacity of the human imagination. As proposed in Chapter 2, the transposition of the principles of the energy-matter continuum from a universal to a human level provides a basis for expressive potential that can be extended to the creation of gesture in acousmatic sound, where the unfolding of energy into a tangible level concerns the aural trace left by the morphogenesis of gesture. Further, we know not only that energy pervades all conceivable forms (matter); we also know that space pervades energy and, therefore, matter. Thus, space can be seen to permeate, support, and enable all sounding gesture.

[150] Johnson developed the theme of opposition in his book, *Owning Your Own Shadow: Understanding the Dark Side of the Psyche* (Johnson, 1991: 3-17).

However, if we consider space *before* sounding gesture – to which it is linked inextricably – the possibilities for spatial design need not be subsumed in spatial impression resulting from the articulation of sounding gesture, space being seen as the object. Rather, spatial design can lead and define sounding gesture since space is governed by the subject – the composer's imaginative capacity.

6.2 The Role of Space in the Four Reception Behaviours

6.2.1 Sonic properties

In 6.1 I explained how energy and matter offer a window of observation for spatial occupancy insofar as their internal interconnectedness and dimensions structure and 'claim' space as part of their identity. Sound is acoustic energy and it dictates spatial impression through the materiality of the aural trace. In acousmatic sound, spatial impression is linked to two elements engendered by the aural trace: physical, otherwise known as three-dimensional, space, in which spatial motion and distribution occur, and spectral space. Although three-dimensional space and spectral space are different entities the two are related as they function in tandem regarding recognisability of gesture-types. Therefore, to explore the relationship between space and acousmatic sound, it is necessary to return, initially, to the Matter-Energy continuum for gesture-types found in Figure 2-2 and the definition of spectral space.[151]

To review, the six categories in the continuum are source-bonded open-air, source-bonded studio-based, hybridised, ambiguous, synthesised, and meta. Different types of spatial impression are associated with sounds in each of the categories to the extent that they help to define the categories. The evolution of spatial parameters correlates with the evolution from a type of gestural expression that translates, at one extreme of the continuum, into 'dense' and 'matter-oriented' spectromorphologies frequently associated with source recordings, to expressions at the other extreme, where matter is 'thinned out,' yielding to energy. For example, source-bonded sounds have very precise encoded spatial associations that aid the listener to define source-bondedness, whether the recording takes place in open-air or the studio. Wishart proposes that this is because "[…] any sort of live recording will carry with it information about the overall acoustic properties of the environment in which it is recorded" (Wishart, 1986: 45). In contrast, the deliberately articulated spatial dimensions in a meta-sound unfold on a vast scale, and include as much spatial detail in the foreground as in the background. However, this does not imply that evolution away from source-bondedness translates, automatically, into vast, complex, distant, or even vague spatial associations. Indeed, as we shall see, hybridised, ambiguous and synthetic sounds can have definite spatial associations whether small or large-scale, the parameters of which are different than those for source-bonded sounds.

[151] Gesture types were discussed in 2.2.1, as was spectral space in 2.3.

As discussed in 2.3.1, the term sound spectra refers to the distribution of acoustic energy as a function of frequency within the aural trace. Thus, sound spectra may imply a vertical spatial axis. Further, the evolution of spectral parameters also correlates with the evolution of gesture-types on the energy-matter continuum.

At this point one could query the importance of the relationship between three-dimensional space and spectral space. If sound spectra imply a vertical spatial axis, they can be seen to occupy bi-dimensional space. The listener perceives three-dimensional spatial motion and distribution in sound *through* acoustic energy in the form of sound spectra, which (1) have an intrinsic frequency profile that may or may not evolve over time, and (2) exist as a physically static or mobile auditory phenomenon in wide-ranging three-dimensional settings. Since spectral space is bound to three-dimensional space, it follows that any transformation that acts on a sound's spectrum will impinge upon the manner in which it is perceived in three-dimensional space, and any transformation that acts on a sound's three-dimensional space will impinge on the perception of its spectrum. Thus, for the purpose of analysis, selected parts of works in the folio will be examined using two methods: (1) three-dimensional space will be rendered in terms of spatial motion and distribution; (2) the occupancy of spectral space will be scored over time. In this way, it will be possible to observe how three-dimensional space can collude with spectral space.

6.2.2 Structural attributes

To understand the omnipresence of *structure* in space, we may return, initially, to the perspective discussed in 6.2.1: energy and matter 'claim' space as part of their identity, thus rendering space 'tangible' and alive. This perspective is shared, in part, by Henri Levebvre who notes, "[…] physical space 'has no 'reality' without the energy that is deployed in it' […]" (Levebvre in Smalley, 2007: 38). If energy and matter render space alive, we may infer that structure becomes tangible when energy and matter are perceived. The human being perceives energy and matter and, therefore, their formal organisation in space through a variety of senses that include the faculty of sight, which utilises part of the electromagnetic spectrum visible to the naked eye (light) to discern spatial form and topology. Through touch, the human explores the surface and form of matter, where through thermoception (the perception of temperature by the skin), the

human can demarcate spatial volume in substances such as air.[152] However, since the physiology of human hearing best suits the morphology of space and, therefore, spatial perception, humans create the most nuanced perceptions of spatial dimensions through hearing. For example, although the human ear is conceived to distinguish sounds most accurately within the field of vision, unlike sight, hearing is a spherical phenomenon since it operates in a 360° range. This might help to explain why human investigation of space has always been built through sound. Barry Blesser elaborates on the apprenticeship of spatial location and organisation in early man, the aptitude of which can be seen as the prototype for acousmatic listening:

> "Had you grown up in an aural 'tribe', you would have become an expert at recognizing acoustic cues, and interpreting their relationship to those spatial 'animals' that created them. As an adolescent, […] you would have been taken through thousands of spaces in the 'forest' of soundscape niches. Many years of such training would have refined your auditory spatial awareness to a high art form. Because each ecological niche offers unique patterns, your ability to learn to recognize those important patterns would have contributed to your survival and to your tribe's survival" (Blesser, 2007: 320).

Further to early man's need to develop spatial location and organisation as a survival skill, there is additional, documented evidence of the human need to organise and structure space, which can be found in early theological texts. The Bible, for example, can be seen as a testimony of early and fundamental human thinking, the first part of which concerns the creation and structuring of space.[153] Indeed, spatial organization and sovereignty have proven to be central to human existence because, as is evidenced through history, the fundamental battles of humankind (e.g. social, political, and military) have taken place over space.

In order to address the role of space in acousmatic music, we may, initially, regard the role of space in the broader context of art. Often, art is intended to rehearse and explain reality. Different art forms rely on different types of spatial organisation

[152] Aristotle classified the traditional five senses as sight, hearing, touch, smell, and taste. However, science has since established that humans possess six additional senses, nocioception (pain), equilibrioception (balance), proprioception (sense of position and orientation of parts of the body), and kinesthesia (joint motion and acceleration), sense of time, thermoception (temperature differences), and magnetoception (direction) (Absolute Astronomy, 2010).

[153] Space is structured, systematically, following the days of the creation in Chapter 1 of Genesis in the Old Testament. On the first day, cyclical time is divided into day and night, affecting spatial occupancy. Subsequent days witness the creation of heaven, the earth and seas, the sun and moon, life forms in three spatial zones (e.g. the sky, the oceans, and on land), and man (The Holy Bible, 1982: 5-6; bk. 1, ch. 1).

and structure to convey diverse messages of reality. For example, the characters and situations expressed through poetry or the narrative of prose occupy a psychological space, while a theatre play is conceived to render characters and situations expressed initially by text into three-dimensional space. Traditional tribal dance reveres and empowers social issues in three-dimensional space. Such dances are often choreographed for celebrations, and they may also be choreographed to invoke rain, fertility and trance, or prepare for war and death.[154] Music has often been thought of as addressing primarily the soul, and therefore as an art form that does not unfold in space, since the soul is not, traditionally, seen to unfold in space. Although space has always been an integral part of music, the theorization of the spatial dimension in music has been underdeveloped. With the advent of the electroacoustic and acousmatic genres, the architecture and deployment of space has become a structuring process in its own right, a compositional parameter that can lead other structuring processes such as spectra and time.

Space in traditional versus acousmatic music

As noted in 6.2.1, sound spectra may imply a vertical spatial axis. A *traditional* musical score represents the outcome of the evolution of organised sound spectra in vertical space over time, while respecting acoustical boundaries and interstices between spectra as well as unoccupied spectral space.[155] During performance, this process is most often mapped onto a static, three-dimensional spatial frame, in the sense that the sources are fixed in position. By contrast, in an *acousmatic* piece the evolution of sound spectra in vertical space is more variable and is, additionally, simultaneously titrated and mapped out onto a three-dimensional spatial frame during composition, the totality of which is recorded onto a supporting medium. This process allows the acousmatic composer to decide what part of spectral space is situated where in three-dimensional space at any instant during the piece.[156]

Structuring sound and space: a question of primacy or symbiosis

Within a musical work, because space becomes integrated and identified with acoustic energy, it becomes integrated and identified with structure and changes as structure is

[154] This is not an exhaustive list.
[155] In this case, traditional music refers to Figure 2-5 in 2.3.1, the standard concert repertoire of the schooled Classical tradition in Western instrumental and vocal music, where spectral content is primarily harmonic and the tactility factor is minimal.
[156] The stereophonic acousmatic idiom offers ample flexibility for spatial design within a stereo field. However, in the multichannel acousmatic idiom, the management of space is at the prow of the poietic processes.

changed over time by the composer. However, viewed from another perspective, structure can be seen as organised space, the parameters of which evolve in time. This begets the following question. When composers place sounds in an acousmatic context, are they attempting to structure sounds through space, or space through sound? The answer is both. Therefore, when we ask how space contributes to structuring processes, we may keep in mind that structuring processes contribute to our need to structure space.

6.2.3 Self-orientation

In order to understand the relationship between space in acousmatic sound and the reception behaviour *self-orientation*, we need to consider their respective definitions in an interactive way. As we know, space is the vector through which all sound is conveyed and received; without it, sound and subsequently, any reception behaviour cannot exist. As discussed in 6.2.1, acousmatic sound has specific internal spatial dimensions that comprise spectral space and three-dimensional space, in which spatial motion and distribution occur. These spatial dimensions are fixed onto a supporting medium embedded as a component of the sounding flow, and unfold in the external, three-dimensional space of the listening space.[157] In self-orientation, defined in 1.4.3, the listening consciousness is mobilised and dominated by a personal viewpoint, which develops as sensations, emotions, or neutral deliberations such as evaluations. However, as seen through the lens of the physical and conceptual systems inherent in the human being, the self contains two components, the body and the mind that together, form the subject. The subject perceives acousmatic sound and then determines which objects will develop through reception behaviours. All objects are manifest via processes, deliberations and responses carried out by, or experienced by, the subject.[158] Therefore, how the subject (the listener) processes space in acousmatic sound can influence which types of sensations, emotions and evaluations (objects) arise and what spatial implications they may have.

[157] Internal and external physical aspects of acousmatic music, derived from the French terms *l'espace interne* and *l'espace externe*, are discussed in 6.3.1.

[158] All reception behaviours can be considered to be self-orientated since they arise through the self, the subject. However, for the purpose of this dissertation, the reception behaviour *self-orientation* centres on behaviours that are directed inwardly, on the self.

Sensations, emotions and evaluations as objects

If we examine the subject, we know the 'intake' of sound occurs aurally, through the body. The ear receives the vibrations and, in turn, transforms the acoustic energy into the electrochemical signals of the human nervous system (Appleton and Perera, 1975). The signals are processed by the brain (mind) where they develop into an object, through a reception behaviour which, in self-orientation, can remain anchored in the context of the mind as an *emotion* or a neutral *evaluation*, or unfold in the context of the body in the form of a *sensation*. I suggest that emotions and evaluations can have spatial dimensions, and that these dimensions can be catalysed by the spatial dimensions (e.g. volume, position and directionality) in the sounding flow. Additionally, acousmatic composers may deliberately create or enhance inherent spatial attributes in the sounding flow so that the attributes highlight the poietic message. For example, Normandeau uses large acoustic spaces to convey sadness in the fourth movement, *Tristesse et espace*, of his acousmatic work *Éclats de voix.* This viewpoint contrasts with that of Blesser, who posits,

> "Emotions are everywhere, like water for fish. Whenever we care about what we are perceiving, an affective component must be present. Thus, emotions become an amorphous concept for everything that gives meaning and texture to our perceptual experiences. If, however, we want to understand how aural architecture produces spatial experiences that have impact and relevance, we need to examine the affective attributes of acoustic spaces " (Blesser, 2007: 332).

Emotions exist in tandem with other types of responses as potential objects which pertain to the self-orientation aspect of the reception behaviour that remains fixated in the context of the mind. It follows that acoustic spaces, whether real or virtual, do not possess affective attributes: they can generate them. This is also true for sensorial attributes, or responses, insofar as they are generated as objects by the subject. Further, if self-orientated reception behaviour is fixated in the body as a sensation (object), it may unfold in a dimension that is appreciable through one of the senses with which the body perceives three-dimensional space as discussed in 6.2.2. Hence, sensations also can be seen to have spatial properties in terms of volume, position and directionality as perceived by the senses.[159] For example, the impression that a sound seems to 'recede and disappear' may be catalysed by the listener's previous visual

[159] However, the scope of sensations is not limited to the scope of space as perceived by the body.

experience, while the sensation that a sound 'is piercing' may be interpreted by the listener's 'inner' sense of touch. A sound that 'feels like a chilly breeze' may be perceived as if it belongs to the sense of thermoception. Finally, the socio-spatial environment in which the listening experience occurs may also impact on the self-oriented reception behaviour, as noted by Patrik Juslin and John Sloboda:

> "Although emotions can occur when a person is alone, their full manifestation very often seems to require other people. For instance, it is well known that young children (e.g. pre-verbal) will look to a nearby adult for a cue concerning how to respond to some events, such as a fall or graze" (Juslin and Sloboda, 2002: 86).

The socio-spatial environment in which the listening experience occurs may also impact on a self-oriented response to space in the sounding flow insofar as a work that is perceived collectively in an external space may influence the listener's reaction to space in the work in different ways than if the listener were alone. For example, if the spatial dimensions in a work are perceived as forbidding (e.g. out of proportion with human dimensions, such that they may be apprehended as suffocating or dwarfing), an adverse reaction could be attenuated by the knowledge of the implied safety of the social climate of the listening experience. However, the reverse may be true. If the spatial dimensions in a work engender feelings of loneliness or despair, listening alone might accentuate those feelings.

The icon in self-orientation

Can spectral and three-dimensional space, as embodied within the sounding flow of an acousmatic work, be iconic to sensations, emotions and evaluations? To address this question, it is necessary first to redefine the *icon*, previously discussed in Chapter 4. An icon is a pointer, founded on a type of resemblance, and it deals with connecting analogous points. Of all existing signs, iconicity is most appropriate for potentially connecting these kinds of points, one being the sign of the other. No other sign function can account for such a parallelism. The observer chooses the contact points. As Langer illustrates,

> "Where the forms of two things are iconic, the *essential relation* between the elements of the two things is one of qualitative identity, despite differences between the 'materials' constituting the elements and consequent differences in the descriptions we might be tempted to

> offer of the relationships within the two sets of elements" (Langer in Davies 1994: 126).

Further, Langer proposes a connection between perceived space and feelings,

> "[…] the spatial form of a painting can be iconic with the temporal form of a feeling, because the essential relationship between the elements of the painting can (be known to) correspond to the essential relationship between the elements of the feeling. Similarly, the relationship between the aural elements of a musical work can be the same as the relationship between the thoughts and sensations that constitute a feeling" (Langer in Davies 1994: 126).

One may suggest that iconicity can occur between the temporality of a feeling and the spatial relationships in a painting for two reasons. The first is that spatial relationships imply temporal relationships by default, and if the implied temporal relationships within the spatial relationships of, for example, a painting or musical work are congruent with the temporality of experienced feelings, an iconic relationship can occur. The second reason is that humans experience the temporality of any situation in three-dimensional space, and therefore can project the temporality of any experienced situation into another conceived three-dimensional space (e.g. musical, literary, plastic arts, theatre). Such a projection can be facilitated if the conceived three-dimensional spatial relationships resemble, or are in some way related to, the three-dimensional spatial relationships experienced while experiencing the temporality of a feeling.

6.2.4 Imaginary realms

As a starting point for understanding the relationship between *imaginary realms* and space, we may return to the definitions of both terms. Initially defined in 1.4.4, imaginary realms is an enlargement of figurativisation in that it allows for variations in figurativisation and, additionally, embraces other listening strategies, notably fiction, fantasy and surrealism, where the listener exercises imagination as an end in itself. We know that, as viewed from a human perspective, the body exists in three-dimensional space, and that the mind 'inherits' three-dimensional spatial imprints through the Body-Mind continuum as proposed by the senses, which perceive via space. Given this spatio-sensorial frame, we may probe two themes: (1) the relationship between space

and the capacity for the human mind to create images; and (2) the poietico-esthesic relationship between the formation of images and the spatial dimensions within the sounding flow of an acousmatic work.

Space and the image: A human perspective

Space is not only intrinsic in the mind as furnished by sensorial input, but is also necessary for the formation of the *image* since all images generated by the mind are experienced as having their own spatial identity. For this reason, space is perceived not only as 'holding' the image, but also as championing the development of the image and the manner in which it unfolds. Any image is experienced as residing within its unique 'holding' space, which may expand or contract over time to accommodate changes in the image's dimensions. For example, images that unfold in three-dimensional space are considered with reference to the three-dimensionality of the body, whether the images are felt to possess a human proportion, or are deemed disproportionately large or small. Images that are created by the mind to function as a fictional narrative seem, equally, replete with the spatial dimensions of the narrative, while figurativistic images created by the mind for the stage – where their actual three-dimensional dimensions often represent larger dimensions – are apprehended by an audience situated in a linked three-dimensional space.

Certain intangible constructs, such as emotions, are considered to possess a psychological space.[160] Although the relationship between space and other seemingly intangible images – for example ones that involve air, temperature, colour and light – initially may be difficult to describe, space is experienced as the vector through which these images are created, apprehended and, ultimately, defined. In this way, we can understand that because air only becomes tangible when it moves in space, images that unfold in air – whether they move or are motionless – are perceptible through our understanding of the movement of air in space. Since thermoception is felt through touch in space, images founded on thermal states or changes are apprehended through our experience with touch. Sight permits us to perceive light (in space), for example, in the form of shafts of sunlight between trees in a dense forest, or through small openings in an otherwise unbroken cloud cover. Further, because light illuminates all physical objects in its path – thereby creating conditions of sufficient luminosity where colour can be sensed – images that are colour-dependent rely on the vector of space to convey light, which when perceived creates the sensation of colour. Finally, images that seem

[160] Psychological space can also be understood as 'mental' space. However, for reasons of clarity of discussion this term is not adopted in the dissertation.

to defy or succumb to gravity are perceptible through our understanding of weightlessness and weightiness as is commonly experienced within a body (space) of water. Thus, space is not only perceived as holding the image but is also perceived to serve as the vector through which the image can become tangible. It is the bearer and carrier for everything that is sensed and, thereby, can be imagined.

Space and the image in the acousmatic environment

In order to convey an *image* through sound, it is incumbent upon the acousmatic composer to create the image and its attendant *space* in musical space – sound spectra which occupy vertical space and are deployed in three-dimensional space – so that the image and its spatial dimensions can be considered to be preserved, even though they are re-cast in a three-dimensional, temporal, sonic environment. To achieve this goal, it is helpful for the composer to develop a dialectic between the spatio-temporal properties of the sounding flow and the spatio-temporal properties of the image to be conveyed.

Initially, the composer (the subject) needs to 'hold' the psychological space so that the image can coalesce before it unfurls in sound, since the creation and shaping of images through sound is governed by the composer's capacity for imagination. Furthermore, sound can also be experienced as holding the space so that the image can be developed in the mind of the composer. This is because sound is regarded as possessing its own spatial landscape, which the composer can listen to and reflect upon, build on, or reincarnate. Similarly, Smalley proposes, "Sounds in general, and source-bonded sounds in particular […] carry their space with them […]" (Smalley, 2007: 38). Because space is experienced as holding an image, the spatial topology of the sounding flow can be seen as holding an image, or holding the three-dimensional space for the image to emerge, thus prompting the reflection that images can be perceived as coming from the sounds themselves.

6.3 Composed Space in the Stereo Acousmatic Idiom

6.3.1 Definition

In the stereo acousmatic idiom, *composed space* can be understood as the result of a dual process whereby sound spectra are: (1) titrated and shaped as they evolve over time in vertical, bi-dimensional, space; and (2) are mapped and superimposed in three-dimensional space within a stereo field in the studio.[161] The vertical and three-dimensional spatial dimensions of sound spectra are considered as the two components of the sounding flow in the work. Creating composed space is thus central to the compositional effort in the acousmatic idiom insofar as it permits the composer to mould and position sound spectra, which exude intrinsic three-dimensional spatial qualities, onto a three-dimensional location in a stereo field.

The following discussion, founded upon personal experience,[162] illustrates how the creation of composed space in a stereo acousmatic work is fundamental to the compositional process. For example, if we listen to the stereo source recording of a foghorn at close range we can perceive a sonic profile that is loud, dense, static, and physically immobile. The composer may choose to leave these characteristics untouched and place the sound, as it is, in the stereo field in the work, where its elevated amplitude, opaque and unchanging spectral nature and three-dimensional immobility, can serve to mask other sound material. However, the composer may otherwise choose to accentuate or attenuate the higher or lower frequencies in the sound, cull its interior in such a way to create spectral grooves or 'hollow out' its interior entirely, and then retransform (e.g. re-filter or fragment) its residual spectrum. The composer may then attenuate the sound's overall volume, which attenuates proximity, and precisely re-calibrate the sound's amplitude envelope to enhance its new spectral character, or to create a sense of trajectory between the foreground and background of the stereo field. Finally, the composer may widen or narrow the sound's original stereo image, or pan the sound so that it travels across the stereo axis. Thus, a massive, non-evolving source-sound can be reformulated to function as a translucent, scintillating veil in the middle-ground of the stereo field, or as a mobile, sylph-like

[161] I address the titration and shaping of sound spectra primarily during a separate stage of sound transformation, using the 'making/listening' method discussed in 2.1, before mapping and superimposing sounds in a stereo or multichannel environment. It is a sequential approach that ensures a wide variety of sound material for an acousmatic work. However, current technology allows the composer to address both compositional processes, using the 'making/listening' method, within one digital audio environment. This approach is integrated because it permits the composer to shape the spectral content of a sound in a specific three-dimensional location within the existing sonic context of the work.

[162] I used this multi-faceted approach to create the vast majority of sounds for the works in the folio.

form that darts or slides across the stereo axis anywhere between the foreground and background, plying either the spectral ceiling or floor of the work, or any zone in between.

The term 'composed space' corresponds to the term *l'espace interne* ('internal space'), one part of Chion's bifurcated discussion of space that addresses music comprising 'fixed' sounds. Internal space is analogous to composed space insofar as it also refers to the spatial dimensions within an acousmatic piece that are recorded onto supporting medium and are characterised by qualities such as sonic relief, and the distribution of sound elements on different channels (Chion, 1991: 50).

The composed spatial content of an acousmatic work is articulated outside the studio, during public performance in a *listening space*, the diverse conditions of which can vary between a stereo monitoring system in a small room, as illustrated in Figure 6-2, and an extensive diffusion system – such as the acousmonium at the *Groupe de Recherches Musicales* – in a large concert space. The word 'acousmonium' is both a term and concept defined by François Bayle in 1974, which refers to

> "[…] an ensemble of 'sonic projectors' that orchestrate an acoustic image. They comprise a series of multichannel 'sonic screens', varied in calibre, distances and directions, that aid the organisation of the acoustic space according to the characteristics of the concert hall, and the psychological space according to given attributes of the work" (Bayle, 1993: 183).[163]

The term 'listening space' corresponds to Chion's term *l'espace externe* ('external space'), which addresses the widely variable physical parameters of listening conditions outside studio or headphone use. It can designate, for example, the acoustic profile of the listening space, the number, type and disposition of loudspeakers, the use of filters or equalisation during performance, and the type of sound diffusion employed (e.g. human interpretation or an automated diffusion system) (Chion, 1991: 50). Other factors play an important role in the 'articulation' of composed space in an external, listening space, notably the power and dimensions of the loudspeakers, as well as the proximity and angle of the loudspeakers in relation to the listener's position. Hence, the listener apprehends the composed spatial content of the acousmatic work within the acoustic frame proposed by the listening space, which, as Smalley notes, "[…]

[163] My translation of Bayle's text: *«[…] un ensemble de « projecteurs sonores » orchestrant l'image acoustique. Disposés en séries d' 'écrans sonores' multiphoniques, variés en calibres, distances, directions, ceux-ci aident à organiser l'espace acoustique selon les données de la salle, et l'espace psychologique selon les données de l'œuvre».*

theoretically encloses the composed space within it. Thus perceived, musical space is always a *superimposed space*" (Smalley, 1996: 91) (Smalley's italics).

6.3.2 Analysing composed space in the stereo acousmatic idiom

Composed space in the *stereo acousmatic idiom* concerns sound spectra, which are moulded in vertical, bi-dimensional, space and are mapped onto implied three-dimensional space within a stereo field in the studio. The vertical and three-dimensional spatial dimensions of sound spectra comprise the sounding flow of the acousmatic work. Although indissolubly bound, spectral, vertical space and its deployment in three-dimensional space are separated for discursive purposes.

My analysis and discussion of composed stereo space centres on a brief section of *Chat Noir*. I would like to suggest a bifurcated approach to the analysis that, to my knowledge, has not so far been applied to this type of music. The discussion may appear technical, but the approach aims to inspire further research in this direction. The section of *Chat Noir* is represented by a sound example and a two-tiered scoring system. One tier comprises a series of stereo spatial images, illustrating the embodiment and movement of the sounding flow in three-dimensional space in two- and three-second intervals. This approach can be considered the aural equivalent of a series of time-lapse photographs taken of moving entities, and illustrates movement much the same way a photograph does of moving road traffic at night, where lights of cars appear to 'stream' in different directions, 'tracing' the movements of the cars in three-dimensional space. The second tier examines the vertical, bi-dimensional occupancy of spectral space over time. The way spectral space is filled and evolves is linked to the behaviour of the sounding flow in three-dimensional space and, consequently, the composer/listener's perception of the sounding flow.

However, this sequential methodology is not without limitations, because when spectral space is illustrated over time, its three-dimensional behaviour is unaddressed. Conversely, a stereo spatial image, particularly one that is visually depicted from a vantage point directly above the listener, addresses the three-dimensional behaviour of the sounding flow in terms of proximity to the listener at the expense of the bi-dimensional subtleties and evolution of spectral space as it unfolds over time. In order to aid the reader to navigate between the two types of scores and vantage points, the alphanumeric symbol assigned to each sound in the legend for the spectral score accompanies the representation of the sound in the stereo spatial images.

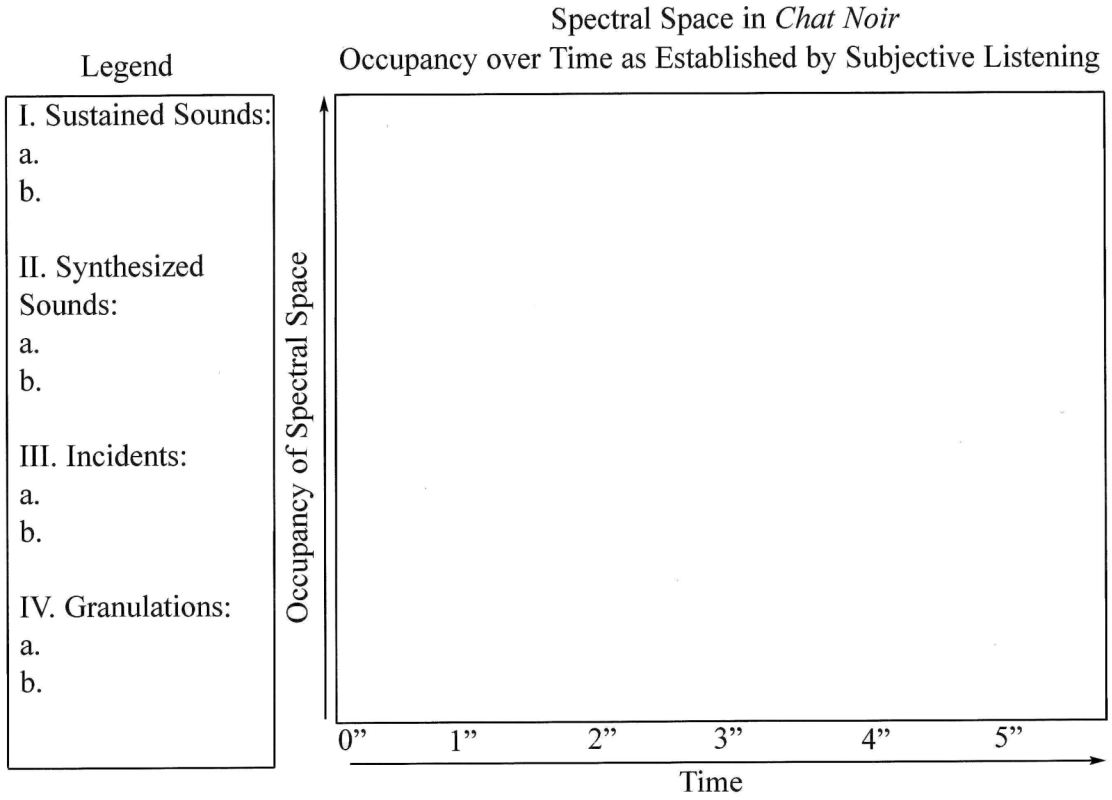


Figure 6-1. Score template for the representation of spectral space in *Chat Noir*

Figure 6-1 is a score template for the representation of spectral space in *Chat Noir*, where the occupancy of spectral space over time is illustrated as established by subjective listening. Low frequencies are represented at the bottom of the score and higher frequencies at the top. The left side of the figure contains a legend showing the categories of primary spectromorphologies found in the piece. Different levels of opacity in the morphological design of sound spectra represent different levels of amplitude. For example, a transparent shade indicates a softer volume, and a more opaque shade indicates a louder volume.

