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Orestis Karamanlis

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 32.4 Channels for a mono piece	32.4 channel tape	May 2007	10:45
Swarm	stereo tape	Dec. 2007	9:00
 Transduction	stereo tape	Mar. 2008	8:05
 Kardaş	stereo tape	May. 2008	9:01
Transduction #2	laptop trio	Jun. 2008	[8:05]
Πλάγιος Β΄	kanun & live electronics	Nov. 2008	8:00
Το Χάος!	santur & live electronics	Dec. 2008	10:00
Absolut Athens	live electronics in SuperCollider	Jan. 2009	3:30
 Acqua Alta	5.0 channel tape	Mar. 2009	4:19
Imago Dixit	interactive installation	Apr. 2009	[inf]
Στέρφος	8.0 channel tape	Jul. 2009	21:16
The times for the pieces involving instruments denote approximate performance durations according to the scores.		total duration	95:26

 Finalist > 35e Concours Internationaux de Musique et d'Art Sonore Electroacoustiques de Bourges, France, (2008).

 Finalist > 36e Concours Internationaux de Musique et d'Art Sonore Electroacoustiques de Bourges, France, (2009).

 Finalist > 36e Concours Internationaux de Musique et d'Art Sonore Electroacoustiques de Bourges, France, (2009).

 Finalist > VII Electroacoustic Miniatures International Contest, Huelva, Spain (2009).

 CD-Release by Studio2 Records, Greece, (2008).

 CD-Release by Dublin Electronic Arts Festival, Ireland, (2009).

 CD-Release by VII Electroacoustic Miniatures International Contest, Junta de Andalucia, Spain, (2010). [oncoming]

List of performances

Ataxia	Percussive Arts Society International Convention	Texas, U.S.	11 Nov. 2006
Ataxia	Cambridge Music Festival, West Road Concert Hall	England, U.K.	19 Nov. 2006
Ataxia	perKmania Festival, Conservatoire de Paris	Paris, France	24 Nov. 2006
Ataxia	Cardiff University	Wales, U.K.	27 Nov. 2006
Ataxia	Royal Welsh College of Music and Drama	Wales, U.K.	28 Nov. 2006
Ataxia	Lemmensinstituut Conservatory	Leuven, Belgium	21 Feb. 2007
Transduction	Bliss Concert, SARC	Belfast, N.I.	13 Mar. 2008
Transduction	CCRMA Stantford University	Stantford, U.S.	4 Apr. 2008
Transduction	International Confederation of Electroacoustic Music, Club Diario	Valencia, Spain	10 Apr. 2008
Transduction	New Music Marathon, Maynooth University	Maynooth, Ireland	19 Apr. 2008
Transduction	Berklee College of Music	Boston, U.S.	23 Apr. 2008
Transduction	38th International Festival of Electronic Music - Synthèse	Bourges, France	2 Jun. 2008
Transduction	ElectroMediaWorks Festival	Athens, Greece	16 May 2008
Transduction #2	International Computer Music Conference	Belfast, N.I.	28 Aug. 2008
Kardaş	Days of Electroacoustic Music	Rethimnon, Greece	26 Oct. 2008
Imago Dixit	Alef Gallery	Athens, Greece	10-16 Mar. 2009
Kardaş	Escola de Música da UFRJ	Rio de Janeiro, Brazil	4 Apr. 2009
Kardaş	Universidade Federal do Paraná	Brazil	14 Apr. 2009
το Χaos!	Sonic Arts Research Centre	Belfast, N.I.	7 May 2009
Πλάγιος Β'	Sonic Arts Research Centre	Belfast, N.I.	7 May 2009
Acqua Alta	Sonorities Festival, SARC	Belfast, N.I.	8 May 2009
Imago Dixit	Athens Video Arts Festival, Technopolis	Athens, Greece	14-17 May 2009
Acqua Alta	Ars Electronica Center, Deep Space	Linz, Austria	19 Oct. 2009
Absolut Athens	Ars Electronica Center, Deep Space	Linz, Austria	19 Oct. 2009
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▶ file | ↪ folder

*DVD on-body drawing by Eleanna Kotsikou

Opening

A watering can in a backyard is a watering can; in a gallery it is priceless.

The structure of the thesis

The current document is a collection of commentaries on the compositions. It echoes the evolution of my thinking during the past three years, but by no means provides a definite intellectual framework. Plainly, it demonstrates an amalgam of thoughts and processes embodied in the act of composition. The written thesis is based upon the belief that it should not be a logbook. It cannot contain all the relevant steps accomplished in order to realise the musical works. The aim is to provide an inside view of the compositions and to place the music in context, considering aspects of form and identity, while trying to reflect back on the mental schemas that gave rise to certain compositional decisions and investigate the reasons why an option might have been chosen instead of another.

The portfolio contains work that encompasses a wide spectrum of creative output and spans through different areas of computer music. The thesis is divided in four thematic unities according to the format of the musical works or the forces needed for their realisation. Within each broad category every musical work is presented by focusing on certain features each time. It is evident that different pieces may embody similar techniques. In each work only a few exemplary characteristics are talked through; the ones which were thought to play an important role amongst the other ‘configurations’.