Figure 6-2 is a score template for a stereo spatial image in *Chat Noir*, a frame in which the three-dimensional behaviour of the sounding flow can be observed with reference to the listener and listening space. The spatial images are scored in a time-lapse fashion, which permits the directionality, occupancy and behaviour of the sounding flow's three-dimensional space to be viewed over brief intervals of time.

The listening room contains a sound playback system with two high-quality studio monitors. The triangular proportions, intuitively established between the left and right loudspeakers and the listener, were confirmed by Smalley, who had proposed a similar type of listening vantage point with a 1:1 ratio between the distance between the left and right loudspeakers and the distance from the centre of the loudspeaker

image to the listener, one of a narrow range of position possibilities that offers suitable conditions for compositional and listening awareness (Smalley, 2007: 50).

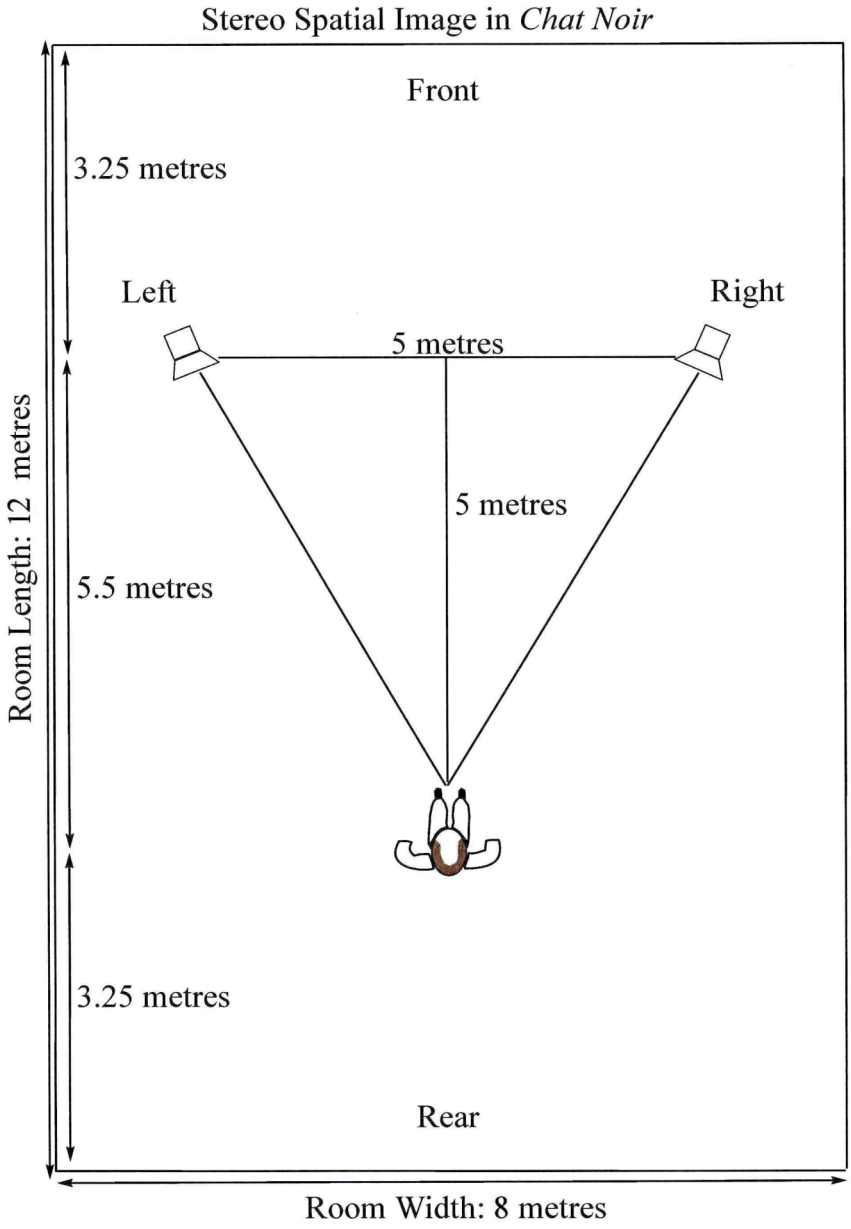


Figure 6-2. Score template for the representation of three-dimensional space in *Chat Noir*

6.3.3 Space in *Chat Noir*

Of the many spectral and three-dimensional spatial scores made for *Chat Noir*, I have chosen to focus on a series that illustrates a transition, from 3'08" to 3'14", which connects two sections of the piece. The scores of the transition reveal how the spectral identity and evolution of one sound can be perceived to collude with its three-dimensional spatial trajectory and gain sufficient impetus to eradicate one sonic

universe and usher in another. The sound is also salient because it re-appears several times throughout the piece, often announcing other structural changes; furthermore, its motion-trajectory in the form of a rotation is a model which is replicated by other sound material that also announces structural divisions, or can otherwise be apprehended within the sections. The discussions on spectral and three-dimensional *space* are based on my own poietico-esthesic analysis. They are followed by a discussion of space from the viewpoint of the four reception behaviours.

Spectral space in *Chat Noir*

The score of *spectral space* in Figure 6-3, which corresponds to sound example 6.1 (track 85), illustrates the transition between 3'08" and 3'14". Sound example 6.2 (track 86) is a longer extract, from 2'23" to 3'41", where the transition can be heard in a wider context. For organisational purposes, the discussion of the spectral and three-dimensional scores of the bridge is divided into three subsections.[164] The first, from 3'08" to 3'09" (0"- 1" in the sound example), is a spectrally striated, sustained sonic universe that, from a structural viewpoint, terminates the introduction of the work. The two sustained sounds present at 3'08" – 3'09" include a high-pitched, whistling (Ia, in light blue), and a drone in the guise of a transparent, harmonic 'veil' based on the interval of a major seventh, (Ib, in dark blue). The higher pitch in the 'veil' is louder, and, thus, its morphological design is more opaque. The other two sounds present from 3'08" to 3'09" are iterative or fragmented in nature and include a transparent, metallic 'scampering' sound (IIa, finely etched in green), and a fragmented, 'chortling' transformation that rises and falls, repeatedly, in pitch and 'tumbles' forward in time owing to the small circumference of its cyclical morphology (IVa, in pink and orange).

In the second subsection (3'10" – 3'11") (2"- 3" in the sound example), the high-pitched, sustained whistling sound (Ia), grows louder and the preceding sonic universe is abruptly severed by a prominent, downward-moving glissando in the form of a rotation (IIIa), denoted by a purple, oblique slash. The sustained veil (Ib), continues during this subsection.

A new sonic universe unfolds in the third subsection (3'12" – 3'14) (4"- 6" in the sound example), comprising lightly fragmented, delayed, filtered recordings of a toy accordion (IVb, in red-orange), and the ongoing sustained veil (Ib). The latter can be interpreted as a 'binding element' that unites disparate sound-shapes before, during and after the bridge.

[164] While my poietico-esthesic knowledge enables me to perceive three separate subsections, listeners may perceive one section.

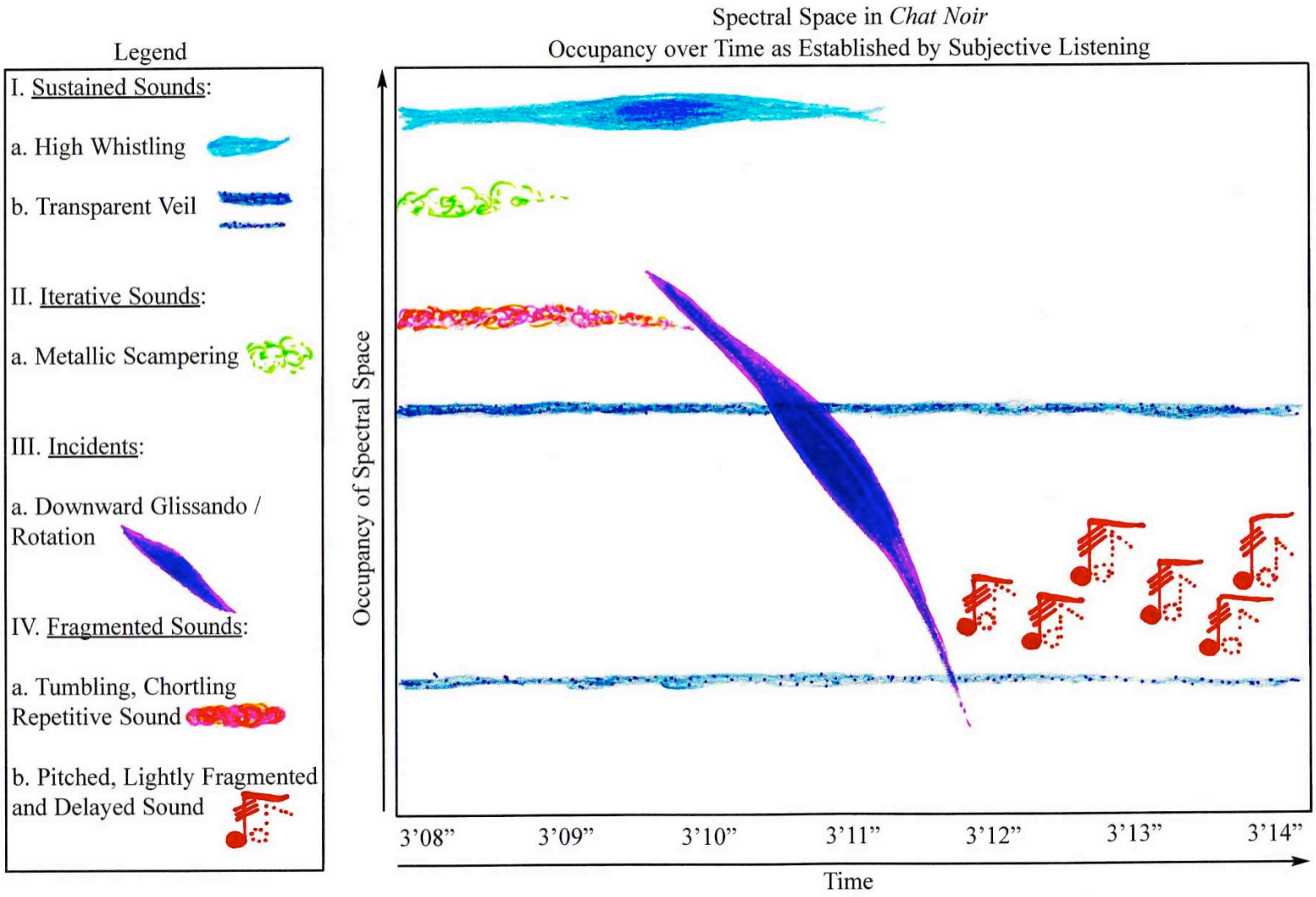


Figure 6-3. Spectral space in *Chat Noir* from 3'08" to 3'14"

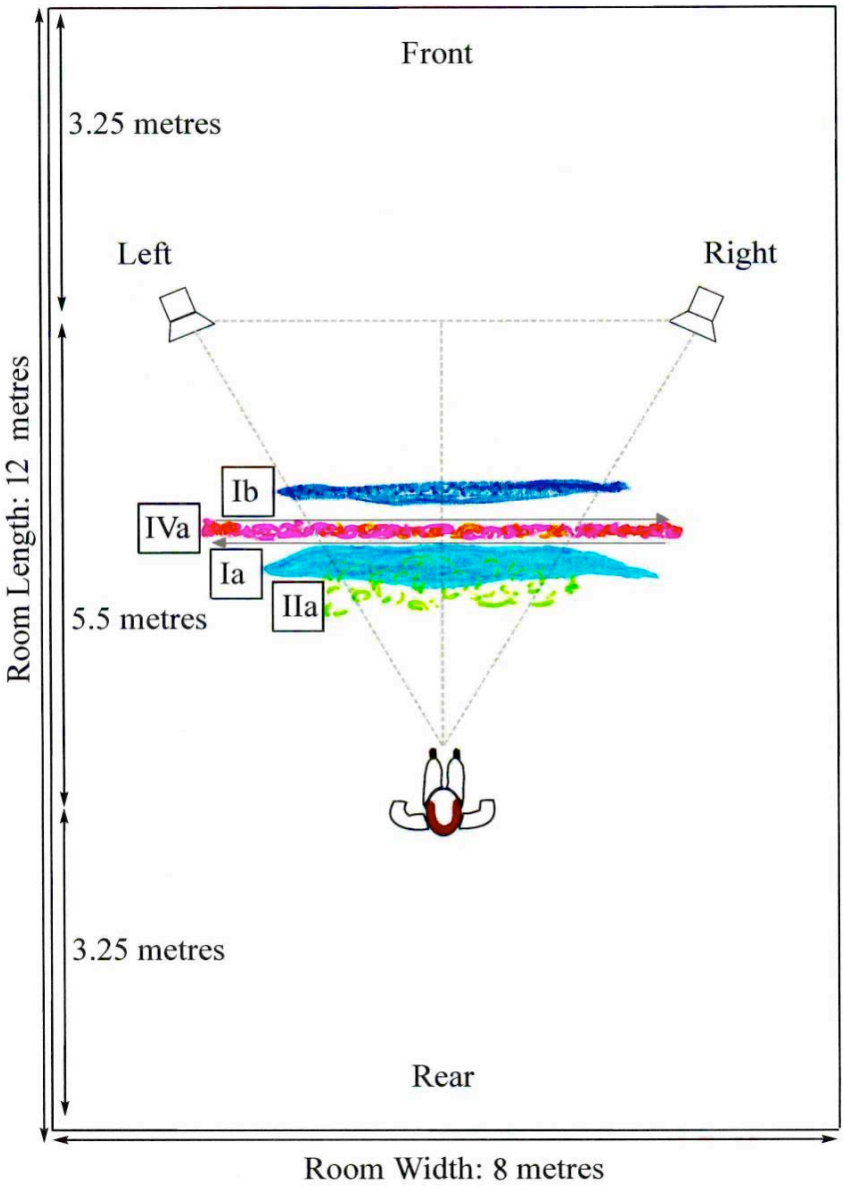


Figure 6-4. Three-dimensional space in *Chat Noir* from 3'08" to 3'09"

Three-dimensional space in *Chat Noir*

Figure 6-4 illustrates the first subsection (3'08" – 3'09") in *three-dimensional space*. If we regard this stereo spatial image as a unified sound-field from the point of view of proximity to the listener – as opposed to the viewpoint of the sounding flow as delivered by the loudspeakers – the transparent, metallic scampering sound (IIa, in green) appears to impregnate the high-pitched, sustained whistling (Ia, in light blue). The two sound-shapes occupy the foreground, relegating the tumbling, chortling repetitive sound (IVa, in pink and orange) and the veil (Ib, in dark blue) – the two pitches of which combine to form one spectromorphology in three-dimensional space – to a more distant location. Sound IVa's audibility and trajectory across the stereo axis, illustrated by the parallel grey lines with arrows, are largely masked by sounds Ia and IIa. However, IVa has a wider stereo image than the other spectromorphological

material in this sound world and, hence, becomes audible when it gravitates to the poles of the stereo axis.

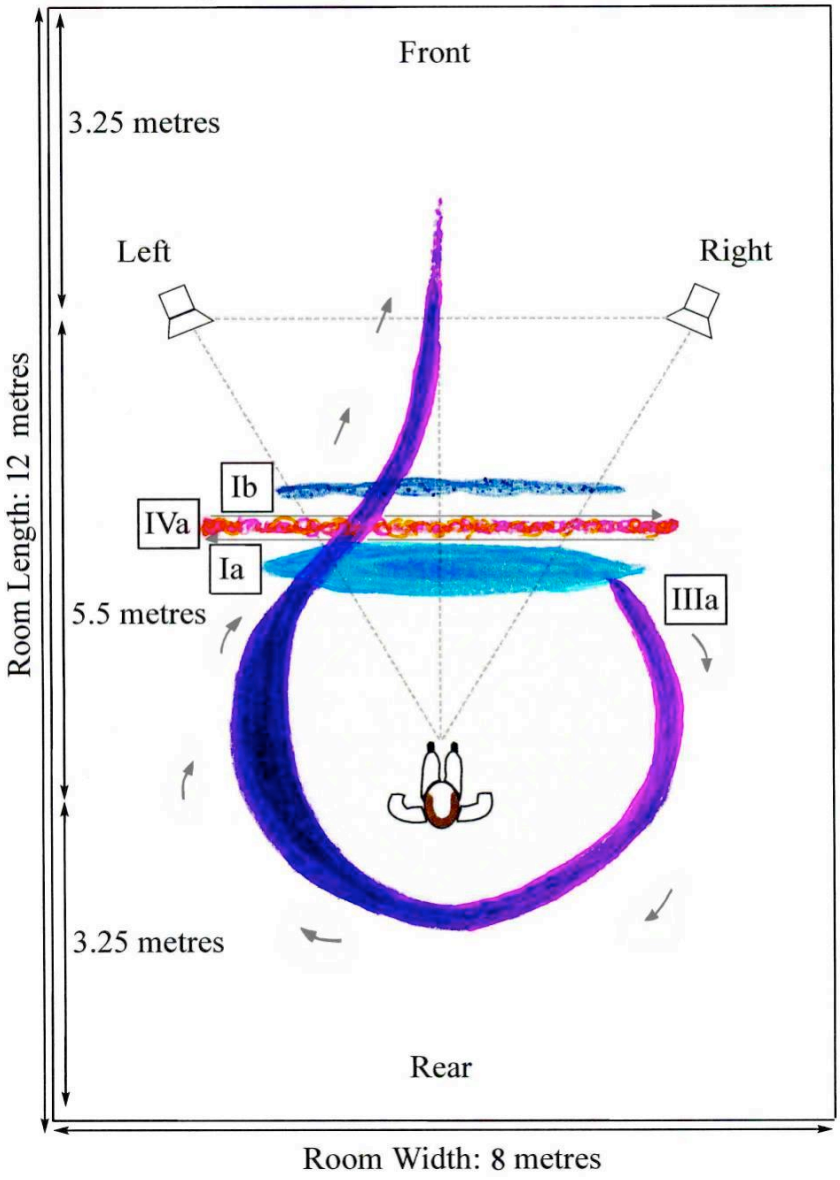


Figure 6-5. Three-dimensional space in *Chat Noir* from 3'10" to 3'11"

In Figure 6-5, which represents three-dimensional space from 3'10" to 3'11", the high-pitched, sustained whistling (Ia, in light blue) becomes louder as illustrated by its more opaque morphological design. The veil (Ib, in dark blue) remains in the background, and the tumbling, chortling repetitive sound (IVa, in pink and orange) continues to travel back and forth across the stereo axis. The downward glissando/rotation (IIIa, in purple), which is mapped onto three-dimensional space in the form of an incomplete rotation, was initially discussed in 3.2.4. From my poietico-esthesic perspective, the 270° trajectory begins at 3 o'clock on an imaginary horizontal clock, and travels in clockwise motion to 12 o'clock. I perceive the trajectory of sound

IIIa to begin on the right side of the stereo axis, travel in clockwise motion, swerving behind me, as denoted by the short grey arrows, and brush against the left side of the stereo axis before it shoots forward to the centre-front of the listening space and dissolves.[165] Although the energy motion-trajectory of the rotation, initially, is directed to the left and can appear to restrain the momentum of the piece, the loudest part of this sound, and the place of maximum torque, is perceived in the second quadrant of the sound's trajectory, between the rear of the listening room and the left side of the stereo axis. Maximum torque on the rear, left side of a circular trajectory in clockwise motion propels an object over time, in this case the rotation, in an opposite direction, centre-rightwards, where it dissolves at the threshold of the fourth quadrant, demarcating 90° of unoccupied 'space' for a new sonic universe to begin in a new 'time'.

This energy-motion trajectory is similar to that of an ocean wave as it crashes on a beach. As discussed in Figure 2-3 in 2.2.3, which illustrates the salient sounding gestures in *Neon* inspired by the wave form, water that recedes from a beach is referred to as backflow. Since the wave model is circular, the force and mass of the backflow contribute to the forward thrust of an oncoming wave. We might thus view the first 180° of the trajectory of the rotation in Figure 6-5 as backflow, which gains force during the trajectory, resulting in the sound being 'flung' away from the listener towards the front of the listening room, otherwise viewed as the crest of the wave.

Figure 6-6, on the following page, illustrates three-dimensional space from 3'12" to 3'14", the aftermath of the downward glissando rotation. In this virtually barren sonic environment, the veil (Ib, in dark blue) remains stationary, and sound material comprising pitched, lightly fragmented and delayed recordings of a toy accordion (IVb, in red-orange) appears in the foreground distributed evenly across the stereo axis. This material is the harbinger for a sonic universe that unfolds in the form of an aural kaleidoscope between 3'12" and 4'24".

[165] Despite poietico-esthesic intent and perception other listeners may not apprehend the intended trajectory of the rotation.

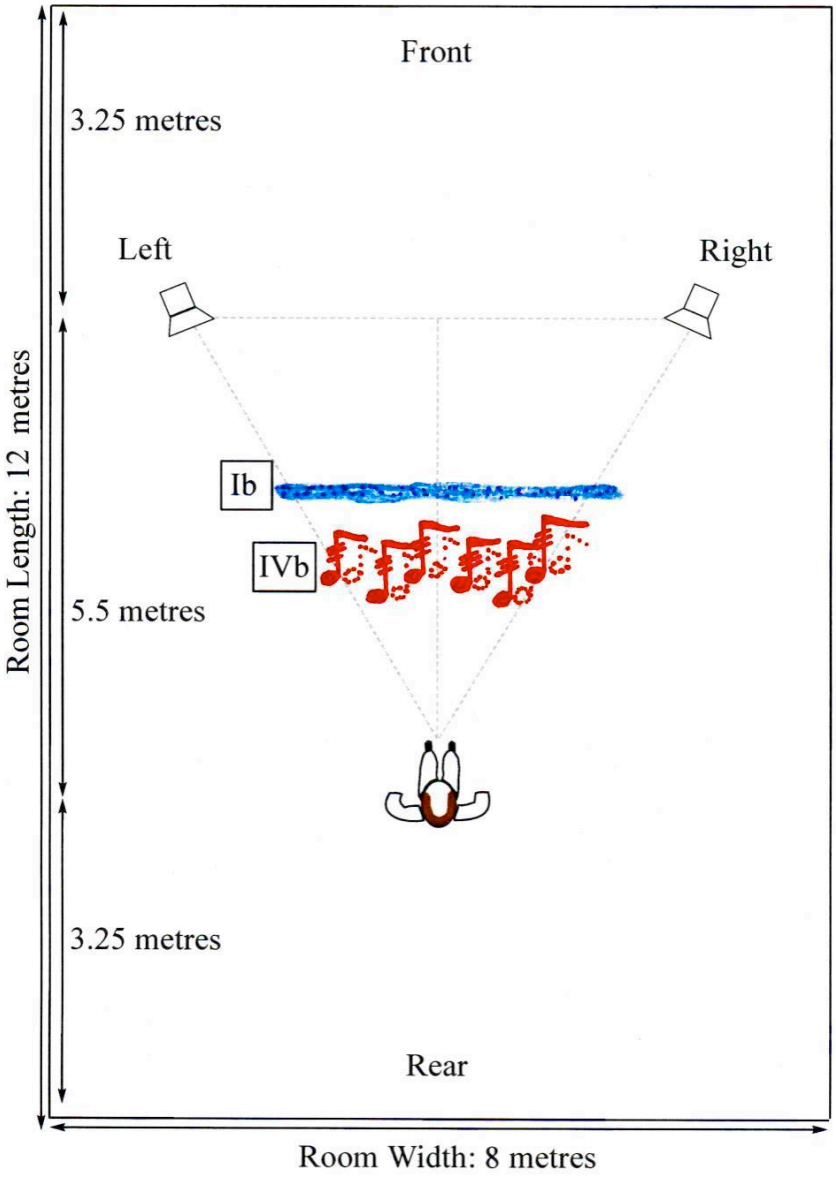


Figure 6-6. Three-dimensional space in *Chat Noir* from 3'12" to 3'14"

Space in *Chat Noir* from the perspective of the four reception behaviours

(i) Sonic properties

Spectral space and its deployment in three-dimensional space is the focus of the discussion regarding this transition in *Chat Noir*. As I suggested in 6.2.1, by analysing these two elements we can observe how spectral space colludes with three-dimensional space to elicit a percept. From my perspective, the aural effect of the downward glissando/rotation (IIIa) is created by its spectral evolution in tandem with its three-dimensional trajectory. A spectrally static sound might be less convincing, aurally, as a rotation, particularly one of such a large bore, due to our experience as to how spectra are perceived to change when sounds 'rush' or 'swirl' past us. Conversely, a downward glissando, while although plausible as a type of distant or close 'aural

comet', can accrue a different and more powerful significance when its motion-trajectory is aligned with its spectral evolution. The smooth, uniform, downward spectral shift of the sound – a transformation of the source recording of air escaping from a balloon – lends itself to a smooth, uniformly evolving motion-trajectory, such as a rotation.

(ii) Structural attributes

The perception of the evolution of sound spectra over time in vertical space can seem to converge with the perception of their deployment over time in three-dimensional space to create an unfolding context comprising three-dimensional 'sonic loci', which, in this discussion, concerns the part of *Chat Noir* from 3'08" to 3'14". From a traditional compositional point of view, where sound is structured through spectral and three-dimensional space (which operate as carriers) the *sonic loci* can be seen to create the architecture of the intersection in this part of *Chat Noir*. However, if we consider the transition from another perspective, where space is structured through sound, the vertical and three-dimensional *space* in which the sonic loci are organised and carried can be seen to create the architecture.

(iii) Self-orientation

In 6.2.3, I noted that, as objects, emotions and evaluations can have spatial dimensions, and that these implications can be catalysed by the spatial dimensions in the sounding flow. This is also true for sensorial attributes as they are also generated as objects by the listener. Although the segment of *Chat Noir* from 3'08" to 3'14" is fleeting, the prominent motion-trajectory of the downward glissando/rotation can be seen to generate sensorial attributes as one possible set of objects in the realm of self-orientation. For example, this sound can be perceived, initially, to encircle the listener, thereby extinguishing the previous sonic universe by virtue of its unexpected trajectory, close proximity, and higher amplitude. The sound can then be perceived to 'propel' the listening consciousness into the centre-foreground of the stereo field, and 'deposit' the listening consciousness at the new location after which it disintegrates to make way for the advent of the new sonic universe.

Although this series of sensorial attributes might seem unremarkable at first glance, a relational shift can occur between the listener and the downward glissando/rotation in three-dimensional space during the sound's trajectory, which can be noticeable in retrospect. The sound initially can appear to encircle the listener.

However, at some point after the initial 180° trajectory, the sound may 'carry' the listener – and the listening consciousness – with it so that the listener has the sensation of having 'ridden astride' the sound and arrived, physically, at a different location at the end of the sound's trajectory. Although it is difficult to pinpoint precisely where this relational shift may occur, it is important to recognise that the spectral and three-dimensional spatial evolution of the sounding flow in an acousmatic work can provoke such sensorial responses. The listener could also observe this phenomenon existing in a prospective image, where in this case, the listener observes the image.[166]

(iv) Imaginary realms

The discussion about imaginary realms and space in 6.2.4 is founded on the premise that all images in the mind are experienced as possessing their own spatial identity. From a poietic viewpoint, the composer (as subject) initially experiences 'holding' the psychological space for the image to coalesce before it unfurls in sound. Seeing the need to create a sound that could function as a pivot between the two sonic universes illustrated in *Chat Noir*, between 3'08" and 3'14", I created the downward glissando/rotation, based on the rotation energy model. The reasons were two-fold. First, I knew that a rotation, as characterised by my image of a wave crashing ashore, would have sufficient thrust and the appropriate motion-trajectory to eradicate one type of sounding flow and propel the piece into another. Secondly, this energy model had previously been introduced in the piece and would engender spectromorphological cohesion for the listener. Thus, I reworked the spectral and three-dimensional spatial characteristics of the source sound to conform to my image.

[166] Prospective space concerns "[…] the frontal image, which extends laterally to create panoramic space" (Smalley, 2007: 56).

6.4 Composed Space in the Multichannel Acousmatic Idiom

6.4.1 Definition

Composed space in the multichannel acousmatic idiom is similar to composed space in the stereo acousmatic idiom because it also comprises sound spectra that are titrated and shaped as they evolve over time in vertical, bi-dimensional, space. The difference lies not only in the mapping and superimposition of sound spectra in three-dimensional space – in a multichannel rather than stereo field, – but in the conception, itself, of three-dimensional space in a multichannel field. A general description of the multichannel acousmatic idiom can provide a foundation for the discussion of the parameters of its composed space.

Although the term 'multichannel' implies pluralism by definition (e.g. octophony, surround sound, etc.), the final choice of format is a result of the composer's imaginative capacity manifested as an aesthetic approach, which governs the management of space in the work, and in turn, influences all compositional decisions. The aesthetic approach thus guides the choice of multichannel form, which can include, but is not limited to, quadrophony, octophony, or systems such as Ambisonics.[167] It also aids the composer to determine the position of the channels and corresponding loudspeakers in three-dimensional space, where appropriate to the form, and guides the compositional strategy. This type of decision-making order helps composers to avoid subjugating their aesthetics to a pre-established multichannel form and loudspeaker array.

The following example, founded upon personal experience and which is the basis for the discussion of space in *Ether* in 6.4.3, illustrates how my aesthetic approach influenced such decisions. Having received a commission for an octophonic, acousmatic work in 2001, I sought to develop an aesthetic approach, which came to be anchored in the three-dimensional spatial movement created by a double spiral.[168] Although the octophonic form was stipulated, I conceived loudspeaker positions that represented the superimposed shape of a cruciform overlaid with a rectangle, as

[167] In acousmatic composition, surround sound is a type of multichannel audio system, comprising different formats, for example, 5.1, 6.1 and 7.1. The number before the decimal point refers to the number of discrete channels, and the number after the decimal point refers to the number of LFE (low frequency effects) channels. The loudspeakers, each delivering a discrete channel, are placed in front of and behind the listener, in specific locations as dictated by the format. Ambisonics can be seen as a type of sound system which is a "[…] reconstruction of the original acoustic wave field" according to Stanley Lipshitz (Ambisonic Network, 2010). In a definition provided by David Malham, ambisonics can be seen as "[…] a method of recording information about a soundfield and reproducing it over some form of loudspeaker array so as to produce the impression of hearing a true three dimensional sound image" (Ambisonic Network, 2010).

[168] The commission was offered by *Musiques & Recherches,* Ohain, Belgium. *Ether* was premiered at the Eighth International Acousmatic Festival, *L'espace du son,* in Brussels, Belgium on October 3, 2001.

illustrated in Figure 6-7, since I realised that specific loudspeaker configuration would convey the three-dimensional spatial movement of the double spiral most convincingly. I then created the spectral character of the double spiral and mapped its three-dimensional spatial trajectory as facilitated by the position of the eight loudspeakers.

6.4.2 Analysing composed space in the multichannel acousmatic idiom

The conceptual territory of three-dimensional space in a multichannel field is larger than in the stereo field, often spanning 360°. Therefore, it is inherently more flexible, and thus can more readily support a broader range of spatial forms, for example, those that are circular, spiral, serpentine, or geometric, as well as an evolution between spatial forms.

My *analysis* and discussion of *composed space* in the multichannel acousmatic idiom centres on a section of *Ether*. The bifurcated approach used is similar to the one that I applied to the section of *Chat Noir* in 6.3.3, as the section of *Ether* is also represented by a sound example and the two-tiered scoring system. Figure 6-7 is a score template for an octophonic spatial image in *Ether*. The loudspeaker layout corresponds to the superimposed shape of a cruciform, depicted by the loudspeakers that deliver channels 7, 8, 5, and 6, which is overlaid with a rectangle, depicted by the loudspeakers that deliver channels 1, 2, 3, and 4. The triangular proportions, between the left and right loudspeakers (channels 1 and 2) and the listener, are represented, however, in a 5:4 ratio due to the limitations caused by the need to create adequate proportions between the eight loudspeakers in the listening room, as well as between the loudspeakers and the listener. The methodology used to discuss spectral space in *Ether* is also similar to that used for the discussion of spectral space in *Chat Noir* as illustrated in Figure 6-3.

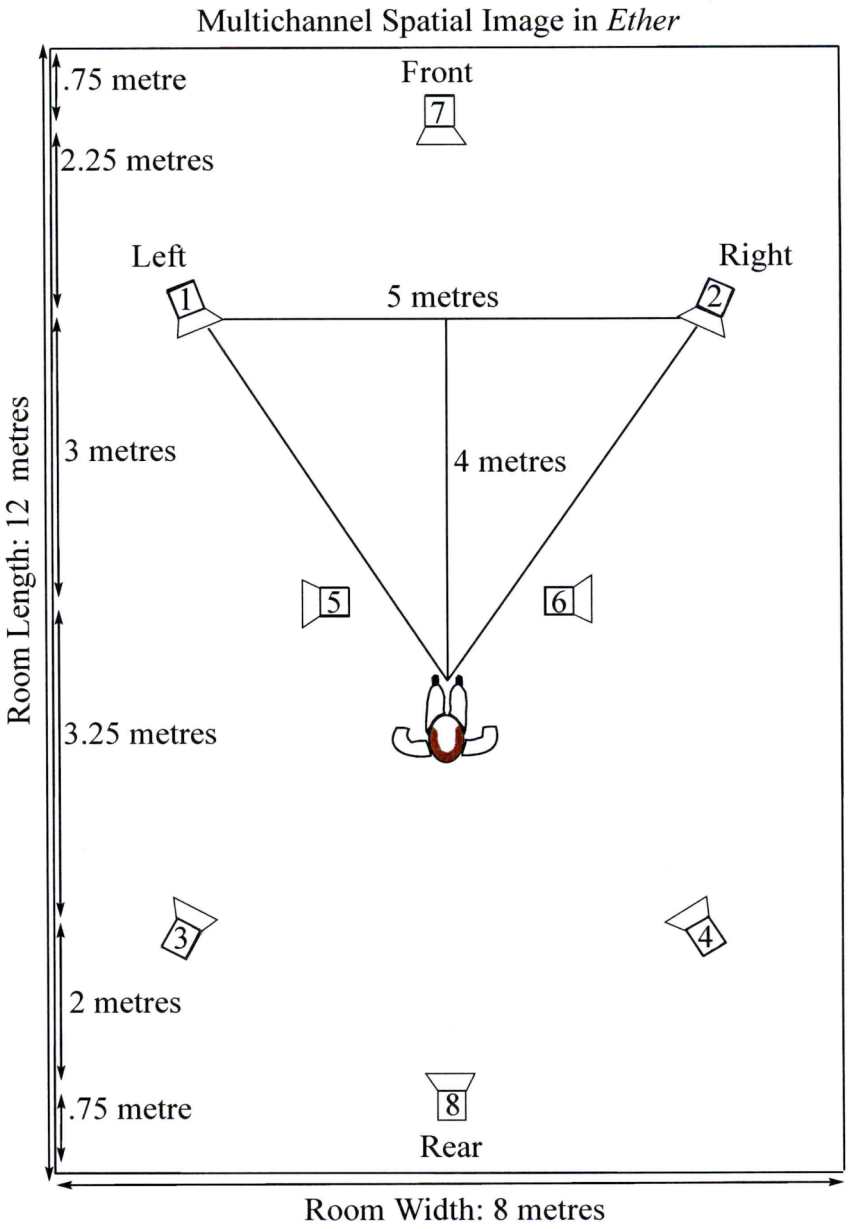


Figure 6-7. Score template for the representation of three dimensional space in *Ether*

6.4.3 Space in *Ether*

I have chosen to discuss the first of the seven sections in *Ether* for which I made spectral and three-dimensional spatial analyses. This initial section, from 0" to 56", sound example 6.3 (track 87), introduces a variety of harmonic and inharmonic sound spectra that reappear throughout the work. These spectra are shaped and titrated to function in tandem with the unfolding three-dimensional spatial trajectory of the sounding flow. For example, at the beginning of *Ether*, the three-dimensional spatial trajectory can be perceived to be spring-loaded and discharged from the centre loudspeakers delivering channels 5 and 6, and then radiate outwards, in a double spiral,

to increasingly distant loudspeakers. Once the circumference of the double spiral is established, it can be perceived to be overlaid with, and give way to, spatial trajectories of a polyphonic nature. The discussions, which are based on my own poietico-esthesic analysis, aim to describe the spectral identity of the sounding flow, and suggest that the sounding flow's spectral character can be perceived to collude with its three-dimensional spatial trajectory to impart contrasting spatial images. They are followed by a discussion of space from the viewpoint of the four reception behaviours.

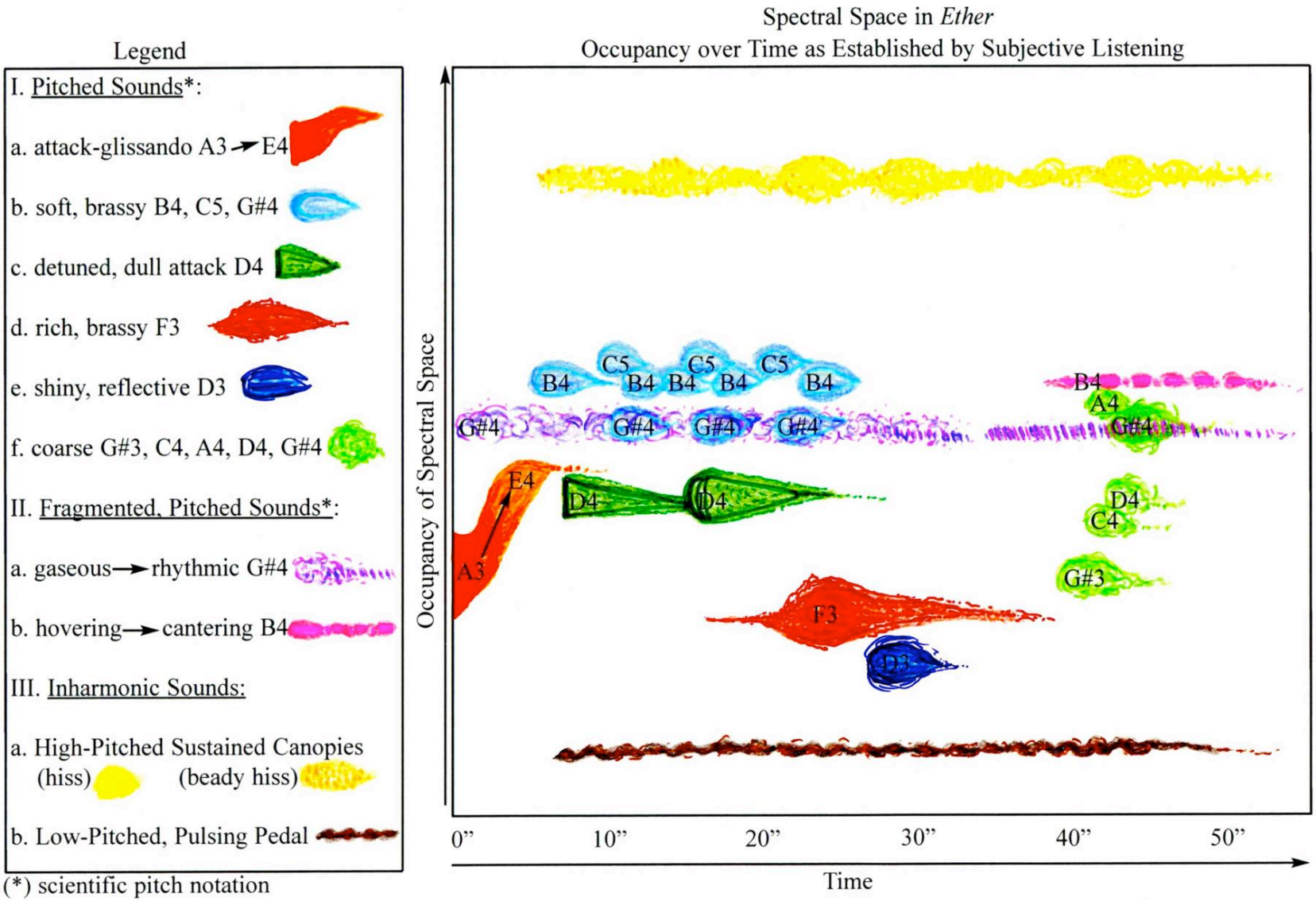


Figure 6-8. Spectral space in *Ether* from 0” to 56”

Spectral space in *Ether*

The score of *spectral space* in Figure 6-8 is an analysis of this first section of *Ether.* In order to illustrate the occupancy of spectral space in eight channels of sound over 56", it was necessary to simplify the representation of the sound-shapes and reduce their scale. Although the pitches conveyed in the section are relative, the spectromorphologies that contain harmonic spectra and convey pitch are depicted with morphological shapes, in lieu of traditional musical symbols, and are labelled with pitch names. In my experience, harmonic spectra can belie a broader swath of spectral space than their frequency bands would appear to impart. Hence, sounds comprising harmonic spectra are scored as they are perceived, often with thicker morphological shapes. The ensuing description is based on my own poietico-esthesic perception of the section and will serve as the basis for further discussion.

(i) First subsection: 0" – 6"

Ether begins with a powerful percussion/resonance (sound Ia, in orange). The attack conveys the pitch A3, and the resonance slides upward a perfect fifth (to E4). Although barely audible, a transparent, 'gaseous' spectromorphology is also present at the beginning of the piece (sound IIa, in purple). The billowy characteristic of IIa is initially noticeable. However, its pitched quality (G#4) is only unmasked as the percussion/resonance fades away.

(ii) Second subsection: 6" – 20"

In the first part of the second subsection, the percussion/resonance (sound Ia, in orange) dies away. The first soft, but brassy sound (pitch B4) in a repeating series of three short, pitched sounds appears at 7" (sound Ib, in light blue). Sound Ib is framed in the upper spectral register by a dual inharmonic canopy comprising twin strands of smooth hiss and 'beady' hiss (sound IIIa, in light and dark yellow) and in the lower spectral register by a pulsing pedal (sound IIIb, in dark brown) at 8".

Later in the subsection, a detuned, timbrally opaque, pitched (D4) percussion/resonance can be heard at 9" (sound Ic, in dark green). Sound Ic is a curious spectral amalgamation that conveys the qualities of pitch and inharmonicity, the latter of which can be perceived as 'muddiness'. The two other pitched components of sound Ib (in light blue, pitches C5 and G#4), can be heard at 10". This series of three short, pitched sounds repeats in its entirety during the subsection. A second detuned, timbrally opaque, pitched (D4) percussion/resonance (Ic, in dark

green) is at 16". However, it is softer, and the incisiveness of its attack is skewed by its 'bubbling' internal morphology. Sound Ic almost masks the inception of the rich, brassy, pitched spectromorphology (sound Id, in red) at 16".

During the last part of the second subsection, the inharmonic, sustained canopy (IIIa, in light and dark yellow) begins to wax and wane in intensity, and can be perceived to 'drench' the other sound-shapes in heavy or light 'showers' of sonic beads and 'clouds' of hiss. Sound IIa (in purple) serves as a spectrally translucent binding element (pitch G#4) through a gaseous morphology, and the pedal (IIIb, in brown) functions as a spectral 'floor'.

(iii) Third subsection: 20" – 30"

In the third subsection, the rich, brassy, pitched spectromorphology (Id, in red) becomes prominent, swelling to the foreground at 24", where it conveys the pitch F3. The three short, pitched sounds (Ib, in light blue) appear, again, at 22" – 23". The sustained canopy (IIIa, in light and dark yellow) continues to surge, notably at 22" – 24", and, again, at 29". Additionally, the sustained, translucent character of sound IIa (in purple) continues to facilitate spectral cohesion, and the low-pitched pedal (IIIb, in brown) begins to pulse. At 29" a shiny, pitched (D3) spectromorphological orb (sound Ie, in dark blue) careens across the image before disappearing into obscurity.

(iv) Fourth subsection: 30" – 40"

One of the most salient attributes of the fourth subsection is the morphological transformation of sound IIa (in purple), which can be perceived to evolve from a pitched, translucent, albeit inert, form to a rhythmically fragmented, repeated sound-shape. IIa appears in its two forms in the fourth subsection. However, the rhythmically fragmented form is in the perceptual foreground. Sound IIa also can be perceived to die away, briefly, at 34", after its metamorphosis, and 'flutter' back to life at 36". In another development, the rich, brassy, pitched spectromorphology (sound Id, in red) slowly ebbs away, revealing the spectral gulf between the sustained canopy (IIIa, in light and dark yellow) and the pedal (IIIb, in brown).

(v) Fifth subsection: 40" – 50"

At 40", a series of coarse, pitched sounds (G#3, C4, A4, D4, G#4) outlining melodic intervals concludes the overt pitched activity in the section (the series is labelled as sound If, in light green). The last sound in the series, If, conveys a G#4. The

conveying of the pitch G#4 by three different sound-shapes in the section sustains and highlights the interval of a Major seventh above the pitch (A3) conveyed by the initial percussion/resonance. Sound If is accompanied by the sustained, inharmonic canopy (IIIa, in light and dark yellow), the pedal (IIIb, in brown), the rhythmically fragmented, pitched sound (IIa, in purple), and a new, pitched spectromorphology (B4), which initially hovers in the background before breaking into a canter (sound IIb, in pink).

(vi) Sixth subsection: 50" – 56"

The sixth subsection imparts a sense of energetic decay. The preceding sonic universe has exhausted itself; its components can be perceived to 'melt' away in the presence of one remaining audible element, sound IIIa, the high-pitched, dual inharmonic canopy – ether.

Three-dimensional space in *Ether*

Due to the manifold nature of the idiom, *three-dimensional space* in a multichannel acousmatic work does not automatically lend itself to being perceived as a series of stereo spatial images. However, stereo spatial images can be perceived when the sounding flow is organised in stereo pairs of channels, and particularly when the pairs are delivered by loudspeakers in front of the listener. Thus, in contrast to the spatial images of *Chat Noir*, the spatial images of *Ether* do not represent a unified stereo sound image from the point of view of proximity to the listener. Instead, the spatial images are represented according to the position of each loudspeaker. Since the loudspeaker and channel numbers are synonymous in *Ether*, the sounding flow is addressed according to the channel number. Sounds are identified in one location on each score, even though they often occur simultaneously in several channels. As a prelude to the discussion, snapshots of the six scored subsections are grouped together in Figure 6.9, giving an overview of three-dimensional space from 0" to 56".

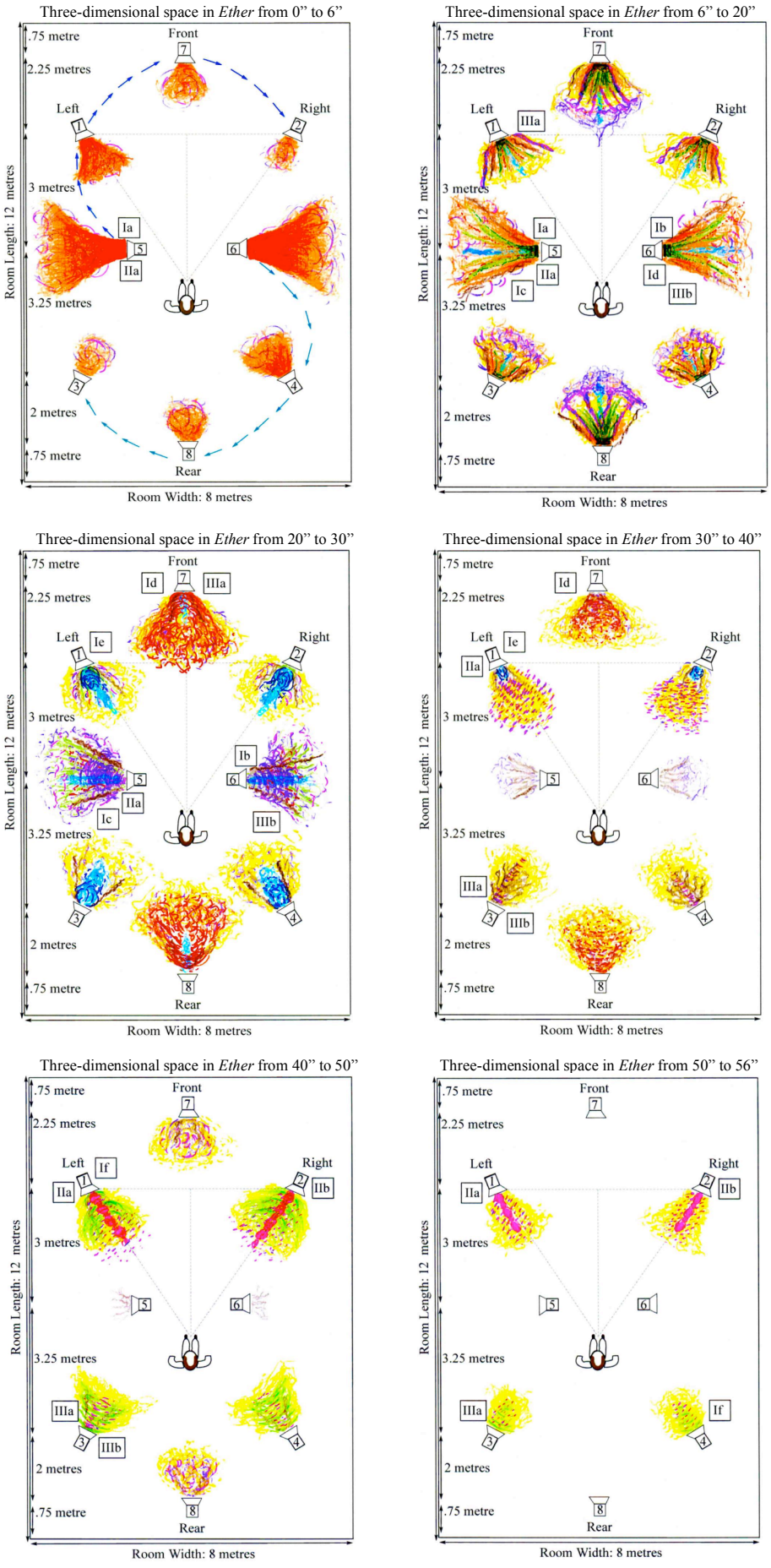


Figure 6-9. Three-dimensional space in *Ether* from 0" to 56" as illustrated through snapshots of the six scored subsections

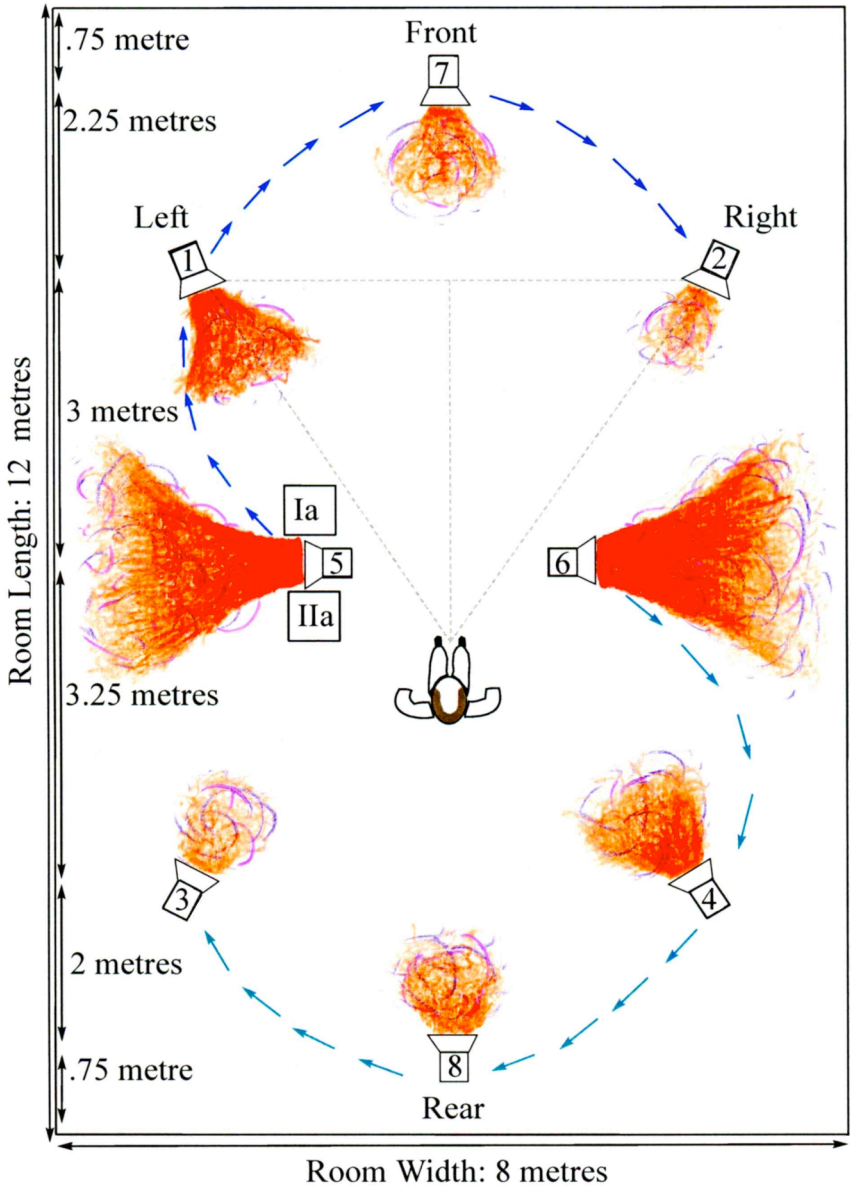


Figure 6-10. Three-dimensional space in *Ether* from 0" to 6"

(i) First subsection: 0" – 6"

The inspiration for *Ether* is derived from the fluid-like state and omnipresent spatial context ascribed to ether, historically considered as "the upper regions of air" (Oxford, 1996: 334). The frame for the work thus initially consists of a vast, empty space. Energy, which appears in the form of sound, springs from the centre of the space and spirals outwards in opposite directions.

Figure 6-10 illustrates the energy-motion trajectories in the first subsection (0" – 6") in three-dimensional space, where the percussion/resonance in stereo (sound Ia, in orange), can be perceived to be spring-loaded and discharged in channels 5 and 6. Sound IIa (in purple), also in stereo, can be perceived as a transparent, gaseous sound-shape that encircles and permeates sound Ia in channels 5 and 6. These two spectromorphologies can be heard in stereo at 1" in channels 1 and 4, and at a lower

volume in, stereo, in channels 7 and 8. At 2" they become audible, also in stereo, in channels 2 and 3. From 3" – 6" the volume of the sounding flow diminishes slightly in channels 5 and 6, and increases slightly in the other six channels.[169]

The three-dimensional spatial movement of the sounding flow is designed to represent the initial semi-circular trajectories of a double spiral, the upward blue arrows starting at channel 5 and the downward green arrows starting at channel 6 illustrate the direction and dimensions of each spiral, which if continued, would depict continuous circular motion of a decreasing order that would terminate in locations approximately 2.5 metres in front of and behind the listener. Although the listener may perceive the three-dimensional spatial movement of the sounding flow in the form of one or two circles, three criteria invite the perception of the spiral form. (1) The sound material in channels 1, 7, and 2 replicates the sound material on channel 5 (the left side of the stereo image), and the sound material in channels 4, 8, and 3 replicates the sound material on channel 6 (the right side of the stereo image), creating two subtly organic three-dimensional spatial zones. (2) The sounding flow is louder in channels 1 and 4 than in channels 2 and 3, which helps to emphasize the existence of the two zones and is intended to direct the listening consciousness in a clockwise motion for each zone. (3) The loudspeaker positions do not form a double circle. The intended imaginary trajectories from channel 2 to channel 5, and from channel 3 to channel 6, while although longer than existing trajectories, impart a smaller circumference, and, hence, the beginning of a double spiral. The beginnings of double spiral trajectories, as represented with other percussion/resonances appear in *Ether* at 58", at 3'52", and, again, at 5'01".

(ii) Second subsection: 6" – 20"

Figure 6-11 illustrates the energy-motion trajectories in the second subsection from 6" – 20". In the second subsection, the initial spiral-like organisation of the sounding flow gives way to a spatial organisation created by stereo pairs of channels that, with the exception of channels 5 and 6, are differently grouped. For example, channel 1 is grouped with channel 2, channel 3 with channel 4, and channel 7 with channel 8. In the second subsection, new sound material is superimposed onto the diminishing resonance of sound Ia, following the new spatial organisation.

[169] When logistics render it impossible to respect the octophonic loudspeaker set up for *Ether* for concert performance an alternate loudspeaker set up, where the loudspeakers are organised in stereo pairs, is permitted (refer to Appendix 2 for details). However, the stereo pairing of loudspeakers/channels does change the spatial layout dramatically and results in a distortion of the spiral at the beginning of the work.

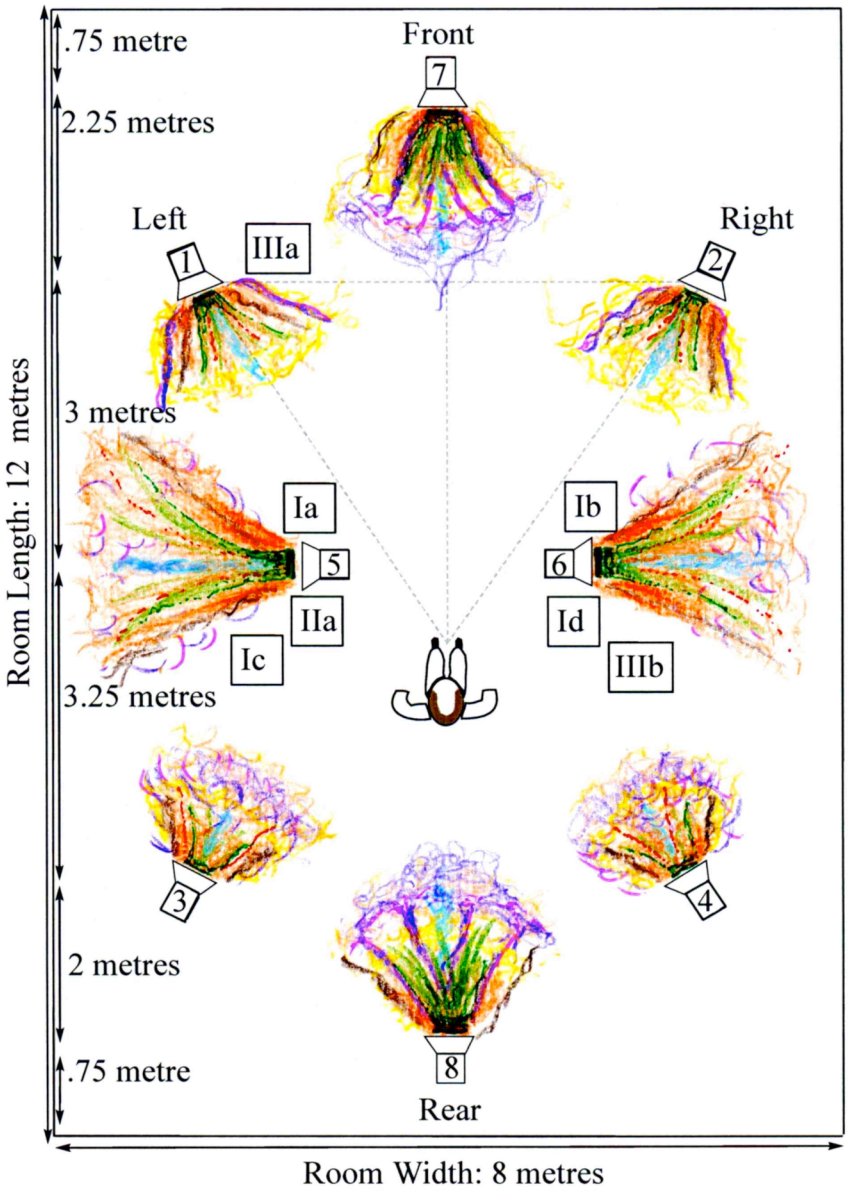


Figure 6-11. Three-dimensional space in *Ether* from 6" to 20"

The superimposition of spatial contexts is inspired by the idea that as energy radiates out from the centre it develops into two distinct types, embodied by the initial percussion/resonance. The first energy type comprises sculptured sound-shapes with a circumscribed spectral content as conveyed by the series of three pitched sounds (Ib, in light blue). The second energy type is represented by vaguely delineated morphological shapes that possess a complex and/or variable spectral content, low viscosity, and, therefore, are prone to disperse in space. It is notable that the two energy types were conceived from a three-dimensional spatial perspective, which prompted their inclusion in this discussion. The transparent, gaseous sound-shape, (IIa, in purple) represents the second energy type in the second subsection because its inherent fluidity can be perceived to outstrip its pitched quality. The dual inharmonic canopy (sound IIIa, in light and dark yellow) and the soft pedal (IIIb, in brown) also

represent the second energy type. Similar to sound Ia (in orange), the timbrally rich yet opaque percussion/resonance (Ic, in dark green) embodies both energy types – an incisive attack followed by a resonance that disperses in space. With the exception of the beginning of the rich, brassy sound (Id, in red dots), all sounds are simultaneously audible in the four stereo pairs of channels throughout this subsection, albeit with subtly different amplitude levels. In the second subsection, the sounding flow, which is almost spatially uniform, inhabits the space left by the initial percussion/resonance. This state of momentary sonic omnipresence is also intended to reflect my image of the omnipresent spatial qualities attributed to ether.

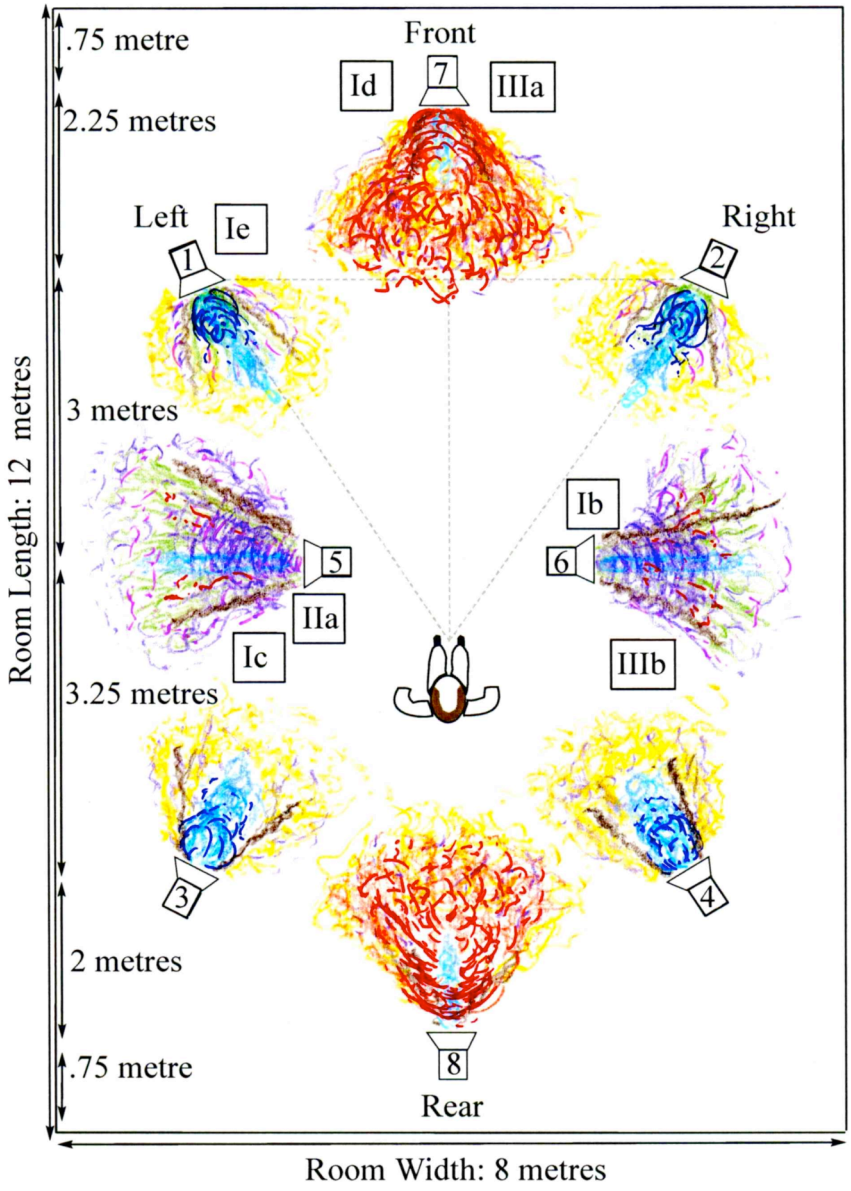


Figure 6-12. Three-dimensional space in *Ether* from 20” to 30”

(iii) Third subsection: 20" – 30"

In the absence of sound Ia in the third subsection, illustrated in Figure 6-12, other sound-shapes continue to develop as proposed by the two energy types. Additionally, in contrast to the second subsection, sound material is sometimes not simultaneously audible in all four stereo pairs. However, when it is simultaneously audible, it is more prominent in specific pairs. For example, the pitched series (Ib, in light blue) and sound Ie (in dark blue), are louder on channels 1 and 2, a situation that is repeated with sound IIa (the purple, gaseous form) on channels 5 and 6, and with sound Id (in red) on channels 7 and 8.

As previously discussed in the spectral score (Figure 6-8), the rich, brassy spectromorphology (sound Id, in red) becomes louder in the third subsection, swelling to the perceptual foreground at 24" on channels 7 and 8 (pitch F3). Sound Id exemplifies the second type of energy because, aside from its brief, billowy surge at 24", it possesses a non-delineated, fluid, morphological shape. Further, as heard within the three-dimensional spatial multichannel context, Id only seems to convey pitch at 24". The shiny, pitched spectromorphological orb, (sound Ie, in dark blue), also exemplifies the second type of energy through its morphology – which resembles an energetic surge – and its complex spectral character, which unites a mother-of-pearl type of iridescence and pitch. The embodiment of sound in the form of the second energy type also becomes more pronounced in sound material previously introduced. For example, the sustained canopy (IIIa, in light and dark yellow) surges more frequently in the third subsection, radiating 'clouds' of hiss and 'showers' of beads in space, and the low-pitched pedal (IIIb, in brown), becomes louder and begins to pulse.

(iv) Fourth subsection: 30" – 40"

As previously discussed, one of the most striking attributes of the fourth subsection, depicted by Figure 6-13, is the morphological transformation of sound IIa (in purple). Seen from the perspective of the two energy types, sound IIa evolves from the second energy type, in the form of a sustained, pitched, translucent shape, to the first energy type, in the form of a rhythmically fragmented, repeated sound-shape, which conveys the pitch G#4 in an insistent manner. Sound IIa can be perceived in its two guises during this subsection (in purple swirls and short purple lines).

As a further development to a previous trend, sound material is often not simultaneously audible in all four stereo pairs. For example, the fading resonance of sound Id (in red) is only present in channels 7 and 8, and the last trace of sound Ie (in

dark blue) is only present in channels 1 and 2. However, one of the most intriguing aspects of three-dimensional space in the fourth subsection is the existence of the two distinct types of energy simultaneously represented by sound IIa, in its initial, gaseous form, in channels 5, 6, 7 and 8, and by sound IIa in its incisive, repeated form in channels 1, 2, 3, and 4.

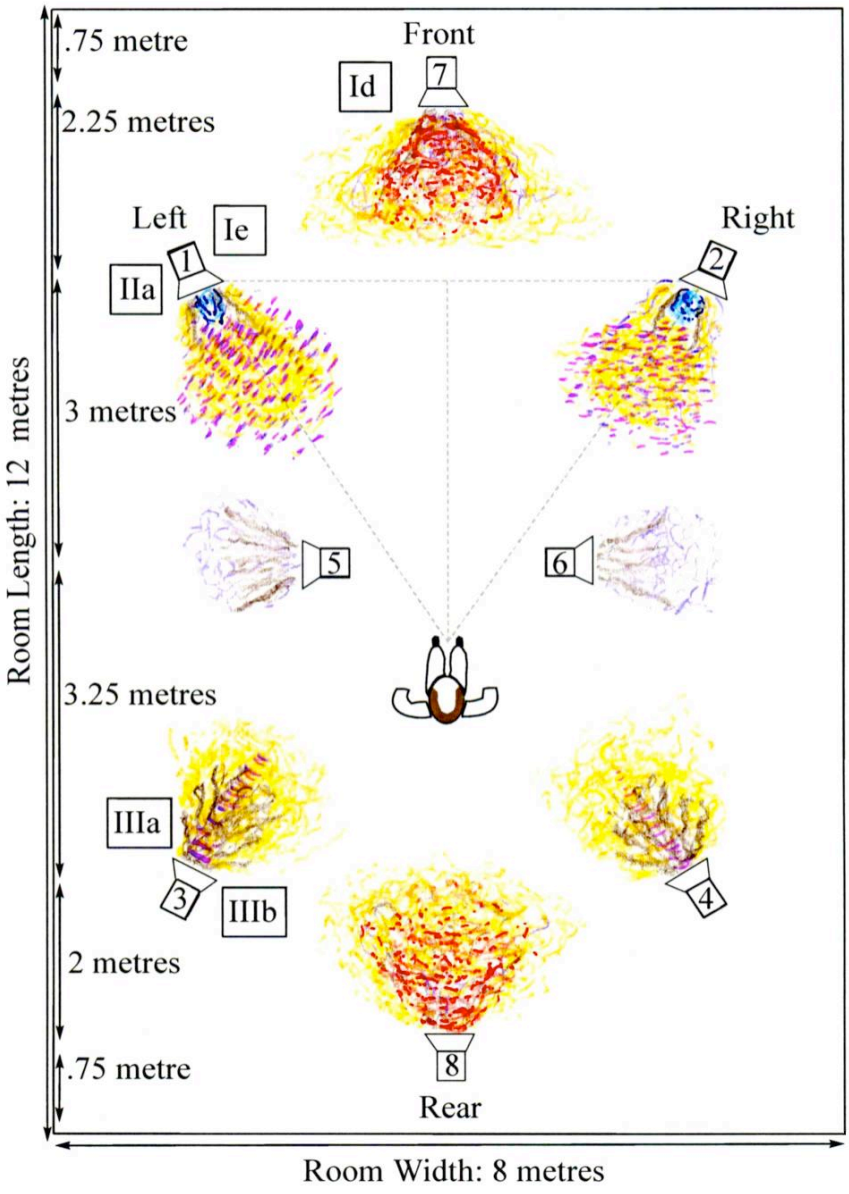


Figure 6-13. Three-dimensional space in *Ether* from 30" to 40"

(v) Fifth subsection: 40" – 50"

Figure 6-14 illustrates the energy-motion trajectories in the fifth subsection of *Ether*, from 40" to 50". In this section, the two guises of IIa (in purple swirls and short purple lines) provide a morphologically heterogeneous backdrop to the first energy type as represented by the series of five pitched sounds (If, in light green) and the hovering/cantering pitched sound-shape (IIb, in pink). The omnipresent pedal (sound

IIIb, in brown dots) and the dual canopies (IIIa, in light and dark yellow) provide a malleable, yet ongoing three-dimensional spatial frame which circumscribes sounds If and IIb in channels 1, 2, 3, and 4.

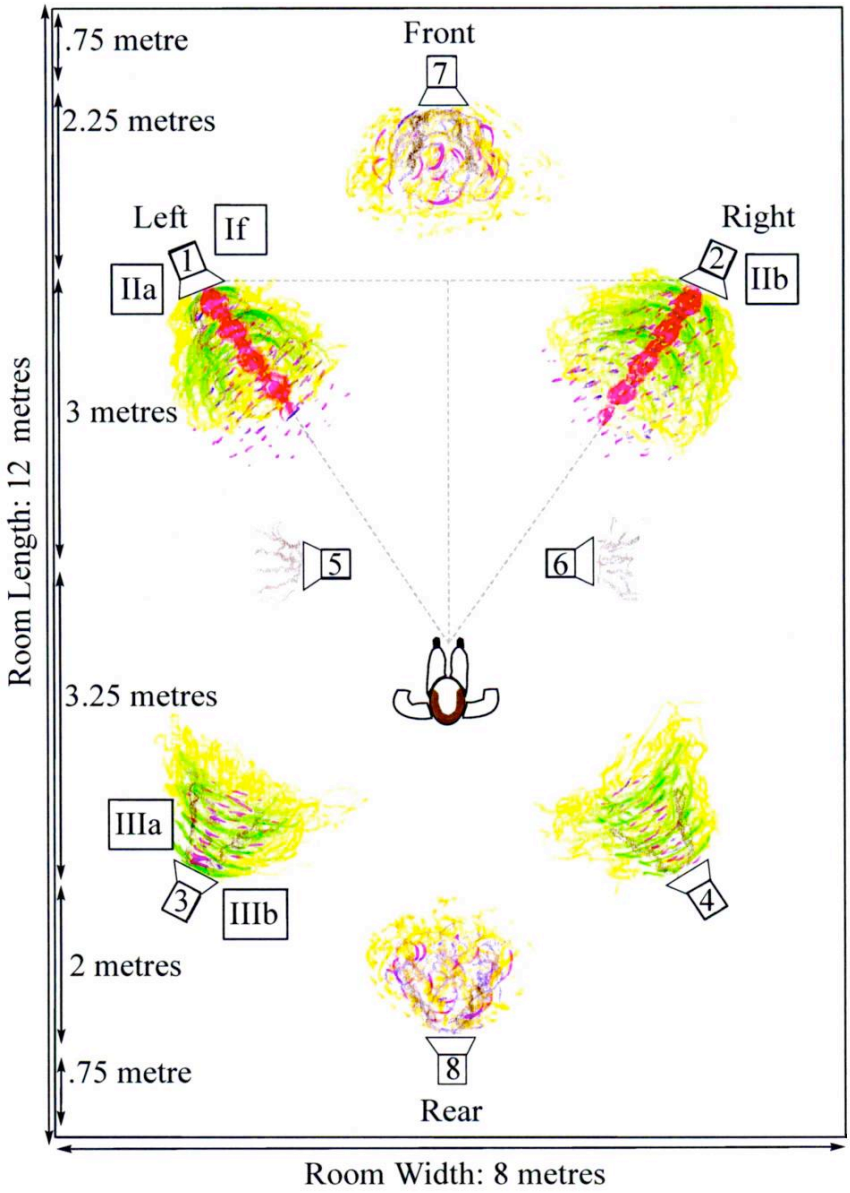


Figure 6-14. Three-dimensional space in *Ether* from 40" to 50"

(vi) Sixth subsection: 50" – 56"

In the sixth subsection, depicted by Figure 6-15, the components of the preceding sonic universe, including sound If (in light green) and sound IIb (in pink) melt away consecutively. The hovering/cantering pitched sound-shape (IIb, in pink) then recedes, and the incisive, repeated form of sound IIa (in short purple lines) finally dissolves, its sonic embers neutralised and washed away by the three-dimensional inharmonic canopy – ether.

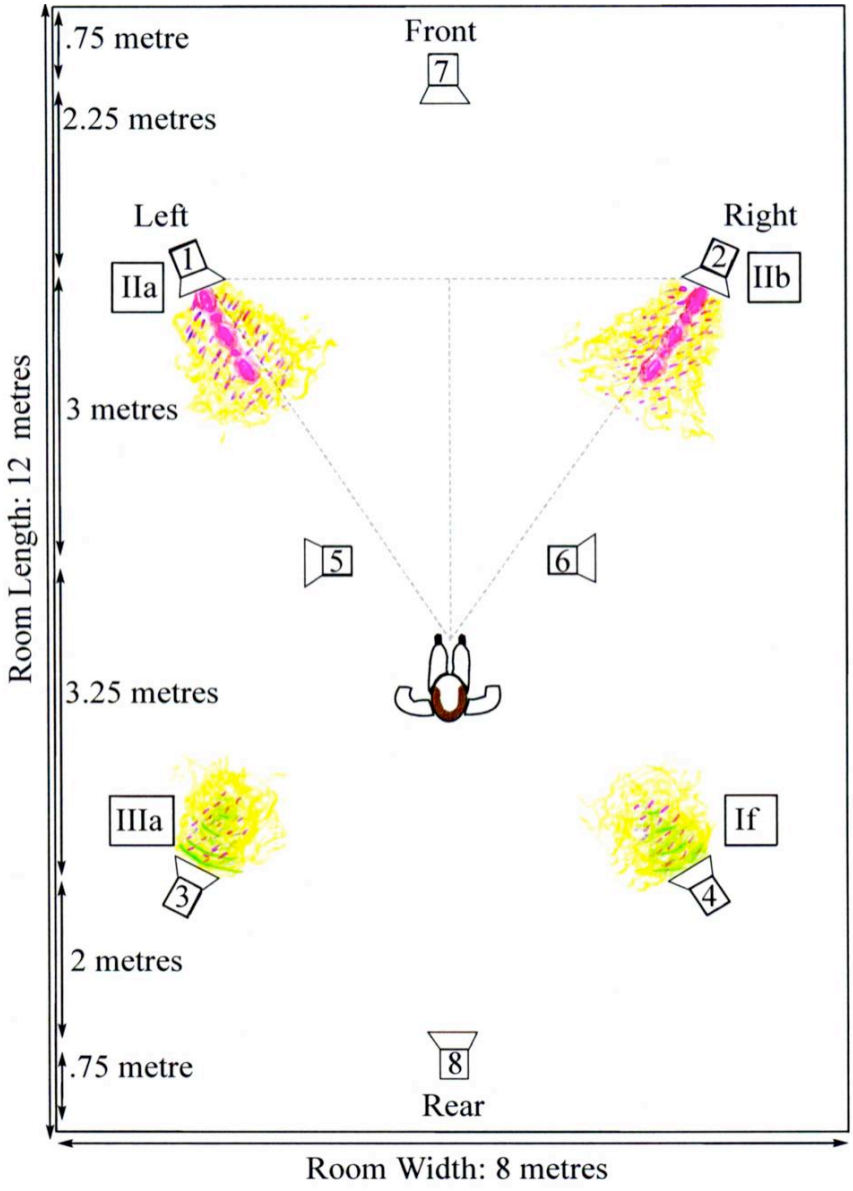


Figure 6-15. Three-dimensional space in *Ether* from 50” to 56”

Space in *Ether* from the perspective of the four reception behaviours

(i) Sonic properties

Although the spectral space in the sounding flow at the beginning of *Ether* is homogenous, the flow itself is more emphasized in certain parts of three-dimensional space than others, which gives the impression that three-dimensional space is ‘held’ and ‘directed’ by these different intensities. The pitched percussion resonance at the beginning of the work possesses an ample, internal spatial topology, and gives way to a series of harmonic relationships that are faintly orchestral. The subtle orchestral quality is imparted by sounds that convey pitches and quasi-instrumental timbres in discrete parts of spectral space, albeit over a fairly large register. However, these

sounds also possess varying degrees and types of inharmonicity and therefore, relate, organically, to the low-pitched inharmonic pedal and high-pitched, transparent canopy.

(ii) Structural attributes

While three-dimensional space is used as a structuring process throughout *Ether*, the structure at the beginning of the work is driven by an imaginary double spiral, which begins with the attack-glissando in the opening percussion/resonance and is delineated through varying intensities of the sounding flow as delivered by different stereo pairs. As the double spiral shape develops in space, the sounding flow diversifies into contrasting spectromorphologies. Some of them have incisive forms that recall the initial attack-glissando, and others, like IIa, support such sounds by creating an aura around them, as well as supporting three-dimensional space in general.

(iii) Self-orientation

The self-oriented response arises through sensation. The listener is bathed with transparent swathes of high-pitched inharmonic sounds that envelope and caress the body. However, the listener may also feel physically supported by the low pitches and rich timbres in the percussion resonances. From another perspective, the expansive register of spectral space in *Ether* can echo the Body-Mind relationship, where the dense, low-pitched pedal and percussion resonances function as the listener's solid body, and the high-pitched inharmonic sounds function as the mind.

(iv) Imaginary realms

When I listen to this first section of *Ether*, a surreal image unfolds of a vast terrestrial ecosystem supported by thousands of integrated electronic circuits that lifts off from Earth, stabilises its vertical position in the Earth's lower atmosphere and, at 40" in the piece, flings itself upwards through the higher atmosphere and into outer space.

6.5 Summary

This chapter begins with the premise that space, the common denominator in my findings from my listening experiment, contributes to the four reception behaviours, an idea I put forward in Chapter 1. However, during my examination of the role of space in the reception behaviours, I became aware that they are founded on spatial pertinences, since what the composer proposes and the listener receives is constructed through spatial vectors.

In acousmatic sound, these vectors comprise three-dimensional space and spectral space, as engendered by the materiality of the aural trace, which unfold through acoustic energy. Thus, energy and matter, the principles on which the works in the folio are constructed, offer a window of observation for spatial occupancy insofar as their internal interconnectedness and dimensions structure and claim space as part of their identity. Seen from this perspective, sounding gesture and subsequent areas of acousmatic composition can be guided and defined by spatial design as illustrated in the discussions centred on excerpts from *Chat Noir* and *Ether*, since space is governed by the subject – the composer's imaginative capacity.

Conclusion

This dissertation began with an investigation of listening strategies in electroacoustic music, founded on the methodology of a reception behaviour framework introduced in Chapter 1, a tool conceived in order to aid the composer/listener and analyst in understanding listening strategies for acousmatic music. The framework owes much to the reception behaviours developed by François Delalande, which were explored through a listening experiment carried out in 1999. I have broadened and redefined Delalande's ideas and added a new listening strategy resulting in the conception of an integrated quadripartite reception behaviours framework, where space can be considered as the common denominator in all listening strategies.

The reception behaviours framework includes an examination of the four listening strategies from the perspective of space since space is the vector through which all poietic expression and esthesis is perceived to occur. Additionally, I have used the listening strategies as a base to develop notions about acousmatic composition as well as to examine my music. Thus, poietico-esthesic discussions of spatio-temporal pertinences perceived in the works in the folio are threaded through the dissertation as seen through the compositional notions presented in the chapters Sonic Properties, Structural Attributes and Space. Through the notions presented in the chapters Self-Orientation and Imaginary Realms, I attempt to broaden and diversify Delalande's listening strategies. These wider perspectives are illustrated with examples from the works in the folio in addition to examples from the experiment, with the intention of illuminating how the composer can attempt to catalyse and steer listening strategies that appear to be self-oriented or to be founded in the imaginary. Finally, examples of the works in the folio are examined through the four listening strategies from the viewpoint of spectral and three-dimensional space. Such a perspective reveals how the composer endeavours to construct and perceive meaning in an acousmatic work, with the intention that listeners would respond to the work and construct their own, perhaps different, meanings or not.

Central to the development of my research is the scholar Tarab Tulku's concept of three interconnecting continua, Matter-Energy, Body-Mind, and Subject-Object, which form the basis of his study on the functioning of the human mind, known as 'Science of Mind', in Indo-Tibetan tradition. Through Tarab Tulku's concepts of energy and matter, as seen within the three interconnecting continua, I discovered a vocabulary to express my view of the primacy of energy in acousmatic composition.

The three interconnecting continua also provided the means to convey what I consider as the limitless capacity of the human imagination, a notion upheld by the Tibetan philosophy which posits the existence of an energy resource native to the human being that contains the potential for all forms of expression. Although the notions of energy and imagination are rarely connected, Tarab Tulku observes that the interrelatedness of energy and matter provides a way to understand the relationship between body and mind as well as between subject and object. Through the relationship between energy and matter we can observe how the mind, of which imagination is understood as an expression, can develop from the energy resource inherent in the body, energy being seen as both the basis of matter, in this case the body, and continuously pervading matter.[170]

The principles of the three interconnecting continua offer another perspective to the poietic and esthesic dimensions in acousmatic composition. For example, the notion of Subject-Object, where the subject refers to the human being and the object refers to perceptual constructions the subject makes, can be associated with Jean-Jacques Nattiez's semiological tripartition. However, in this case, Nattiez's concepts are extended into a semiological quadripartition if we accept to view the composer as (1) a subject, whose poietic effort becomes tangible through (2) the aural trace of a piece (the object conceived by the composer), which is perceived, esthesically, as (3) an aural trace (the object conceived by the listener) by (4) another subject. In this quadripartition, Nattiez's *neutral level* [171] is divided into two *different* objects that are founded on two different types of perceptions: (1) the aural trace resulting from the composer's creative process which is perceived by the composer in a unique way; and (2) the aural trace that serves as the basis for the listener's perception, which is experienced differently by each listener. The power of the thinking presented by Tarab Tulku arises from the principle that objects are assumed not to exist in and by themselves. By proposing that objects are perceptual constructions formed by the subject, the Indo-Tibetan perspective honours the unique capacities of each individual.

In the chapter Sonic Properties, I illustrate how the concept of the energy-matter continuum can support the conditions for the creation of the sounding flow in acousmatic composition through the proposed energy resource native to the human being – in this case the composer – seen as the basis for expressive potential. This basis for expressive potential can be manifested by the composer in the creation of gesture in acousmatic sound, where the distilling of energy into a tangible register

[170] (Tarab Institute, 2010).
[171] The term, neutral level, is synonymous with the term, 'trace' (Nattiez, 1990: 12).

concerns the aural trace left by the morphogenesis of gesture. Vande Gorne's energy models can be situated within the perspective of acousmatic composition as seen through the Indo-Tibetan lens, where they are invisible and endlessly malleable frames through which the composer's imaginative capacity materialises. The concept of matter is also congruent with Schaeffer's notion of sound as sonic matter, since sound spectra, which comprise the aural trace, may be perceived to have a material quality.[172] Further, through the materiality of sound spectra, the concept of matter can be related to Smalley's notion of spectromorphology.[173]

The energy-matter continuum is also a useful model for the examination of gestural forms through their corresponding aural traces, because it provides a way to *qualify* source-bondedness, transformation and synthesis. In this series of gestural categories, the evolution from matter to energy culminates with the meta-sound, a form constructed with entirely revised spectromorphological qualities, that unfolds on a vast scale. In *Neon,* the six gestural categories described in my Matter-Energy continuum (Figure 2-3) are represented by sound-shapes as distilled through the fluidity energy model.

The discussion of fluidity in *Neon* provided the opportunity to illustrate the confluence between the limitless gestural possibilities available to the composer through energy models, and the categories of aural traces as qualified through their corresponding gestural forms from the perspective of the Matter-Energy continuum. For example, from the perspective of the energy model, the source-bonded sound of a waterfall unfolds through fluidity. From the perspective of the aural trace as qualified through the Matter-Energy continuum, the composer may consider whether the dense, matter-oriented spectromorphology of the source-bonded waterfall represents a waterfall or not. The source-bonded waterfall also may be manipulated, or serve as a model for sound synthesis with the intention of representing a waterfall or other sounding and non-sounding notions of fluidity, such as mist or tide, mud or lava. These poietic possibilities reveal my enthusiasm for transforming sounds that I hear and for fabricating those I imagine to participate in the universe I choose to create. Thus, although we may associate the fluidity energy model with the source-bonded wave sound, from the viewpoint of the aural trace as seen through the Matter-Energy continuum, various expressions of fluidity (sounding and non-sounding) also can be represented through transformed, synthesised and meta-sounds. Further, as noted, source bonded sounds and their respective transformations may not be intended to

[172] (Schaeffer, 1966: 548, 556).
[173] (Smalley, 1997: 107-126).

reflect or represent the energy model through which they materialised, when placed in an acousmatic context.

This network of gestural possibilities illustrates the options available to the acousmatic composer, and explains my conception of meta-environments which pervade the works. Meta-environments comprise multiple layers of sounding gestures that operate as hyper-realities or portals for the listening imagination to shift from reality to abstraction or vice-versa.

The notion of expressive potential for gesture also extends to sound spectra insofar as they refer to the distribution of acoustic energy as a function of frequency within the aural trace. Since sound spectra are essential to the tangibility of the aural trace, they may be perceived to have a material quality. Whereas Schaeffer addressed materiality through his notion of grain, I have chosen to regard materiality as microstructure in the form of tactility that can be viewed on a continuum, the extremes of which address smooth or granular types of microstructure. Because microstructure is inherent in sound spectra, I devised a second continuum where sound spectra are addressed from the perspective of harmonicity or noise. The interconnectivity of sound spectra and tactility are illustrated in the eight sound worlds represented in Figures 2-5 – 2-12, where we can see that harmonicity is not allied, systematically, to the quality of smoothness, and inharmonicity and noise are not inexorably linked to granularity. The wide variety of existing spectral and microstructural combinations, which may not be perceived to the same extent within each sound, can inspire the acousmatic composer to address spectral content and tactility independently and in different ways, thereby probing the expressive capacity of these two elements. The transformation of the source recording of bells from the Church of the Holy Sepulchre in Jerusalem illustrates this separation of transformational processes. The recording was slowed and filtered in stages, resulting in a sound-shape comprising low-pitched harmonic spectra that have an unalloyed, velvety fibre, which tumbles forward with greater power and scope in *Les Forges de l'Invisible* than in the original recording.

From the viewpoint of spectral content, inharmonicity and noise can have great expressive power either through their relationship with harmonic spectra or as ends in themselves. This interconnectivity offers the acousmatic composer an approach to supercede the perceptual dominance or exclusivity often associated with harmonic spectra, where they can be considered as part of a broader vista in which inharmonicity and noise are honoured to an equal degree. Further, by embracing inharmonicity and noise, the acousmatic composer infuses the sounding flow with spectral forms associated with 'life' – since these forms appear around us in civilisation and nature, as

well as in ourselves – thereby creating a situation that expands the concept of art, and in return, may open the listener to experience the world in another way.

In the chapter Sonic Properties, I suggested that the unfolding of energy into a tangible level concerns the aural trace left by the morphogenesis of gesture, a process that is governed by the subject – the composer's imaginative capacity, imagination being understood as an expression of the mind. In the chapter Structural Attributes, energy can be seen to pervade and enable *all* structuring processes. From the perspective of structure, the trace, as distilled from a single gesture, can be regarded as the smallest integral building block and expressive element. The chapter thus opens with a discussion of small-scale gesture as seen through energy models. For example, the fluidity energy model serves as a paradigm for my conception of swells, the extreme elasticity of which serves not only a wide range of structural functions, but also renders swells capable of sustaining metaphorical construction, as occurs in the first movement of *Les Forges de l'Invisible*. Swirls and rotations can fulfil the same function as swells. However, as apprehended in *Neon*, the three-dimensionality often found in a swirl or rotation allows it to mediate in a figure/ground relationship in addition to any structural function offered by its trajectory across the stereo axis.

As illustrated in the Matter-Energy continuum (Figure 2-2), the aural trace does not only refer to the entity distilled through the morphogenesis of gesture in the form of a source sound. It also can refer to the trace produced by reshaped and composite gestures, the trace as distilled into incomplete and distorted sounds, or the complex meta-sound, amongst others. Further, energy can be considered to play a second role in many structuring processes, as illustrated in the discussion regarding reshaped sounds. For example, when a composer redesigns spectromorphological properties comprehensively in a sound, a technique frequently employed in *Protopia/Tesseract,* the composer's poietic knowledge of the connection between the source-bonded and reshaped sounds can function as a binding element. This is due to the organic nature of the relationship between a sound and its reworked counterpart, which is founded on energetic similitude, and can influence the composer's intentions. This relationship can affect the listener's esthesic reception subliminally particularly when the type of energy the listener brings to the listening act is compatible with the intention of the composer. Since the common denominator between sound-shapes is energetic similitude, the listener may perceive the organic connection without being fully conscious thereof.

In incomplete and distorted sounds, the notion of imperfection is seen as a welcome and valuable structuring process on three registers. On an overt structural register, these sounds can enhance and steer the sounding flow, punctuate it, and add

semantic interest. On a second register, because the departure from an expected trajectory or behaviour exceeds the perceptual threshold of normality, the listening consciousness can shift the sound from the realm of the 'known' to one of the 'unknown'. The listening consciousness, as proposed by Leonard Meyer, is drawn to the concept of expectation by denying it.[174] Through the denial of expectancy, incomplete and distorted sounds allow the listening consciousness to construct psychological space and enable the mind to imagine and experience emotion. On a third register, by embracing the idea of the 'imperfect' as an integral part of a piece, we employ a necessary component for artistic construction. Imperfection usually resides on the opposite side of the concept of beauty, both of which are balanced by the fulcrum of human consciousness.

Time's function as a structuring process relies on the capacity of spectromorphological energy to drive the sounding flow. Different types of forward-moving sound-shapes can combine to impart linear time, which produces temporal impetus in a larger sonic context in the same way that different types of repetitive sound-shapes can combine to impart vertical or suspended time. As illustrated in *Les Forges de l'Invisible* and *Protopia/Tesseract*, I frequently superpose linear and vertical sonic contexts to create an elastic temporal flow that can be accentuated, enabled, hindered, or arrested.

Energy pervades other large-scale sonic contexts in my works, notably figure-ground constructions, thereby shaping the structuring processes by distilling energy into matter, and vice versa. Figure-ground relationships can mediate between the foreground and the background of a sounding flow. For instance, background material can re-distil into energy – since energy is seen to pervade matter – and push, nudge, or fling sounds into the foreground. Conversely, foreground material can develop and mask the background. Further, rotations, which have an inherent three-dimensionality, can mediate between figures and grounds. As exemplified by the meta-rotation in *Neon* at 4'30", this type of large-scale sound-shape can make contact with a ground and thrust it to the fore. Figure-ground relationships can also be engendered by sonic webs, sheer swathes or woven filigrees of transparent and/or translucent sound materials, that are often somewhat pitched and sit on the fulcrum between figures and grounds where they can 'reach out' toward a figure or 'stretch' back into a ground. Finally, the absence or attenuation of energy can be seen as a structuring process too, as perceived through silence, stasis-points and inactivity, voids and omission.

[174] (Meyer, 1956: 14).

In the chapters, Self-Orientation and Imaginary Realms, I develop Delalande's concepts of empathy and figurativisation, illustrated with examples from my experimental findings as well as in poietico-esthesic discussions about the works. As we have seen, self-orientation is a reception behaviour where listeners focus perception inwards as opposed to referring outwards to sonic properties or structural attributes. Listeners engage their own emotional and physiological responses to the sounding flow. These reactions are classified as physiological sensation or emotion. Self-orientation also refers to more neutral observations listeners can make about their own personal reactions such as contemplation or intellectual reflection, which I consider to be evaluation. In suggesting alternatives to the overtly reflexive relationships listeners create between their perceptions of the sounds and themselves, I attempt to broaden the concept of the self-oriented listening strategy.

In order to understand how meaning arises in a self-oriented behaviour, I conceived the notion of perceptual vectors: evocation, the transfer of function, the transfer of behaviour and the transfer of meaning. The vectors act as mental tunnels that can steer the nature of developing significance. They can engender first-level 'extrinsic' topics, notably listeners' thoughts and perceptions involving physiological sensations and emotions. The vectors can also engender second-level 'extrinsic' topics, experienced as external to the self and the piece. I suggest the reason behind the listener's use of perceptual vectors resides in the human need to make sense of a piece. Further, as discussed, all perceptions take a form as they unfold, before they materialise into a final precise object, whether the perception unfolds through a perceptual vector or not.

The purpose of the chapter Imaginary Realms is to probe the imagination in order to illuminate possible manifestations of imagination during the poietic and esthesic processes. The reception behaviour *imaginary realms* owes much to Delalande's figurativisation, but does not rely on the contrast between sonic configurations linked to the living being and other configurations that have a contextual function. A poietico-esthesic analysis of the works in the folio and the findings from my listening experiment contributed to the foundation for the reception behaviour imaginary realms which includes listening strategies in addition to figurativisation, where the listener can exercise imagination as an end in itself. These comprise fiction, fantasy and surrealism. Of considerable importance to imaginary realms is Bachelard's notion of imagination, which he considers as the dynamic force that deforms

commonly agreed-upon objects furnished through perception.[175] By suggesting that our sensitivity mediates between perceptions and dreams, Bachelard's notion correlates with the Indo-Tibetan perspective that highlights the unique capacities of each individual.

Ideas for chapter 6, Space, arose from two sources: (1) an analysis of the findings from my listening experiment, where space, the sole common denominator in all four listening strategies, is omnipresent in perceptual constructions; and (2) my personal sensitivity to the pervasiveness of space, which is grounded in an interest in the relationship between the physical universe and the human being, and which slowly evolved to become a major force behind my work. The discussion on space begins with a reference to the energy-matter continuum, since energy and matter are deployed in space and, conversely, space becomes tangible through energy and matter. In acousmatic composition, space can be considered as enabling all sounding gesture. Further, spatial design can lead and define all structural forms.

In conceiving the reception behaviour framework, I hope to have offered the composer/listener and analyst a tool to understand listening strategies for acousmatic music. However, the framework also reveals how the acousmatic composer attempts to create and perceive meaning in a work, as illustrated by the poietico-esthesic discussions of the accompanying compositions.

[175] (Bachelard in Durand in Bayle, 2003: 82).

Appendix 1

Pre-doctoral Experience

After a liberal arts education at Gettysburg College (Gettysburg, Pennsylvania), which culminated with a Bachelor of Arts in Music in 1982, and a Master of Music in composition in 1987 from the Peabody Conservatory of Music (Baltimore, Maryland) I travelled to Brussels, Belgium in 1987 to study instrumental composition with Jacqueline Fontyn at the *Conservatoire de Musique de Bruxelles.*

The 1990s were formative years during which I explored instrumental, electronic and electroacoustic music composition in the Dutch- and French-speaking communities in Belgium. The aesthetic of electronic music composition at the *Koninklijk Vlaams Muziekconservatorium* in Antwerp was oriented to the Cologne school of electronic music, and hence, through Joris de Laet, I learned to compose parametric music, where all musical parameters of a piece are pre-calculated through computer programming. Eighty kilometres south, the aesthetic of the *Conservatoire de Musique de Mons* was anchored in the Schaefferian tradition as conveyed by Annette Vande Gorne.

The exposure to diverse cultures and experiences during my youth and liberal arts education was pivotal to my development as a composer of music on a supportive medium. However, navigating between northern and southern European culture during the first part of the 1990s, as proposed through the divergent aesthetics of electronic and electroacoustic music, gave me added experience in dealing with opposites, a theme that would later arise in my doctoral research.

Appendix 2

Programme Notes to Accompany Compositions/ Loudspeaker Placement Schemes for Multichannel Works and Multichannel Sound Examples

(In Chronological Order)

Chat Noir .....10'06"

Electroacoustic work in stereo
1998 – 1999

Chat Noir is the second work in a cycle of works that are based on the book *Owning Your Own Shadow – Understanding the Dark Side of the Psyche* by Robert A. Johnson. *Chat Noir* explores the paradox of opposition in the psychological reality of mankind in particular the shadow-making process in a young human being.

Being that the civilizing process culls out characteristics that are dangerous to the smooth functioning of our ideas, the shadow becomes that which has not entered adequately into consciousness. It is the despised quarter of our being that is pushed to the bottom of the spiritual pool. We divide the self into an ego and the shadow because (Western) culture insists that we behave in a particular manner.

Chat Noir explores this shadow. It is a scherzo. The human being assimilates its own contradictions of the soul presented here in the form of a game which the young being learns as he plays. However, the socializing process is at work here. At every game, a 'right' and 'wrong' are established, thus sewing the seeds for internal conflict. The shadow roars up in the musical form as 'knots', moments of great tension, which predictably, or sometimes suddenly, appear.

Running counter to the image of the young being and its turbulent development is the counterweight of a small being – like a cat – whose presentation in the piece is parallel to that of the human. This figure represents the ego in us, the pure shadow. It does not develop or become cultivated; its personality is limpid. The presence of this small character in the piece is important as it demonstrates the existence of the 'pure gold' part of our personality which is often relegated to the shadow because it can find no place in that great levelling process that is culture.

Much of the sound material for *Chat Noir* was composed in the studios at *Groupe de Musique Expérimentale de Marseille*. Parts of this piece were mixed in the studios at City University London and also at the studio *Métamorphoses d' Orphée* at *Musiques & Recherches*, in Ohain, Belgium. The final mix was done in the composer's studio.

Chat Noir was a finalist work in the 2001 ASCAP / SEAMUS Student Composition Competition. The work was created with the support of the *Ministère de la Communauté française Wallonie-Bruxelles*, and is recorded onto the compact disc *Musiques Acousmatiques Belges-Génération 2000.*

Neon ….....10’04”

Electroacoustic work in stereo
2001

Neon is the third and final piece in a cycle of works that are based on the book *Owning your own shadow – Understanding the dark side of the psyche* by Robert A. Johnson. One of the ideas examined by Johnson explores the place in human consciousness where light and dark touch, the edge where miracles occur.

In *Neon*, the microcosm of human consciousness is elevated to an environmental scale. The creation of the divine thus takes shape in the exterior world when opposites touch, such as matter / antimatter, illumination / darkness, searing heat / glacial cold. The discourse of the piece concerns itself with the sonorisation of these ideas which are constructed to work together to impart this central theme: the elevation of a microcosm of non-sounding phenomena, consisting of contrasted thoughts and feelings we experience in the human consciousness to a macrocosm that is incarnated, and whose opposing forces are reconciled, through simultaneous strata of acousmatic sound.

Human presence manifests itself in this sonic vista by way of a series of high-pitched sounds. These occur throughout the piece as iterations, sustained tones, those with a melodic profile or those encased in a more complex harmonic structure. Concretely, these sounds at once striate the work and bind it together. Symbolically, this material functions as the bright light of human consciousness.

Much of the sound material for *Neon* was composed in the studios at *Groupe de Musique Expérimentale de Marseille*. Parts of this piece were mixed in the studios at City University London. The final mix was completed in the composer’s studio in Brussels.

Neon received an honourable mention at the IV International Electroacoustic Music Contest of Sao Paulo in 2001 and was, additionally, a selected work in the V International Contemporary Music Contest *Città di Udine* (Italy) in 2004. *Neon* is recorded onto the compact disc *Contemporanea Mikrokosmos 2004.*

Ether …….....13’41”

Octophonic electroacoustic work
2001

The frame for *Ether* initially consists of a vast, empty space. Energy, which appears in the form of sound, springs from the centre of the space and spirals outwards in opposite directions. As the energy radiates it develops into two distinct types. The first energy type is more articulated. It is characterised by a family of sounds where the morphologies, which also comprise differing factors of transparency, are sculpted and are often directional. The second type is of a resonant variety and is represented in the piece by sonic material that has vaguely delineated morphological shapes. In addition, each of these sounds has a separate factor of transparency that can range from the opaque to the diaphanous.

Once established, the piece concerns itself with the propagation of a series of superimposed spaces the dimensions of which, while often initially tethered by the more articulated energies, are frequently inhabited by energies that are more resonant. The different factors of transparency attached to the sounds help to define, sustain, expand, or contract the spaces in which these sounds are placed. The interplay between the highly transformed and quasi-recognisable sounds, both types of which can be found in the two energy groups is, in addition, a deliberate attempt to provoke the listener’s imagination.

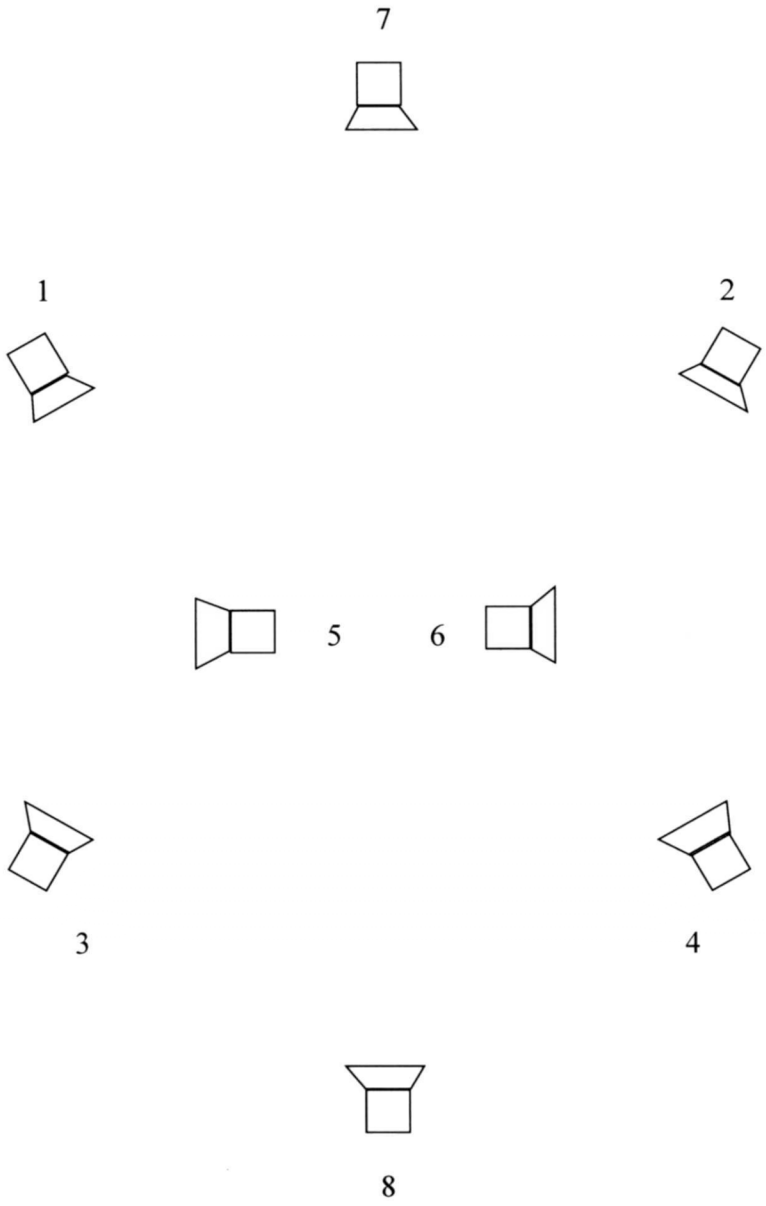
Some of the sound material for *Ether* was created during a residency at the *Centre de Création Musicale Iannis Xenakis* in Paris with the support of *Le service de coopération et d’action culturelle de l’ambassade de France en Belgique*. Other sound material came from recordings made in the old city of Jerusalem during a trip to Israel. I am also grateful to Thomas Gardner for providing me with opportunities to record his playing of the violoncello, the recordings of which also served as a base for sound material.

Ether was a commission from *Musiques & Recherches*, Ohain, Belgium. It was composed in the studio *Métamorphoses d’Orphée* at *Musiques & Recherches*, in the studios at City University London, and in the studio *Akousma* at the *Académie de Musique de Soignies,* Belgium. *Ether* was selected at the International Tribune of Electroacoustic Music in 2002.

Ether is dedicated to the victims of the attacks that were committed on September 11, 2001.

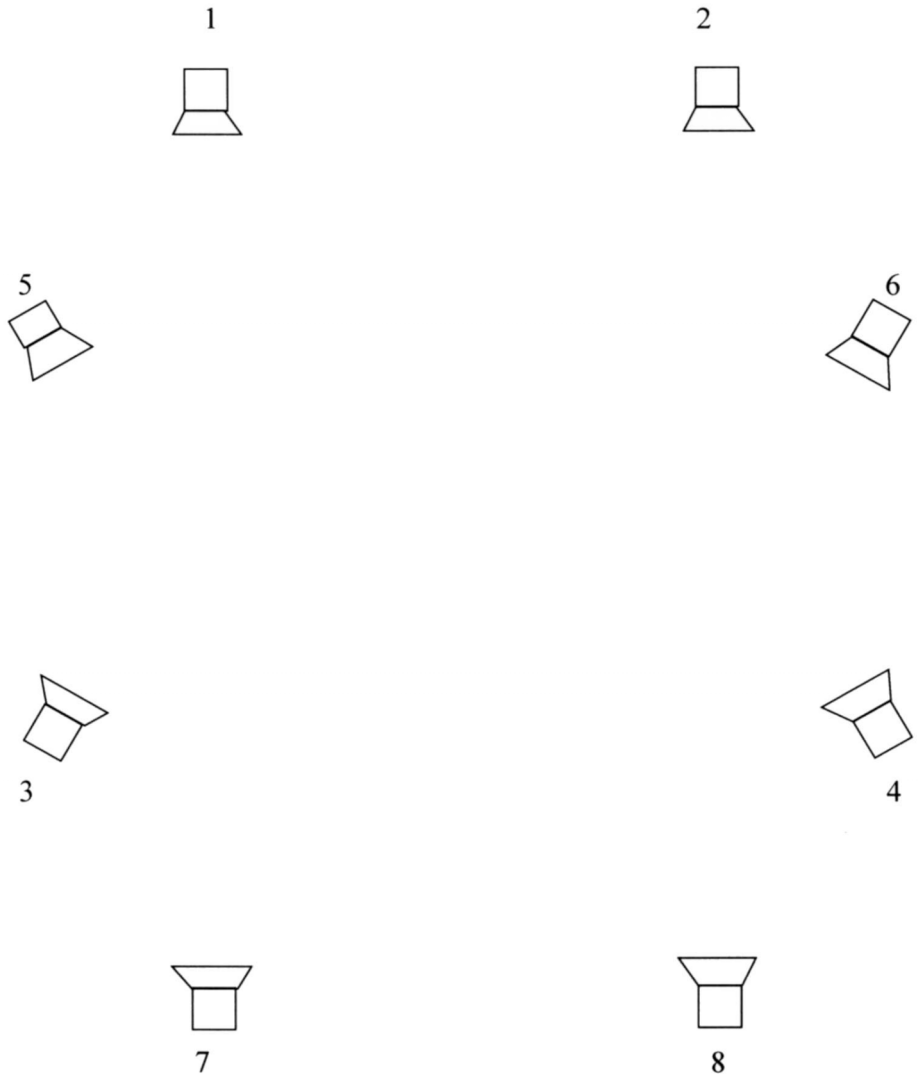
SPEAKER PLACEMENT FOR *ETHER*,
OCTOPHONIC ELECTROACOUSTIC WORK, 2001
Elizabeth Anderson

(the loudspeaker number corresponds to the channel number)



ALTERNATIVE SPEAKER PLACEMENT FOR *ETHER*,
OCTOPHONIC ELECTROACOUSTIC WORK, 2001
Elizabeth Anderson

(the loudspeaker number corresponds to the channel number)



176

[176] As previously noted, this alternate loudspeaker set up is permitted when logistics render it impossible to respect the octophonic loudspeaker set up for *Ether* for concert performance, a situation I have encountered on several occasions. However, because the stereo pairing of loudspeakers/channels does change the spatial layout dramatically, resulting in a distortion of the spiral at the beginning of the work, this setup should be used as a last resort.

Les Forges de l'Invisible ….....14'

Octophonic electroacoustic work in two movements
2003 – 2004

Les Forges de l'Invisible is inspired by the spirit of the 18th-Century English poet, engraver, and visionary, William Blake who often wrote of the indestructibility of innocence, the necessity of seizing life and the awakening of the imagination. Many instances of dual imagery also can be found in Blake's poetry. Among the examples in his poem, *The Tyger*, are the twin instincts of destruction and creation, the former a necessary prelude to the latter.

I was immediately struck by Blake's philosophy, in particular with the place he accorded to the concepts of imagination and duality. From this came the idea of transposing these notions onto the electroacoustic canvas, which, in its endless malleability, is ideally suited to their transmission. In the first movement the listener is invited to promenade through a world of almost entirely transformed sounds that alternate between diaphanous webs and moments of almost violent force. The second movement centres on the concept of the forge and the duality inherent to its function: melt down in order to reconstruct.

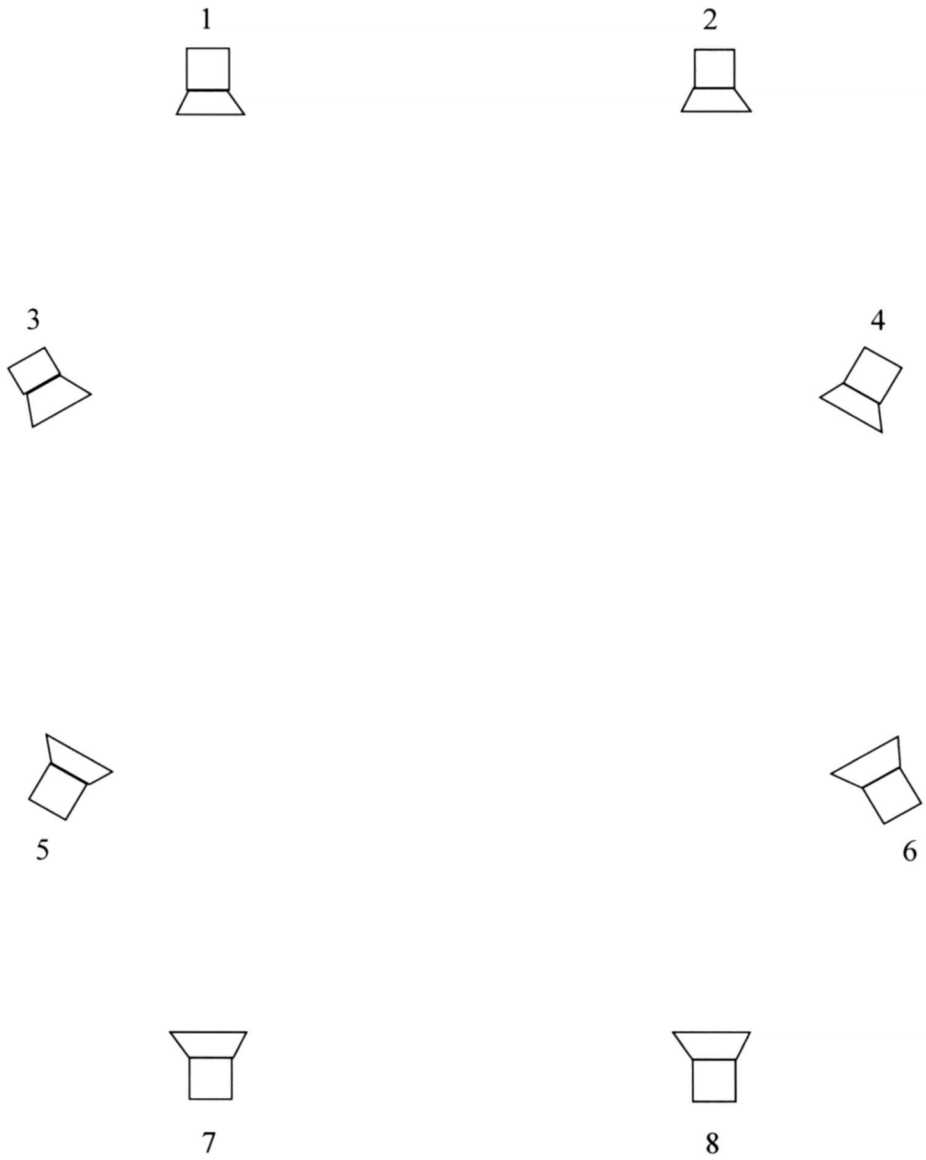
Some of the sounds for *Les Forges de l'Invisible* were created during a residency at the *Centre de Création Musicale Iannis Xenakis* in Paris with the support of *Le service de coopération et d'action culturelle de l'ambassade de France en Belgique*. I am also grateful to Thomas Gardner for providing me with opportunities to record his playing of the violoncello. These recordings served as an additional base for sound exploration.

The sound material was developed in the composer's personal studio in Brussels, Belgium. The octophonic mix was completed in the studios at City University London and in the studio *Akousma* at the *Académie de Musique de Soignies*, Belgium.

Les Forges de l'Invisible received an honorable mention in the V International Electroacoustic Music Contest of Sao Paulo in 2003 and, additionally, the First Prize and the Audience Prize in the *Concours International de Composition Acousmatique Métamorphoses 2004*. *Les Forges de l'Invisible* is recorded onto the compact discs Sonicity and *Métamorphoses 2004*.

SPEAKER PLACEMENT FOR *LES FORGES DE L'INVISIBLE*,
OCTOPHONIC ELECTROACOUSTIC WORK, 2003
Elizabeth Anderson

(the loudspeaker number corresponds to the channel number)



Protopia/Tesseract …..……..……...……....13’49”

Octophonic electroacoustic work in two movements
2005 – 2007

Protopia is a combination of two Greek terms, ‘*proto’*, (original) and *‘topos’* (place). Its construction echoes that of Utopia, a term coined by the sixteenth century author Thomas More. In geometry, the tesseract, derived from the Greek τεσσερες ακτινες (four rays), refers to the four-dimensional analogue of the three-dimensional cube, where motion along the fourth dimension frequently delineates bounded transformations of the cube through time. The relationship between the *tesseract* and the cube is identical to that between the cube and the square.

The initial idea for the acousmatic work, *Protopia/Tesseract,* was inspired by a literary interpretation of the tesseract, defined in the children’s fantasy novel *A Wrinkle in Time* by Madeleine L’Engle as a concept where intergalactic travel is made possible through spatio-temporal compression. *Protopia/Tesseract* explores the link between spatio-temporal contrast and evolution engendered by the multichannel electroacoustic medium, and various images of fantasy that can come to a reader’s mind. The work opens with contrasting sounds, each with its own temporal thrust. At the outset, the sound material, which has a cloistered quality, is placed in intertwined virtual spaces. However, despite the intertwined spatial attributes, the form of the first movement is decidedly linear. During the second movement, the sound world evolves towards a glossy and lush spectral landscape, after which part of the sound material begins to spin in clockwise and counter clockwise rotations. These increase in speed and intensity, and attempt to call to mind the compression of space and time.

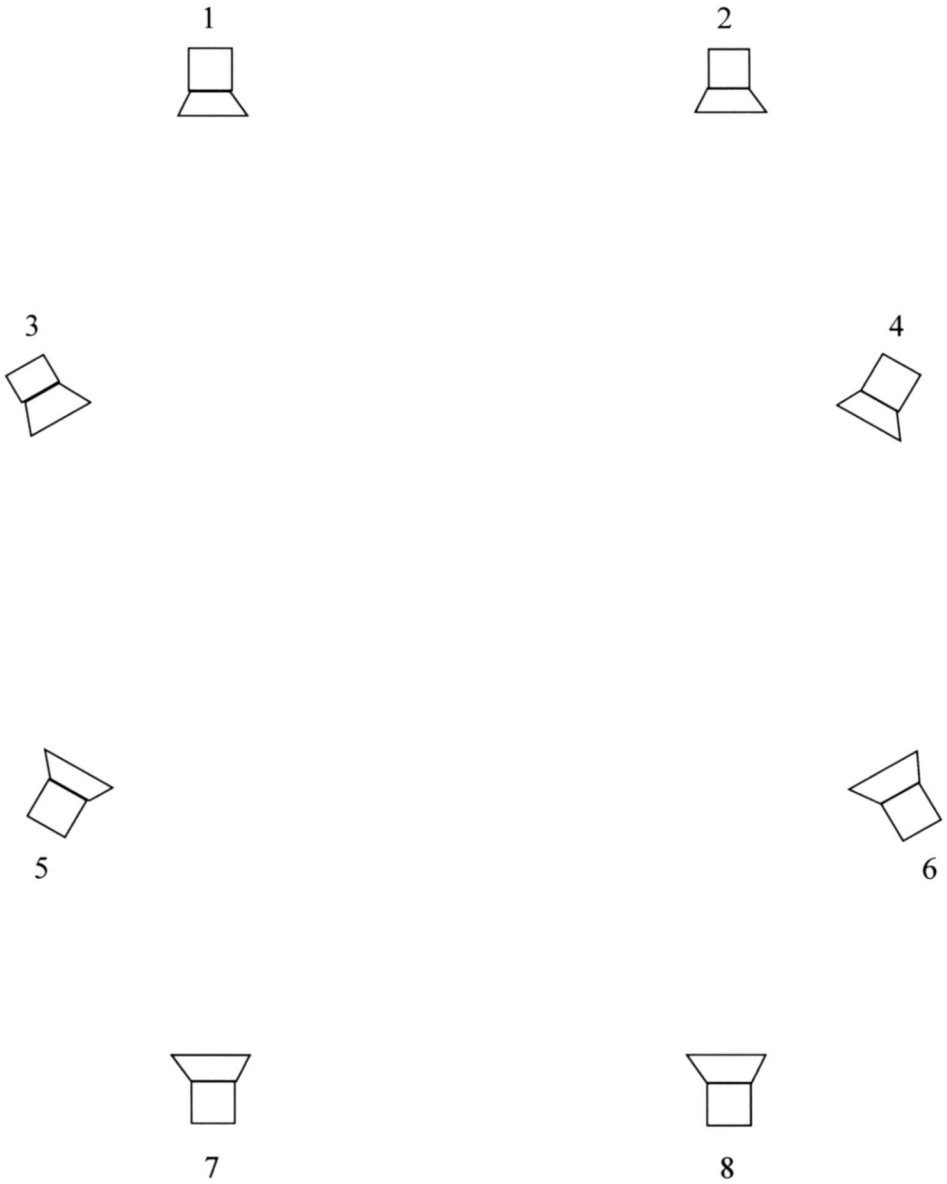
Protopia/Tesseract was composed in the framework of my doctoral studies at City University London. Much of the sound material was created during a residency at the *Centre de Création Musicale Iannis Xenakis* in Paris with the support of *Le service de coopération et d’action culturelle de l’ambassade de France en Belgique.* The work was composed in the multichannel electroacoustic studio at City University, the studio *Métamorphoses d’Orphée* at *Musiques & Recherches* in Ohain, Belgium, and the Studio *Akousma* in the *Académie de Musique de Soignies*, Belgium. I am grateful to Annette Vande Gorne and Jean-Louis Poliart for having opened their institutions to me. This work is dedicated to them.

Protopia/Tesseract received the first prize at the Musica Nova electroacoustic composition competition in Prague in 2008, and an honourable mention in the VII International Electroacoustic Music Contest of Sao Paulo in 2007. *Protopia/Tesseract* was realized with the assistance of the *Communauté française: Direction Générale de la Culture, Service de la Musique* in Brussels, Belgium.

The work is recorded on the compact disc ‘Electro AC’, produced by the agency *Wallonie-Bruxelles Musiques*, under the auspices of *Wallonie-Bruxelles International* and the *Ministère de la Communauté française Wallonie-Bruxelles.*

SPEAKER PLACEMENT FOR *PROTOPIA/TESSERACT*,
OCTOPHONIC ELECTROACOUSTIC WORK, 2007
Elizabeth Anderson

(the loudspeaker number corresponds to the channel number)



L'éveil …….....10'10"

Electroacoustic work in stereo
1997
(Pre-doctoral work included for reference)

L' éveil is the first work in a cycle that explores the paradox of opposition in the sense of physical appearance as well as in the psychological reality of mankind. The piece concerns itself with the creation of the universe and its two poles: matter/antimatter, illumination/darkness, and searing heat/glacial cold. Paradoxically, in this silent and hostile universe the human being awakens and, in the image of its environment, assimilates its own contradictions such as the light and the shadow of the soul, which are balanced delicately on the fulcrum of the conscience.

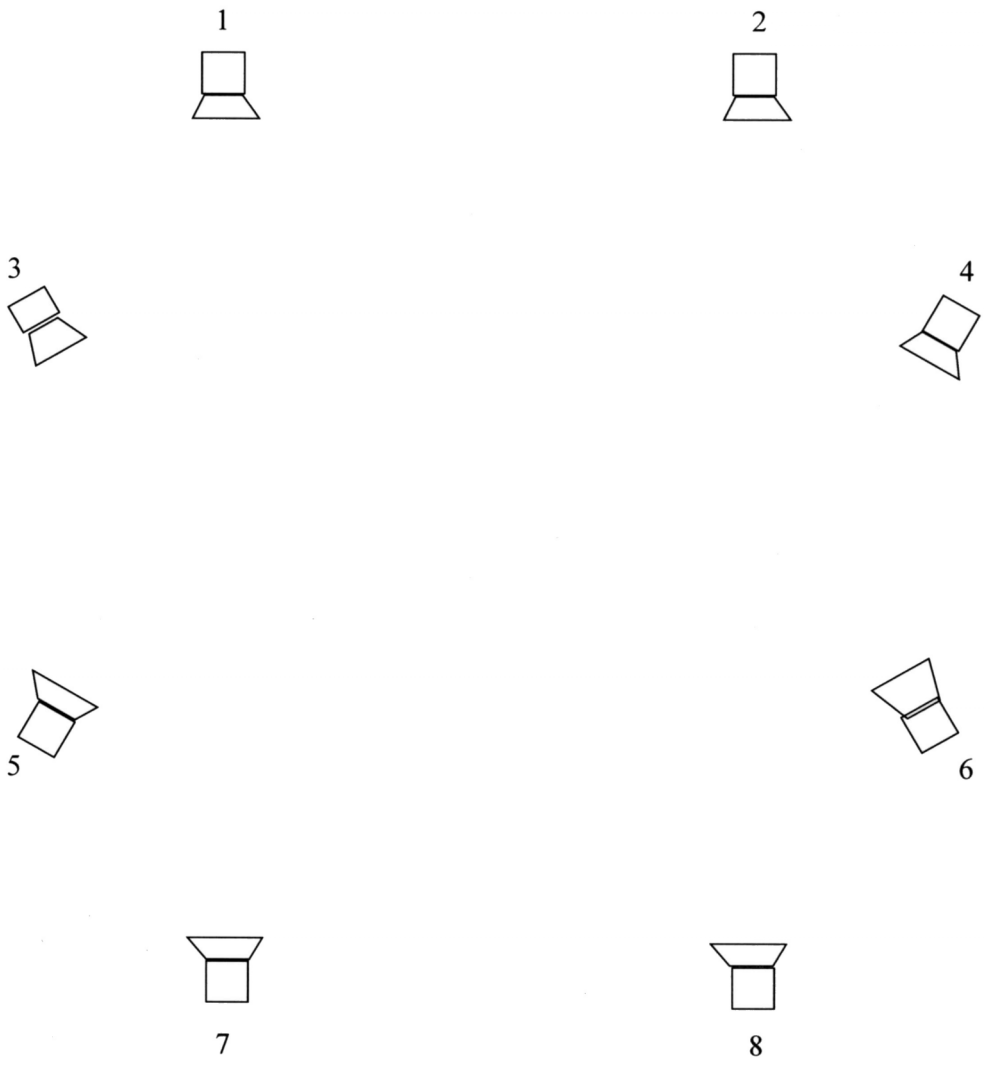
L'éveil begins with a low, sustained, pitched sound. This initial event is followed by a scalar passage that introduces a high, sustained pitched sound. The resulting static atmosphere is interrupted by short but powerful fragments which explore the intermediary register between the two initial sonic poles. The low sustained sound dies away after the first of the incrustations. Several moments after the second incrustation the high pitched sound yields to a frenetic and sensual dance.

The idea of contrasts presented in the introduction develops on a larger scale: slow and relatively peaceful sections are alternated with highly charged, tense sections, low-pitched sounds are confronted with high-pitched ones and rough textures alternate with smooth material. These contrasts draw their inspiration from reality itself where the meeting of opposites creates a fascinating frame for the creation of life and art in the vast universe as well as in man's consciousness.

L'éveil was composed at the studio of *Musiques & Recherches*, Ohain, Belgium. *L'éveil* received the Audience Prize in the *5e Prix International Noroit – Léonce Petitot 1997* for acousmatic composition (Arras, France). The work is recorded onto the compact disc, *5e Prix International Noroit – Léonce Petitot 1997*.

SPEAKER PLACEMENT FOR MULTICHANNEL
SOUND EXAMPLES FOR DISSERTATION, 2011

(The loudspeaker number corresponds to the channel number)



Appendix 3

Computer Tools Used for Composition

Certain sound material was created separately on the SYTER (*SYstème TEmps Réel)* and UPIC platforms. Different Macintosh platforms were used, over time, to compose the pieces in the folio:

Power Macintosh 7300/200

- *Protools 4.1.1 (with an Audiomedia III sound card) by Digidesign* – The sixteen channel digital mixing was used to compose *Chat Noir*, *Neon*, and the premixes for *Ether.*

- *Sound Designer II by Digidesign* – Editing processes were used in *Chat Noir*, *Neon*, *Ether,* and *Les Forges de l'Invisible.*

- *GRM Tools 2.0 (VST)* – The spatialisation, filtration, freeze, and fragmentation transformation processes were used in *Chat Noir*, *Neon*, *Ether,* and *Les Forges de l'Invisible.*

- *Hyperprism 1.2.1, by Arboretum Systems* – The filtering, pitch change, fragmentation, and spatialisation transformation processes were used in *Chat Noir*, *Neon*, *Ether,* and *Les Forges de l'Invisible.*

- *Turbosynth* – Sound synthesis was used in *Chat Noir*.

- *Metasynth 2.5, by Arboretum Systems* – Sound sculpting transformation processes were used in *Neon*, *Ether, Les Forges de l'Invisible* and *Protopia/Tesseract.*

- *WavesSystem, by Waves* – The equalisation, filtration, and spatialisation transformation processes were used in *Neon*, *Ether,* and *Les Forges de l'Invisible.*

- *Sound Maker 1.03 by Micromat* – The filtering, pitch shift, spatialisation, and convolution transformation processes were used in *Ether, Les Forges de l'Invisible* and *Protopia/Tesseract.*

- *SampleCell by Digidesign* – The sound sampling and transposition possibilities were used in *Chat Noir* and *Neon*.

Macintosh G3

- *Protools 4.3 (with an Audiomedia III sound card) by Digidesign* – The sixteen channel digital mixing was used to compose *Chat Noir* and *Neon.*

Macintosh G4

- *Protools 5. 1 LE (with a Digi 001 interface) by Digidesign* – The twenty-four channel digital mixing was used to compose *Ether* and *Les Forges de l'Invisible.*

- *Sound Maker 1.03 by Micromat* – The filtering, pitch shift, spatialisation, and convolution transformation processes were used in *Ether, Les Forges de l'Invisible* and *Protopia/Tesseract.*

- *HyperEngine, by Arboretum Systems* – The filtering, spatialisation, vocoder, frequency, and pitch transformation processes were used in *Ether* and *Les Forges de l'Invisible.*

- *Audio Sculpt version 1.2, by IRCAM.* The cross synthesis, filtration, and transposition transformation processes were used in *Les Forges de l'Invisible.*

Macintosh G5

- *Protools 6.8 (with a Digi 002 interface) by Digidesign* – The twenty-four channel digital mixing was used to compose *Protopia/Tesseract.*

- *Protools 7, (with a TDM system HD3) by Digidesign* – Eighty channels of digital mixing was used to compose *Protopia/Tesseract.*

- *Audio Sculpt version 1.2, by IRCAM.* The cross synthesis, filtration, and transposition transformation processes were used in *Protopia/Tesseract.*

- *GRM Tools (RTAS Plug in software)* – The spatialisation, filtration, freeze, fragmentation, and frequency transformation processes were used in *Protopia/Tesseract.*

- *HyperEngine, by Arboretum Systems* – The filtering, spatialisation, vocoder, frequency, and pitch transformation processes were used in *Protopia/Tesseract.*

Other Platforms:

- *SYTER (SYstème TEmps Réel* at the *Groupe de Musique Expérimentale de Marseille (GMEM)* – The filtration and fragmentation transformation processes were used in *Chat Noir*, *Neon*, *Ether*, and *Les Forges de l'Invisible.*

- *UPIC System* at the *Centre de Création Musicale Iannis Xenakis,* (Paris) – Sound transformation processes were used in *Ether*, *Les Forges de l'Invisible*, and in *Protopia/Tesseract*.

Other Hardware:

- *Mackie mixer* (micro series 1202 VLZ) (composer's personal studio).

- *Audio Innovation pre-amplifier* (composer's personal studio).

- *Audio Innovation amplifier* (composer's personal studio).

- *Custom-made loudspeakers* from J&F audio, Belgium (composer's personal studio).

- *ATC auto amplified monitoring loudspeakers* (City University electroacoustic studios).

- *Alesis ADAT recorder*, 16 bits (City University electroacoustic studios and Studio *Akousma, Académie de Musique de Soignies* electroacoustic studio).

- *Octophonic monitoring system with 8 Genelec loudspeakers* (City University electroacoustic studios).

- *Soundcraft mixer* (City University electroacoustic studios).

- *Octophonic monitoring system with 8 custom-made loudspeakers* (Studio *Akousma, Académie de Musique de Soignies* electroacoustic studio).

- *Octophonic monitoring system with 8 Caravelle Cabasse loudspeakers and 2 FAR monitoring loudspeakers* (Studio *Métamorphoses d'Orphée* electroacoustic studios, *Musique & Recherches*, Ohain, Belgium).

- *Yamaha CS1X Control Synthesizer* (composer's personal studio).

Appendix 4

Information about the Listening Experiment

Description

I devised a listening experiment in 1999 to test Delalande's reception behaviours. During the experiment, a group of listeners heard one movement from a multi-movement acousmatic work and three extracts from three separate acousmatic works. Listeners were invited to express their reactions in the form of a written description of their perceptions. However, they were also encouraged to make scores, designs, or drawings, where needed, in order to allow for the widest possible range of responses on paper. The titles of the pieces and the composers' names were disclosed to the listeners at the end of the experiment. I carried out the experiment three times in three locations: May 26, 1999 at City University in London, May 31 and June 1 at the *Académie de Musique de Soignies* (Belgium), and on June 15 at the International School of Brussels.

Acousmatic music played

- The second of two adjacent movements from *Deux aperçus du jardin qui s'éveille* (3'03"), by Lejeune from his eleven movement electroacoustic work, *L'invitation au départ,* composed in 1984.[177]

- A 2'27" extract (3'22" – 5'49"), from the electroacoustic work in stereo, *Bois*, (12'27" duration) composed in 1986 by Vande Gorne.

- A 3'07" extract (3'40" – 6'47"), from an electroacoustic work in stereo, *Crystal Music*, (14'43" duration) composed in 1994 by Roy.

- A 3'08" extract (8'01" – 11'09"), from an electroacoustic work in stereo, *The Gates of H*, (18'08" duration) composed in 1993 by Brümmer.

Venues and participants

I conducted the experiment at City University during my post-graduate electroacoustic music research seminar. The group of twelve participants comprised three professors of composition in the Music Department, although one of the professors was not a composer of electroacoustic music, and nine English-speaking, post-graduate music students in electroacoustic music composition, the majority of whom were doctoral candidates.

The experiment was conducted in French at the *Académie de Musique de Soignies*, a pre-conservatory level music school in French-speaking southern Belgium, where the twelve listeners were all Belgian, French-speaking students of electroacoustic music. Eight participants were adolescents, one listener was an

[177] The version of the second of the *Deux aperçus du jardin qui s'éveille* used in the listening experiment was non-commercial and was obtained at *Musiques & Recherches*, Ohain, Belgium. The two *aperçus* have a combined duration of 6'40". The commercial recording of Lejeune's work, *L'invitation au départ,* contains three adjacent movements which he entitled *Trois aperçus du jardin qui s'éveille.* In the commercial recording, the second movement, *Ramages*, is almost identical to the movement used in the listening experiment.

elementary school pupil, and three listeners were adults. Due to the average age of the participants the general level of exposure to, as well as academic knowledge of, acousmatic music was significantly less than that encountered at City University. It also must be acknowledged that most members of the group had some traditional musical training prior to the experiment and were also pursuing music studies parallel to the electroacoustic composition course.

The experiment also took place at the International School of Brussels, a private English-speaking primary and secondary school. The seventeen listeners were eleven and twelve-year-old students in sixth grade at the elementary school. The experiment was conducted during a general music class in which they were enrolled during the 1998 – 1999 school year. These participants had some musical training through the general music class, and they later specialised in required music ensembles. Further, several students were also enrolled in the School's private music lesson programme, but the majority of participants had little or no known exposure to electroacoustic music, as it was not a part of the School's music curriculum. As noted in 1.3.1, although the students at City University and the International School of Brussels were English speakers, English was not necessarily their first language.

Conditions

Listeners sat a quiet room for the duration of the experiment. After an introduction to the experiment, the movement and three extracts were played on one pair of loudspeakers located in front of the room. The listeners were asked to notate their reactions to the music, anonymously, on four separate, blank pages while it was played. Approximately five minutes were given after the movement and each of the three extracts in order for listeners to complete their responses.

Physical characteristics and acoustics of the venues

The experiment initially was conducted in the City University Music Department in the former Performance Area, which was a relatively large and acoustically 'live' room (+/- 20m x 15m). The loudspeakers (professional studio monitors) were placed approximately four metres in front of the listeners who were seated in a group. The twelve listeners from the *Académie de Musique de Soignies* were placed in a medium-sized electroacoustic studio (+/- 8m x 6m) which was somewhat dampened due to the acoustically absorbent fabric that covered the back wall of the studio. Listeners sat in a group approximately two metres away from the loudspeakers. The loudspeakers were powerful but were not as precisely conceived for electroacoustic music monitoring and diffusion as those at City University. Listeners at the International School of Brussels were invited to listen in the relatively close quarters of a music classroom (+/- 10m x 5m). This space was acoustically dampened because of the wall-to-wall carpet. The participants were seated together in a large group approximately two metres from the loudspeakers. The music was played on a medium quality stereo system.

Methodological details

It is possible that the closer proximity of the loudspeakers to the listeners at the *Académie de Musique de Soignies* and at the International School of Brussels played a role in the way the sounding flow was apprehended. It is also possible that the nature

of group listening, where some participants were seated closer to the loudspeakers than others or were seated to one side of the stereo field, helped to provoke different types of responses.

Although François Delalande did not specify the nationality of the listeners who participated in his project one can assume, by reading the list of participants' names, that they were all French-speaking adults. In contrast, there was a variety of nationalities and age groups represented in my experiment. For example, the group at City University included listeners from Asian, Latin American, Scandinavian, and Continental European cultures as well as listeners from the UK. Listeners at the *Académie de Musique de Soignies* were all French-speaking Belgians and had all been educated in Belgium. Despite the wide variety of backgrounds represented in the listening experiment at the International School of Brussels (Asian, Latin American, African, Indian, Continental European cultures in addition to the North American and British) listeners were united by their age. Further, unlike non-native English speakers at City University, these children had not yet been exposed to higher education in a second language. Therefore, one could suppose that their cultural identity was still intact, albeit inchoate.

One may suggest that a young multi-cultural group of listeners would produce the most varied types of imaginative responses. Consequently, one may expect more coherence in imagery proposed by listeners who participated in the experiment in the setting of their own culture, or by foreigners who participated in the experiment in the context of higher education. One could also propose that younger listeners might produce the most unbridled responses, while more mature listeners could possibly demonstrate a capacity for more complex responses. A preliminary examination of my findings supports these proposals. However, only through a series of experiments in a controlled setting can these notions be adequately addressed.

Methodological inconsistencies

The second of two adjacent movements from *Deux aperçus du jardin qui s'éveille* and the extracts from *Crystal Music* and *The Gates of H* were played at the International School of Brussels. Participants did not listen to the extract from *Bois* due to lack of time, a situation that rendered the listening experiment incomplete.

Although the listening experiments at the *Académie de Musique de Soignies* and the International School of Brussels were each introduced by an explanation, the experiment at City University was preceded by my seminar on perception. Thus, City University listeners may have identified more closely with the reception behaviours presented in the seminar and could have more readily embraced them during the experiment. Without the explanation of listening strategies as a prelude to the experiment the participants at the *Académie de Musique de Soignies* and the International School of Brussels were left to probe the music more intuitively, perhaps unaware that the listening behaviour they manifested had been the subject of prior research.

It is difficult to ascertain the importance of listener awareness of reception behaviours in this early stage of this research. The 'educated' listener may feel obliged to employ one or more strategies or to shift listening strategies consciously when interest in one wanes. 'Non-educated' listeners could perhaps shift more intuitively between strategies or decide not to listen, without remorse, because they may not feel

an intellectual responsibility to use the numerous tactics offered to them through education.

Differences in methodology between Delalande's study and my experiment

The participants in Delalande's study listened individually to *Sommeil* one, two, or three times in the presence of one of the individuals responsible for the study. In addition, it has not been determined whether the participants knew the number of times they would be exposed to the music at the inception of the experiment. A point can be made from this information: listeners may adopt different reception strategies when apprehending the music more than once. In contrast to Delalande's study, listeners in my experiment participated in a group setting in which a movement from an acousmatic piece and three extracts from three acousmatic piece were played once. The possible consequences are:

(i) The listeners may be confused or discouraged by the incomplete presentation of the works, which may impinge upon their ability or desire to engage in a listening strategy.

(ii) Listening awareness may be artificially heightened if participants know that they will listen once.

(iii) Group listening in an institution differs from listening "[…] in comfort, as if at home" (Delalande, 1998: 24) in the presence of one other person.

In a further difference, the participants in the Delalande study were interviewed after the experiment, which allowed them to elaborate on and develop their perceptions. There are three consequences (Delalande, 1998: 25-26):

(i) "A verbal testimony is […] undoubtedly influenced by the self-image of the listener."

(ii) "Free discussion follows a conversation dynamic, and thus a differently conducted discussion would […] have led the listener to insist on other points."

(iii) "Once these testimonies have been collected and transcribed, the comparisons carried out are the result of the analyst's appreciation."

In contrast to Delalande's methodology no interviews took place after my experiment as listeners were invited to make spontaneous judgements and conjectures in writing, or with drawings or designs. The following observations are pertinent:

(i) The mood or self-image of the listener may influence a written or drawn testimony differently than an aural testimony.

(ii) A written or drawn testimony follows a different dynamic than one delivered in conversation. Reactions are often articulated in a more condensed manner and favour the listener's first impression, as there is less time for elaboration.

(iii) The analyst's appreciation can be more pronounced due to the interpretative skills needed to decode anonymous text, drawings, and designs.

Findings

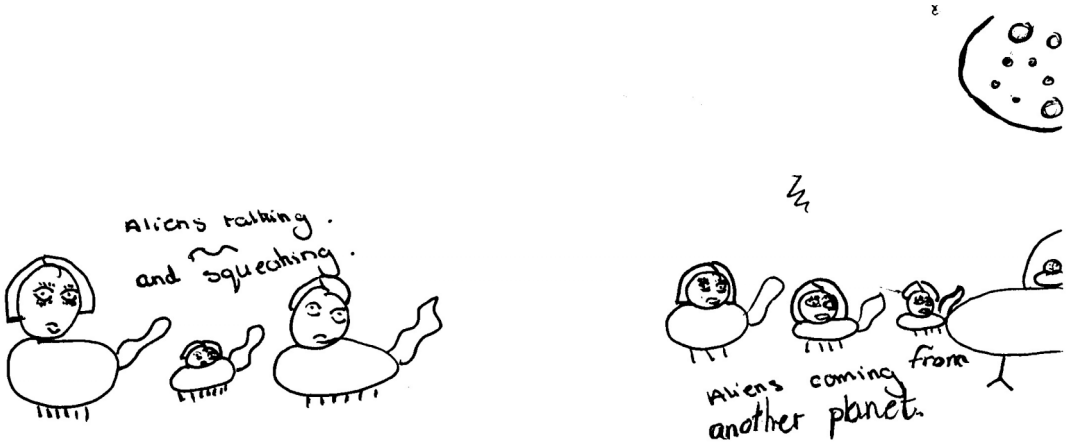
Refer to Appendix 5 for the complete set of responses from the listeners at the International School of Brussels. Responses from listeners at City University and the *Académie de Musique de Soignies* are available on request.

Appendix 5

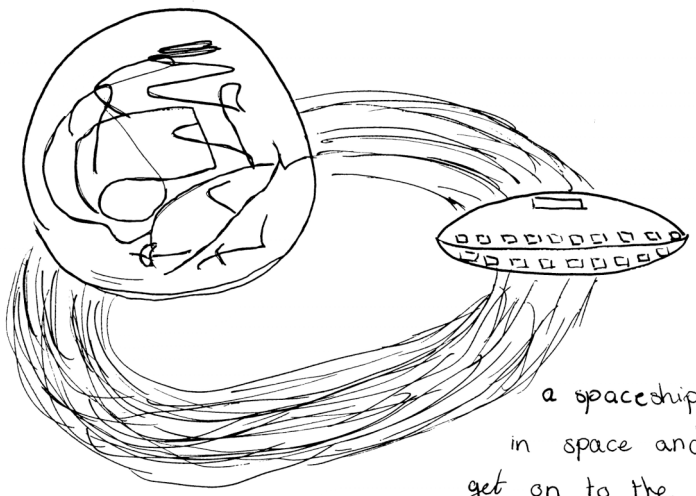
Findings from the Listening Experiment at the International School of Brussels

The scale of several listener responses was slightly reduced or enlarged for the purpose of page layout.

International School of Brussels Listener A response to the second movement from *Deux aperçus du jardin qui s'éveille*:

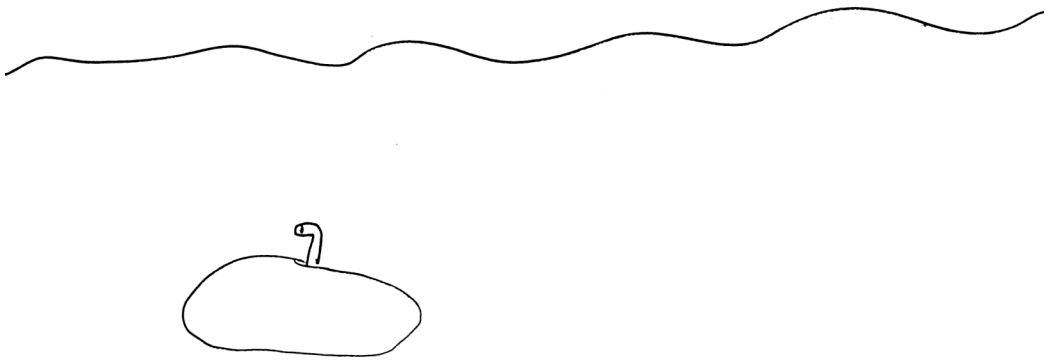


International School of Brussels Listener A response to the extract from *Crystal Music*:

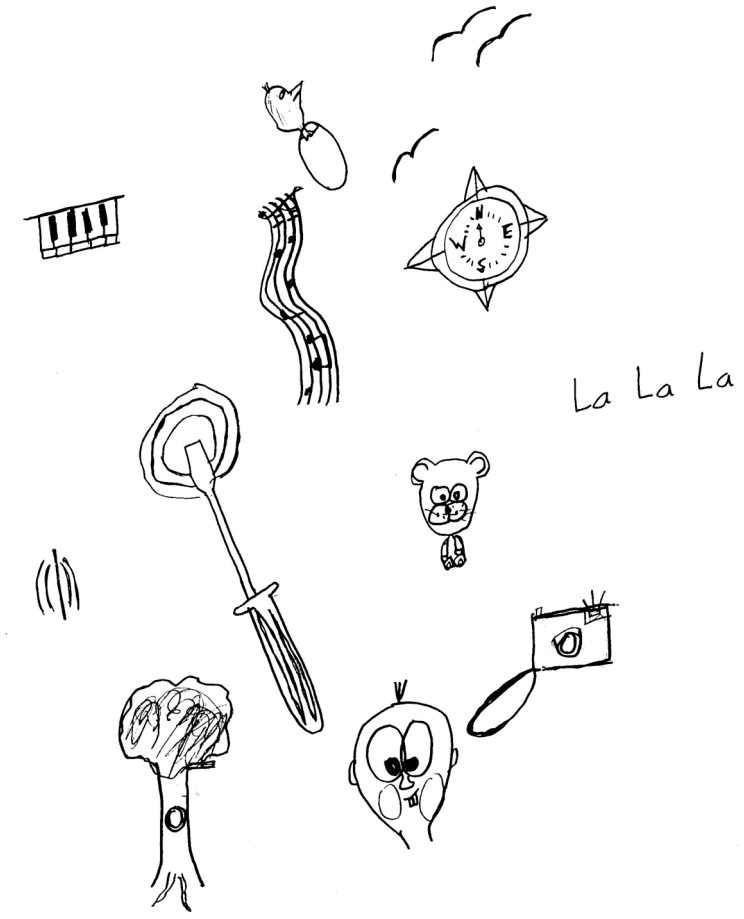


a spaceship flying in space and aliens get on to the spaceship and tamper with the radio and ~~strat~~ start to kill all the people onboard. It all goes silent and they all are kill. The ship slow crashes.

International School of Brussels Listener A response to the extract from *The Gates of H*:

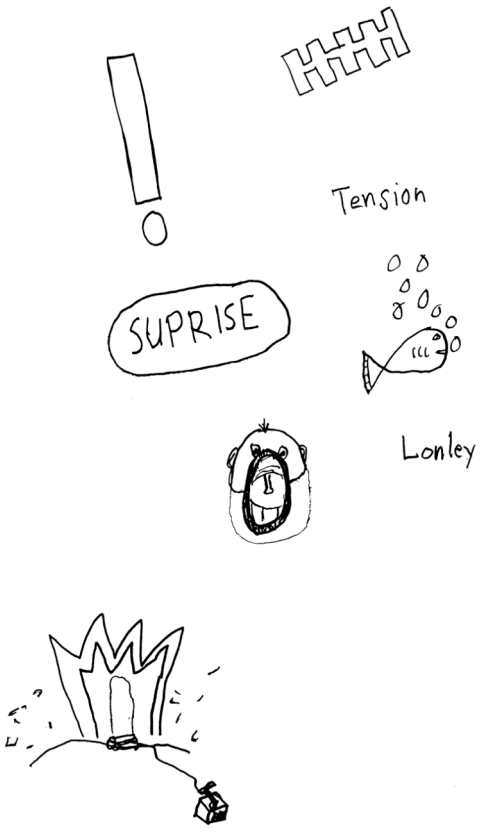


International School of Brussels Listener B response to the second movement from *Deux aperçus du jardin qui s'éveille*:

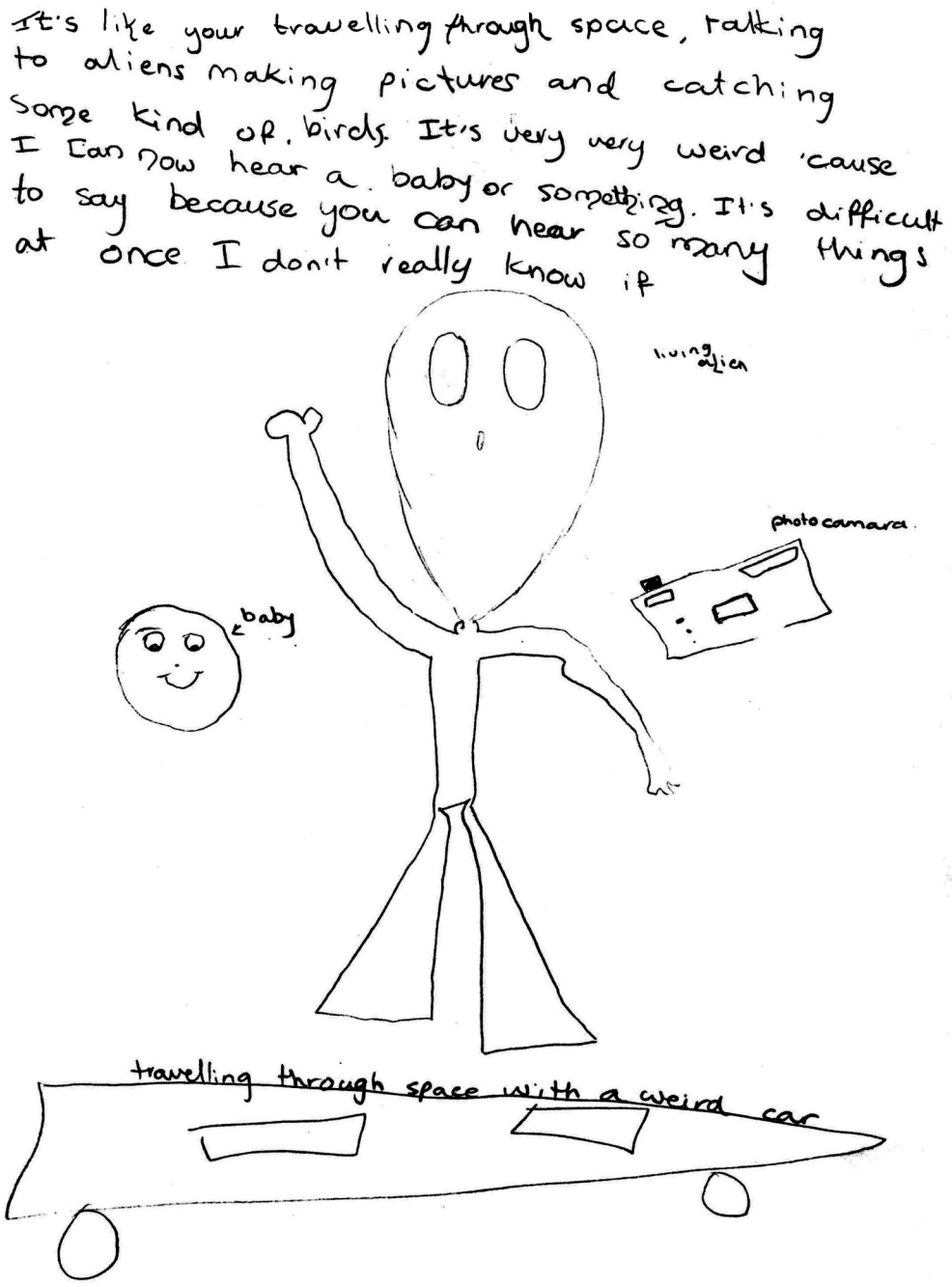


International School of Brussels Listener B response to the extract from *Crystal Music*:

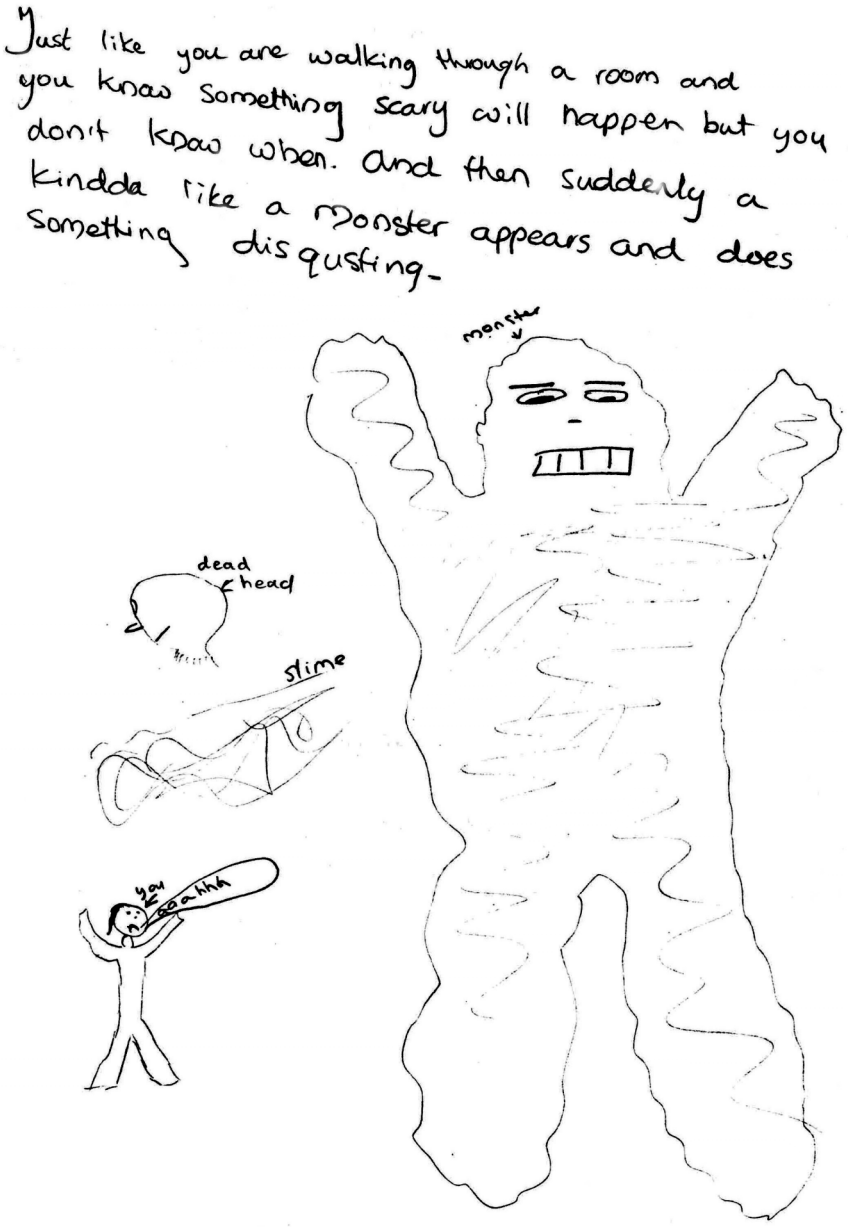
International School of Brussels Listener B response to the extract from *The Gates of H*:



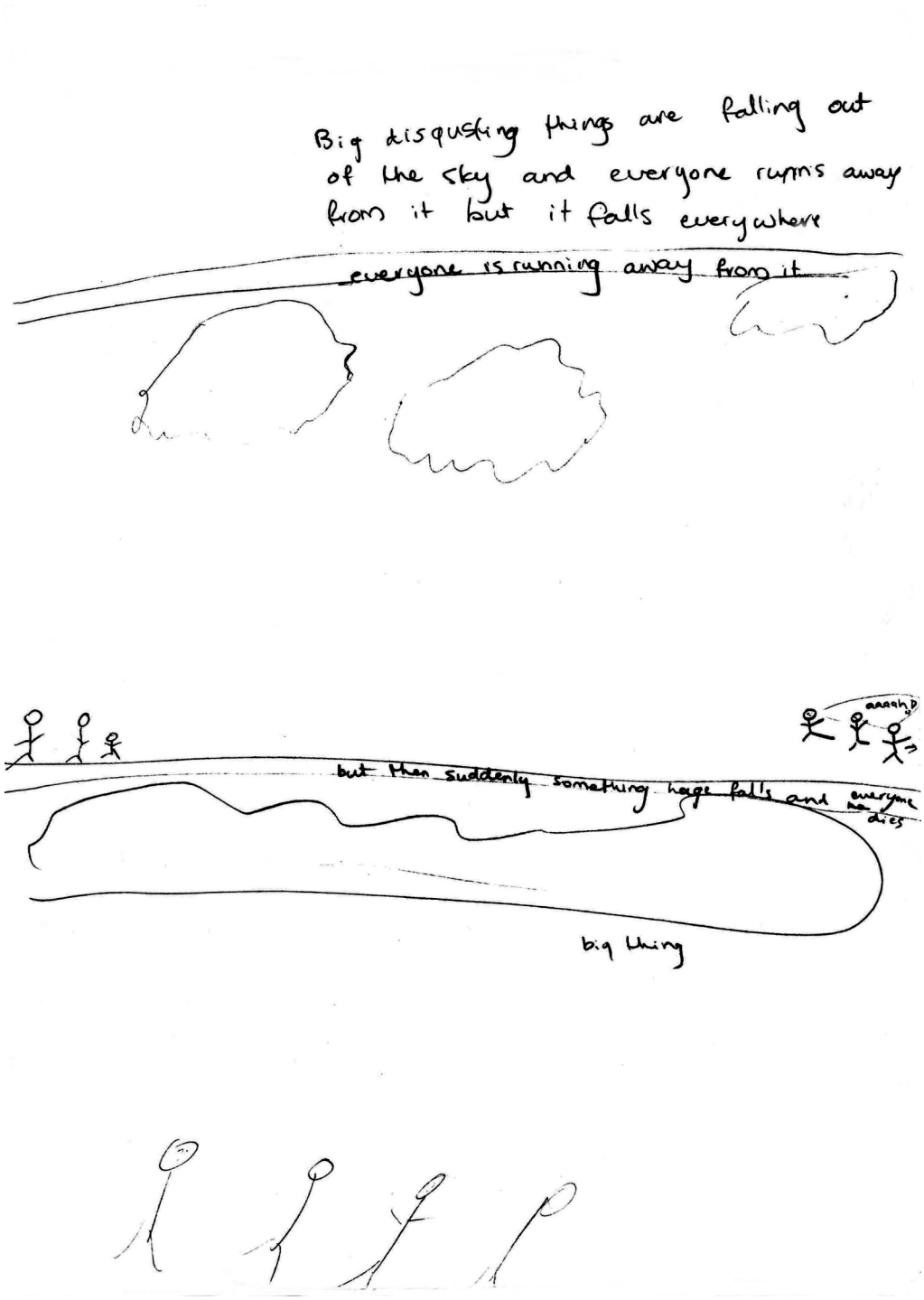
International School of Brussels Listener C response to the second movement from *Deux aperçus du jardin qui s'éveille*:



International School of Brussels Listener C response to the extract from *Crystal Music*:

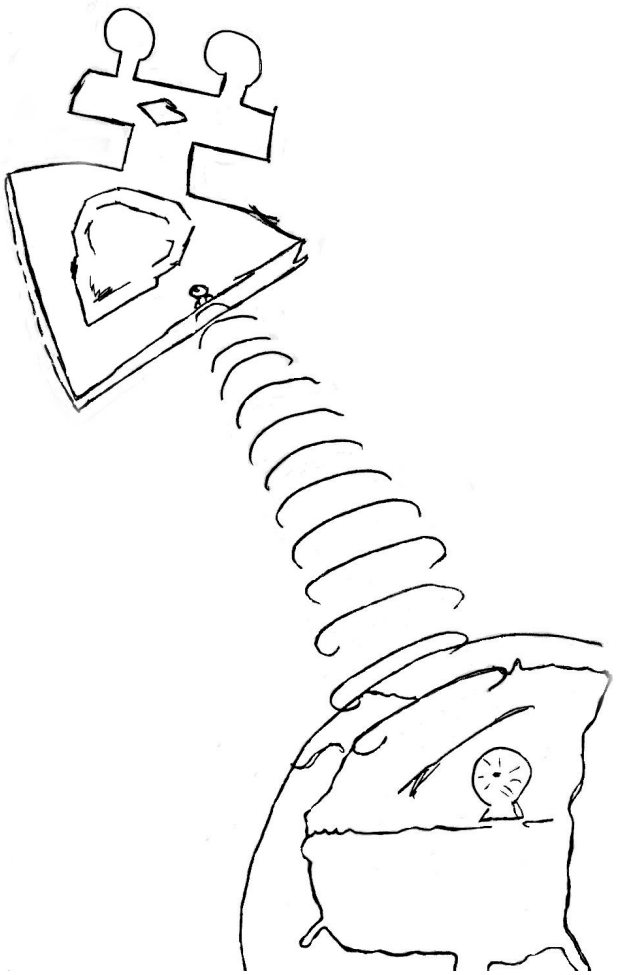


International School of Brussels Listener C response to the extract from *The Gates of H*:



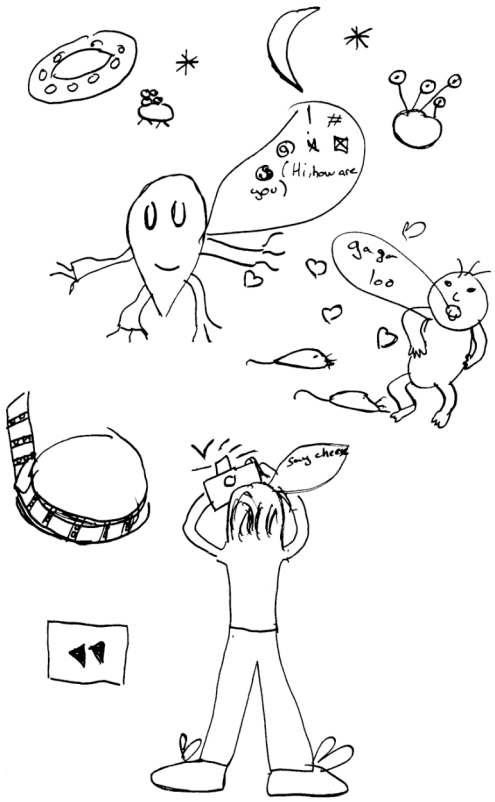
International School of Brussels Listener D response to the second movement from *Deux aperçus du jardin qui s'éveille*:

International School of Brussels Listener D response to the extract from *Crystal Music*:



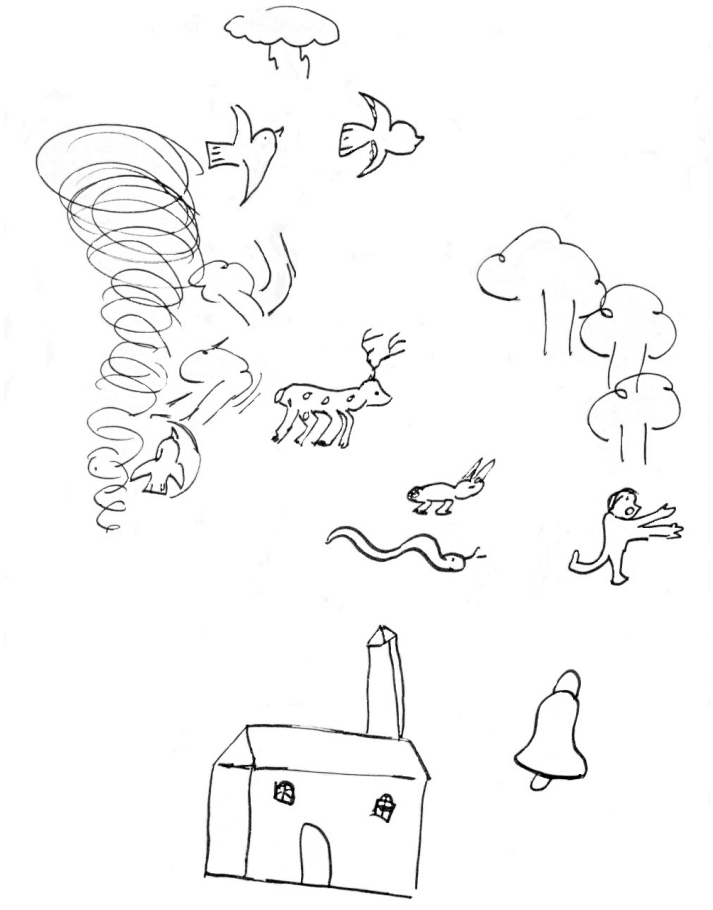
International School of Brussels Listener D response to the extract from *The Gates of H*:

International School of Brussels Listener E response to the second movement from *Deux aperçus du jardin qui s'éveille*:

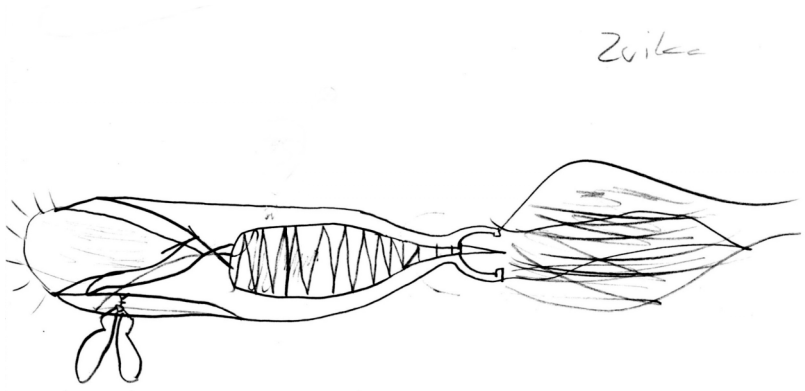


International School of Brussels Listener E response to the extract from *Crystal Music*:

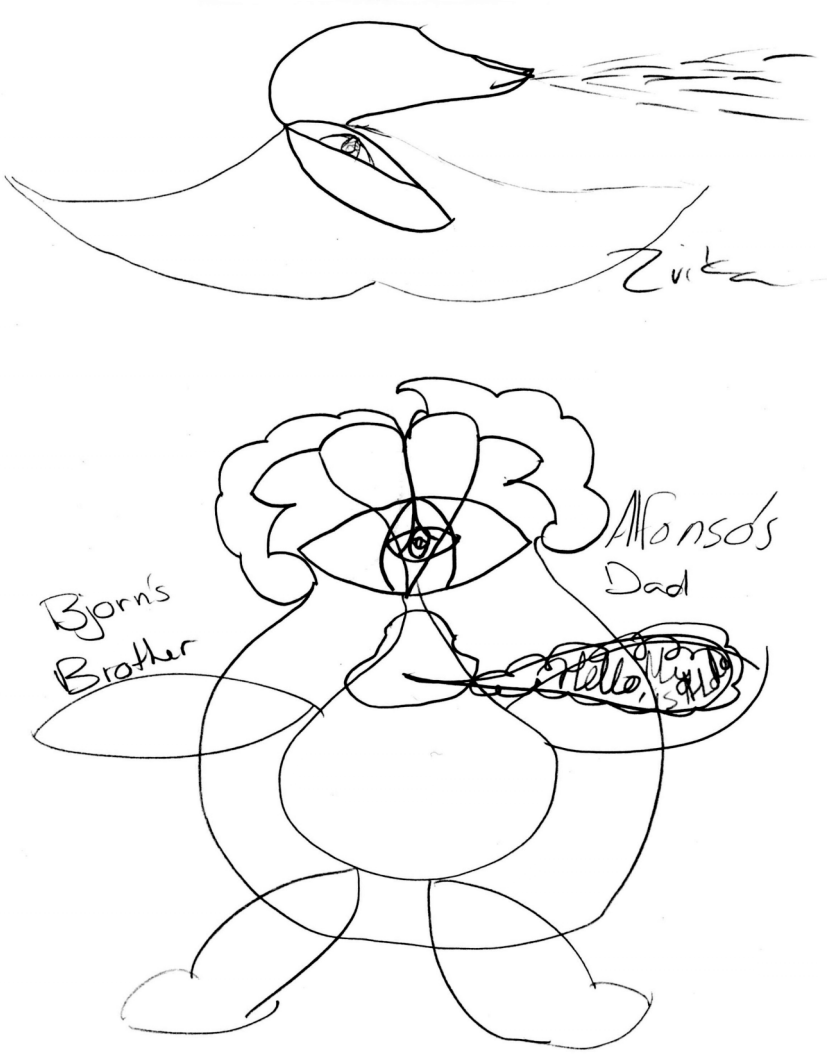
International School of Brussels Listener E response to the extract from *The Gates of H*:



International School of Brussels Listener F response to the second movement from *Deux aperçus du jardin qui s'éveille*:



International School of Brussels Listener F response to the extract from *Crystal Music*:

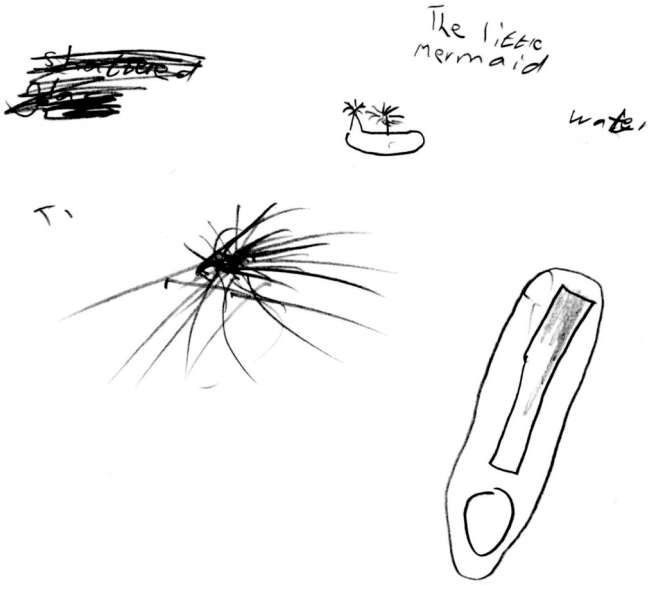


International School of Brussels Listener F response to the extract from *The Gates of H*:

International School of Brussels Listener G response to the second movement from *Deux aperçus du jardin qui s'éveille*:

International School of Brussels Listener G response to the extract from *Crystal Music*:

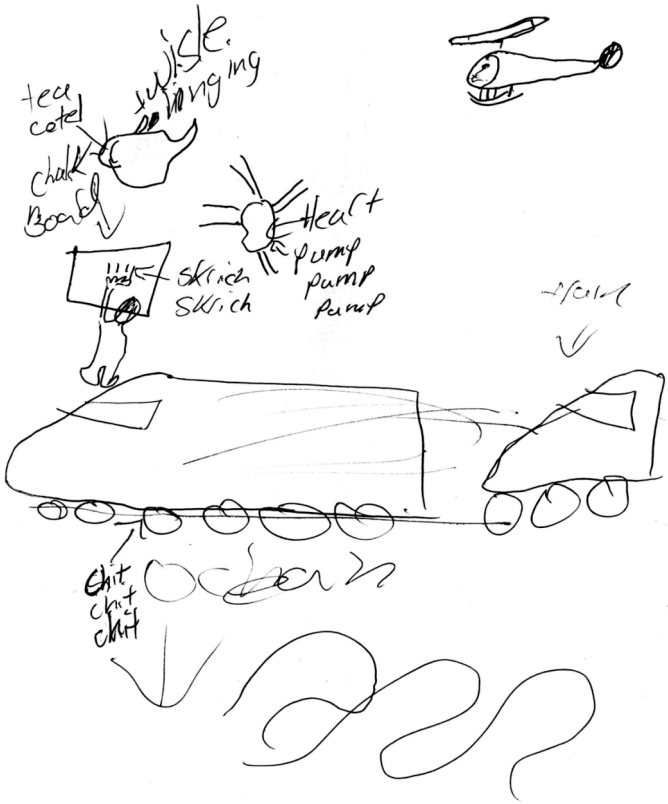
International School of Brussels Listener G response to the extract from *The Gates of H*:



International School of Brussels Listener H response to the second movement from *Deux aperçus du jardin qui s'éveille*:

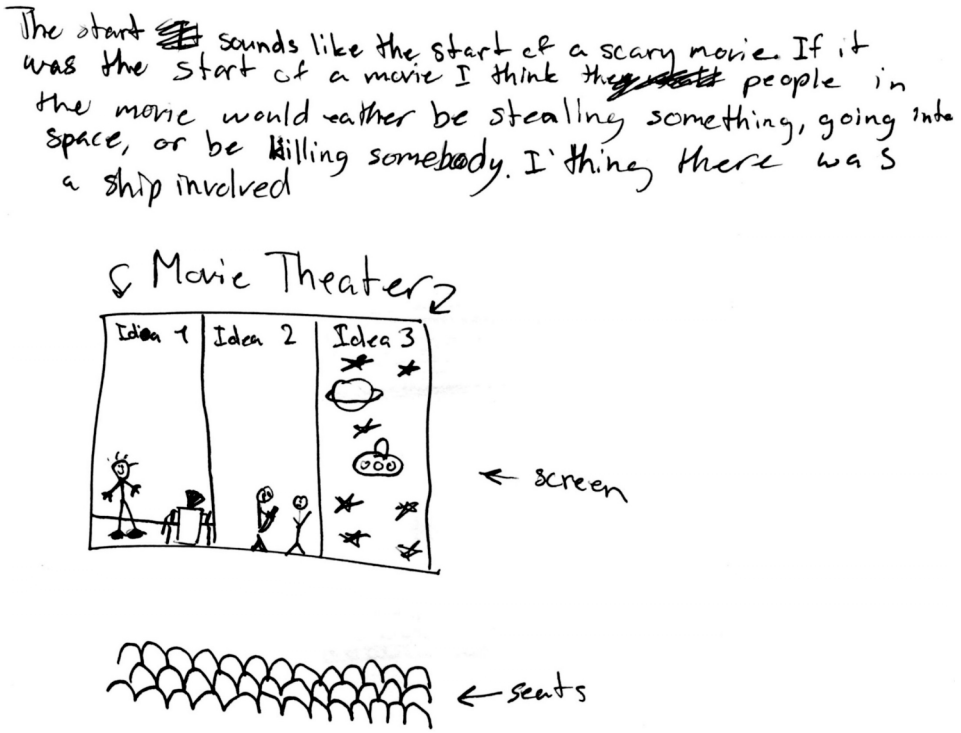
International School of Brussels Listener H response to the extract from *Crystal Music*:

International School of Brussels Listener H response to the extract from *The Gates of H*:

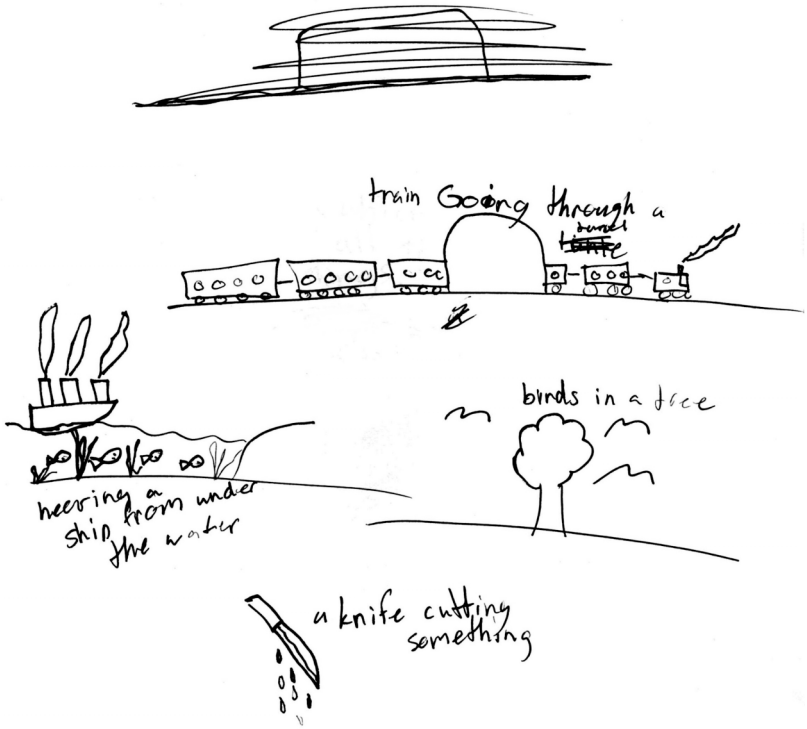


International School of Brussels Listener I response to the second movement from *Deux aperçus du jardin qui s'éveille*:

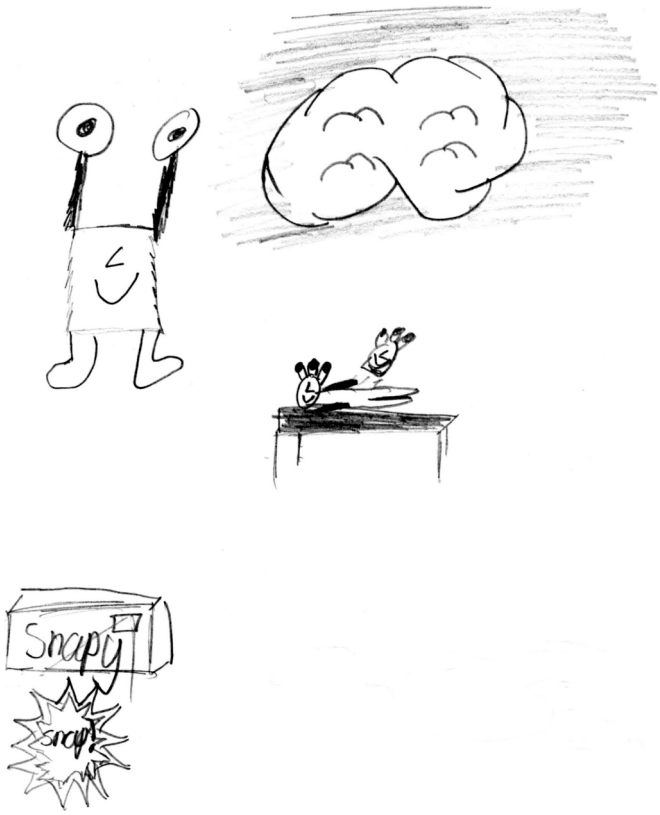
International School of Brussels Listener I response to the extract from *Crystal Music*:



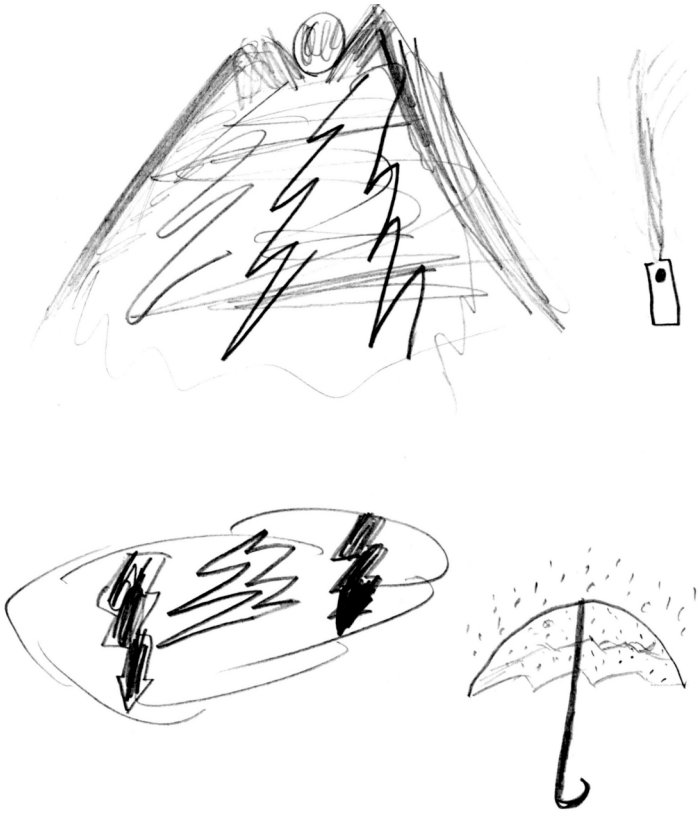
International School of Brussels Listener I response to the extract from *The Gates of H*:



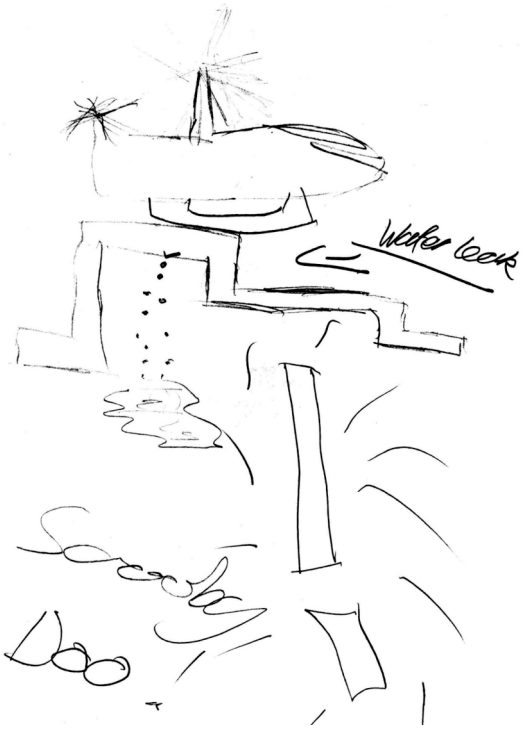
International School of Brussels Listener J response to the second movement from *Deux aperçus du jardin qui s'éveille*:



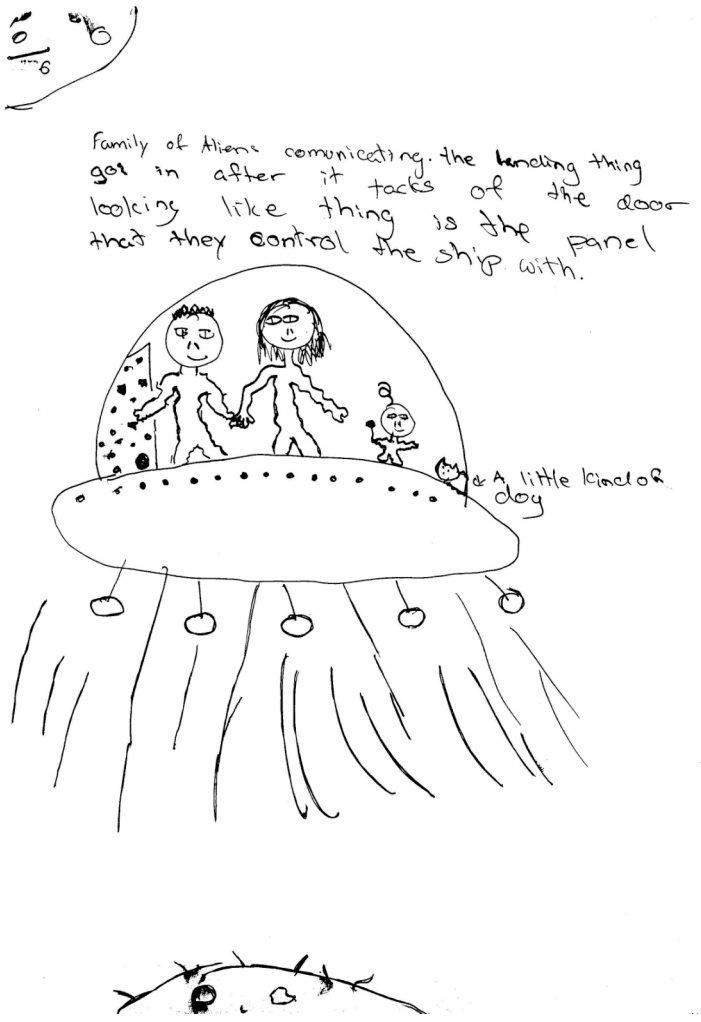
International School of Brussels Listener J response to the extract from *Crystal Music*:



International School of Brussels Listener J response to the extract from *The Gates of H*:

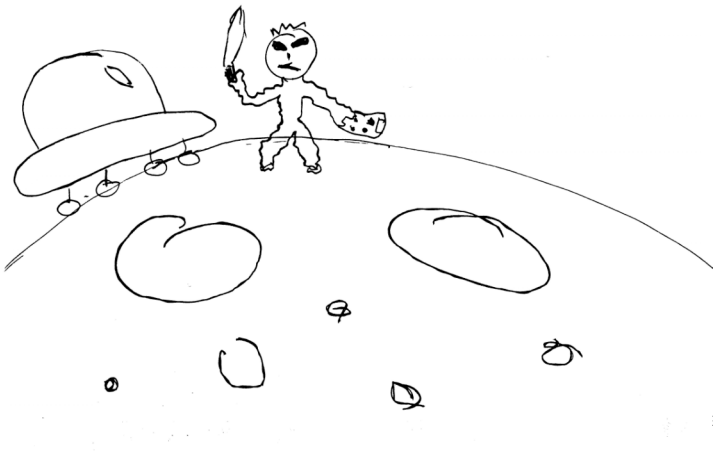


International School of Brussels Listener K response to the second movement from *Deux aperçus du jardin qui s'éveille*:



International School of Brussels Listener K response to the extract from *Crystal Music*:

An Alein has got out of it ship to explor. It hees a tight saver & A life tracking ditise they both made really wierd & strange noises.



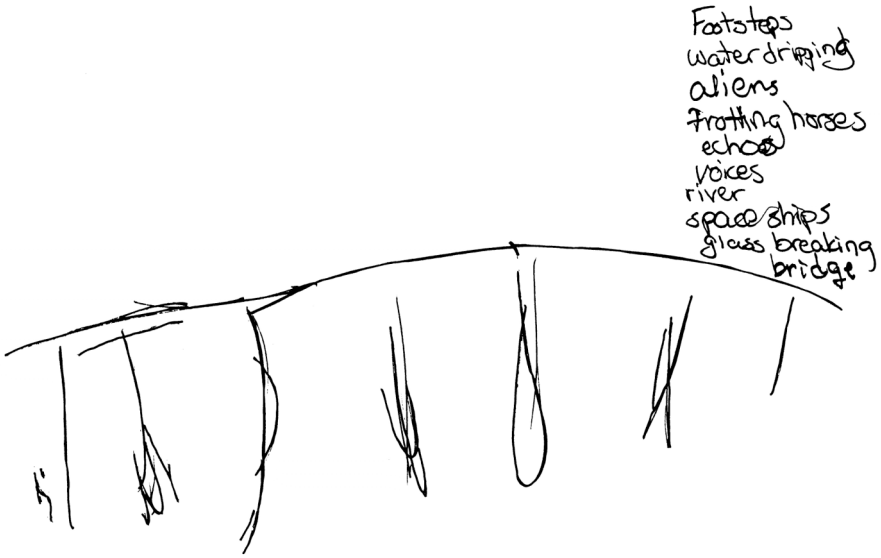
International School of Brussels Listener K response to the extract from *The Gates of H*:

A ship landing with aliens comonica -ng & diging whotes

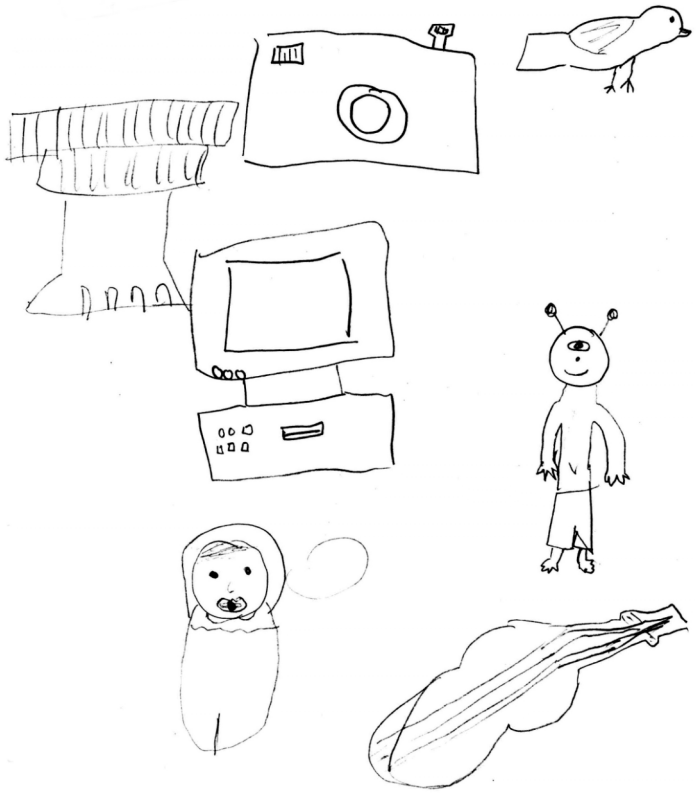
International School of Brussels Listener L response to the second movement from *Deux aperçus du jardin qui s'éveille*:

International School of Brussels Listener L response to the extract from *Crystal Music*:

International School of Brussels Listener L response to the extract from *The Gates of H*:

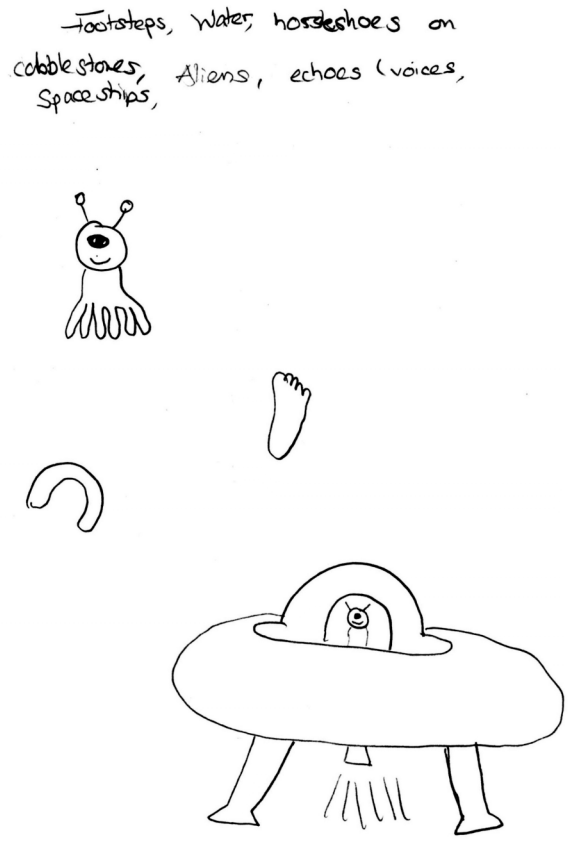


International School of Brussels Listener M response to the second movement from *Deux aperçus du jardin qui s'éveille*:



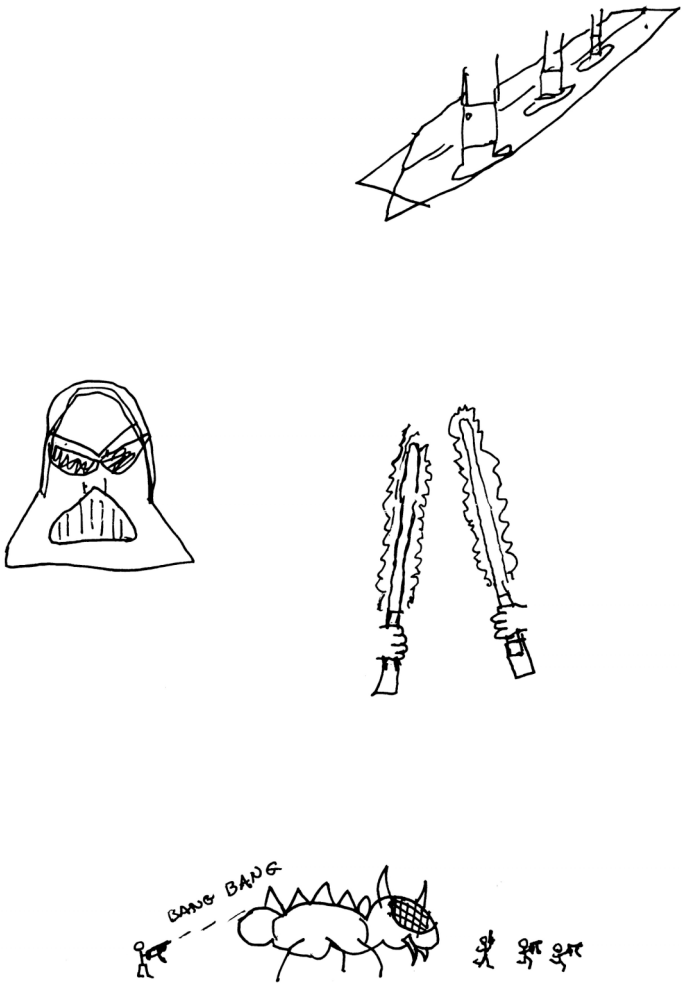
International School of Brussels Listener M response to the extract from *Crystal Music*:

International School of Brussels Listener M response to the extract from *The Gates of H*:

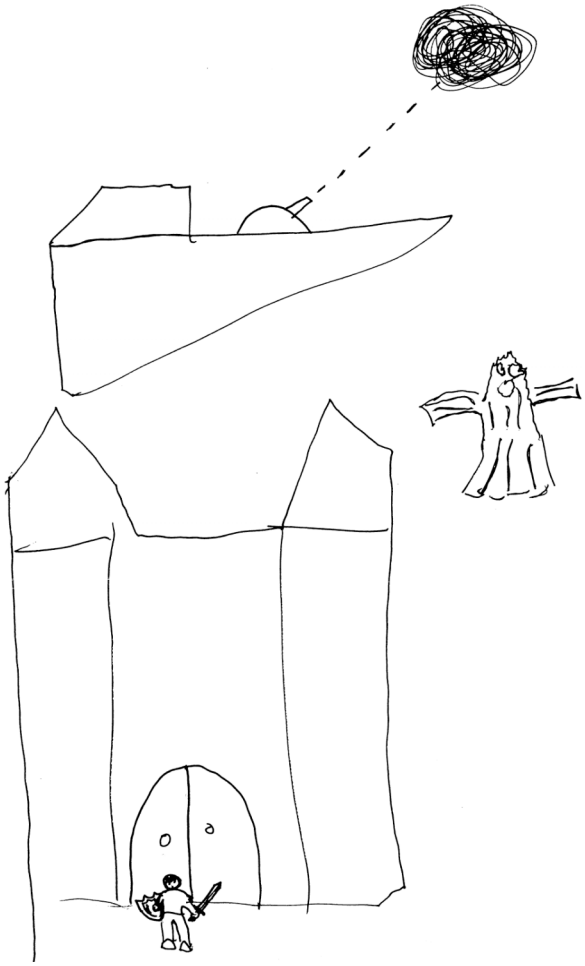


International School of Brussels Listener N response to the second movement from *Deux aperçus du jardin qui s'éveille*:

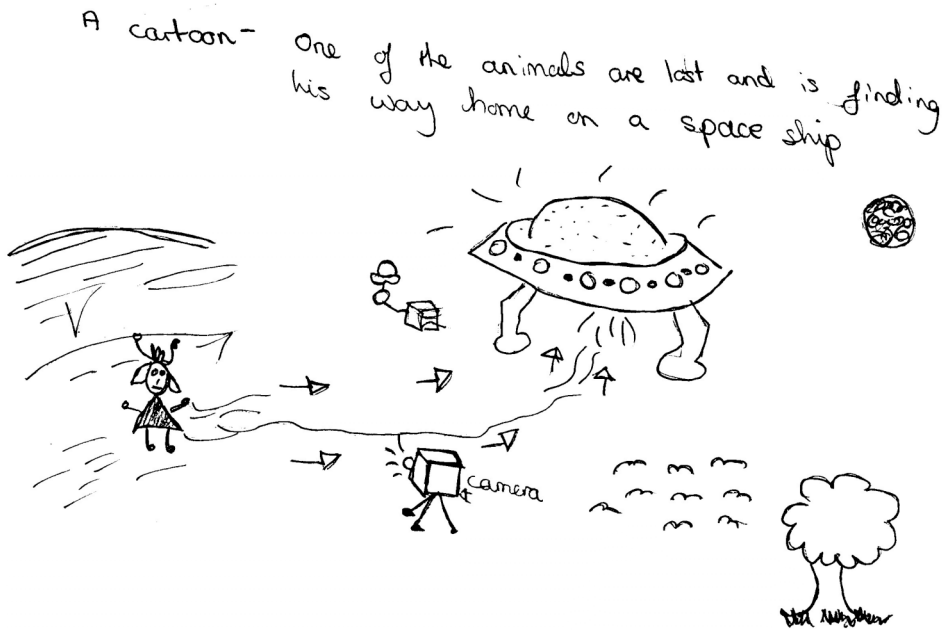
International School of Brussels Listener N response to the extract from *Crystal Music*:



International School of Brussels Listener N response to the extract from *The Gates of H*:



International School of Brussels Listener O response to the second movement from *Deux aperçus du jardin qui s'éveille*:



International School of Brussels Listener O response to the extract from *Crystal Music*:

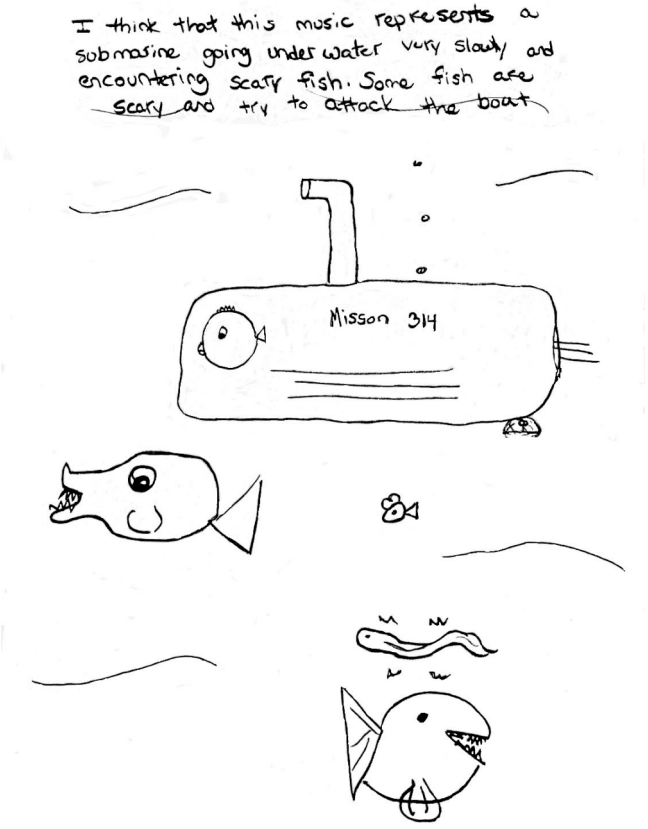
International School of Brussels Listener O response to the extract from *The Gates of H*:

International School of Brussels Listener P response to the second movement from *Deux aperçus du jardin qui s'éveille*:

I think that this music is a tropical rainforest with many bird, insects and creatures in it. The creatures are furry and have high-pitched voices. There are different noises made by these creatures in the forest.

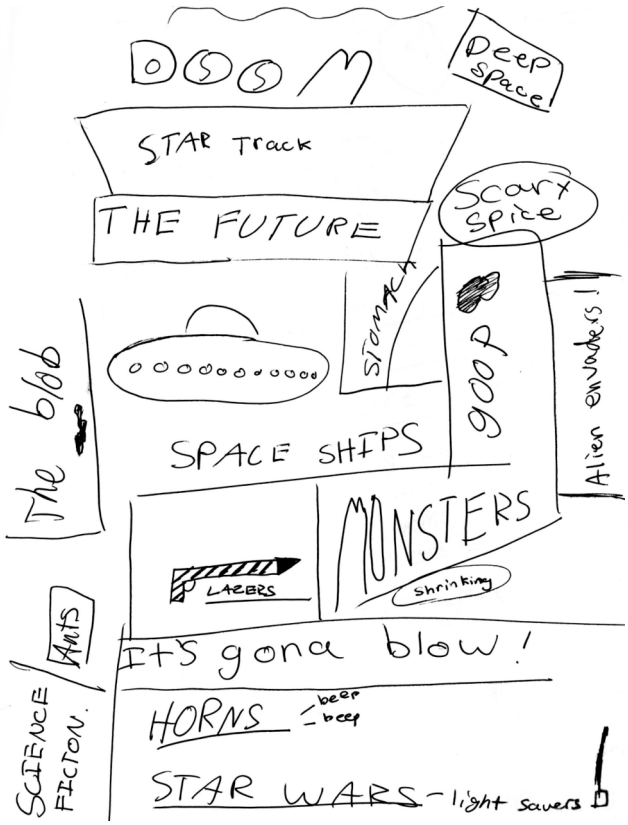
International School of Brussels Listener P response to the extract from *Crystal Music*:

International School of Brussels Listener P response to the extract from *The Gates of H*:

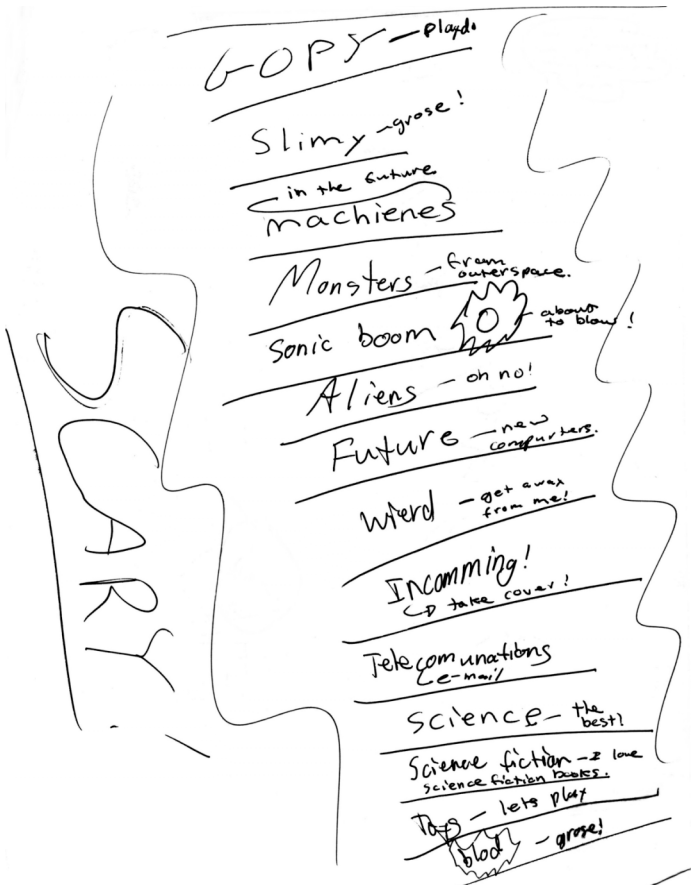


International School of Brussels Listener Q response to the second movement from *Deux aperçus du jardin qui s'éveille*:

International School of Brussels Listener Q response to the extract from *Crystal Music*:



International School of Brussels Listener Q response to the extract from *The Gates of H*:



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