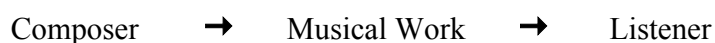
In detail, Part I is devoted to the mixed genre pieces (a format that incorporates both acoustic instruments and electronics) and looks at issues relative to causality, fusion and contrast [chapter 1], live interactivity [chapter 2] and an applied strategy for thematic evolution in the electroacoustics [chapter 3]. Part II deals with the acousmatic works, exploring ideas that have to do with stream form and development [chapter 4], goal-oriented syntactic resolution and cultural content [chapter 5]. Part III is the most diverse and is devoted to physical controllers and live electronics. It investigates the use of a

custom-built machine for gestural control of sonic material, examines laptop performance practice [chapter 6] and comments on a piece for live electronics that uses stochastic processes [chapter 7]. Part IV situates electroacoustic composition in the context of an interactive installation for painting and sound [chapter 8]. Finally Appendix I describes a piece which springs from a process-based compositional strategy and is contextualised in a different manner than the rest of the portfolio works.

The thesis in context

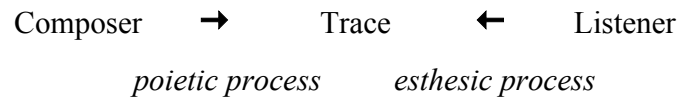
In writing a commentary for a musical piece it is tempting to apply normative judgements, which are often personal evaluations or expressions of taste and are common sense since everyone can attempt an axiomatic assessment upon anything. I am sure that these judgements are useful to some extent, yet, if left unsupported they are crude simplifications giving little information about the musical work itself, the act of composition and its reception. Even more problematic are assertive statements relative to the communicative power of a musical work.

The classic notion of communication suggests that there must be a clear link between the composer's intentions and the listener. In other words it is believed that the artwork functions as an intermediary in the communication process between the producer and the receiver and that the listener makes direct contact with the mind of the artist (Deryck Cooke 1959: 19). The notion of this sort of communication can be represented with the following schema.



Though my thinking is a lot closer to Jean-Jacques Nattiez's approach¹, considering communication to be just a possible result of a constructive activity that involves both the composer and the listener. Following Nattiez (1990), the traditional schema of communication can be reformed to account for the interpretant's contribution.

¹ Nattiez draws from Jean Molino's semiological theory.



In this model the artwork is a result of a complex creative process (*poietic*) and is not simply an intermediary in the communication. Nattiez understands the *poietic* to be all the components that go into the work's material embodiment. It relates to form and content. At the same time a musical work provides the stimuli for a complex process of reception (*esthesis*) that reconstructs the 'message'. The *esthesis* can be understood as being a 'description of perceptive behaviors within a given population of listeners'. That is, how an aspect of sonorous reality is captured by the perceptive strategies of a particular audience (Nattiez 1990: 92).

The important aspect in Nattiez's semiotic approach is that the two processes (*poietic* and *esthesis*) do not necessarily correspond, and in practice rarely do. Even conscious structures applied by the composer can be very ambiguous at the listening level. The mental schemas of the composer, embodied in the musical work, may be perceived in an entirely different manner by the listener, who may have a completely different idea about the work's meaning and structure, not necessarily coinciding with the composer's intentions.

These are well known issues in the theory of semiology, but are often ignored amongst composers where a possibly romantic attitude is present, believing that the musical work carries an explicit message which is conveyed through the performance. I reckon that by adopting a normative position we neglect the constructive feature of 'musical communication'.

One cannot examine music without taking into account a) the immanent configurations of the work, b) the procedures that relate to the act of composition, c) the procedures that relate to the reception and interpretation of the work. Categories b) and c) correspond to the analysis at the *poietic* and *esthesis* level as defined earlier. In other words, an analysis that focuses on the investigation of the conditions surrounding the creation and

reception of the work respectively. Category a) corresponds to the conventional structural analysis that tries to reduce the musical work to its basic properties and is called analysis at the *neutral* level. If we are to understand a musical fact then all three dimensions should be taken into account².

I shall not be returning to semiological issues within the thesis. I have briefly touched upon the theory in order to demonstrate the different circumstances under which I may approach the compositions through the written text. In the following chapters, depending on the nature of each individual piece, I may focus more or less on a particular level. The commentaries are not intended to be an in depth analysis within these categories. In each case they usually describe some important features, touching upon the *hows* and *whys* of the creative process. On the other end, I do not attempt any perceptive evaluation of my music; I could only speculate what is happening at the listening level from the audience's perspective, hence I refrain from commenting explicitly.

I have to be sincere and acknowledge that during these years of music making I have found no faithful answer as to the reasons why I am compelled to compose. I can only naively say that I would probably feel less happy if I was doing otherwise. For the time being, I have no real intention in trying to convey concrete ideas with music, being aware of the difficulties that are intrinsic in the communicative process. I do not wish to imply that I am uninterested in the social dimension of music; on the contrary, I am indeed very much concerned about the impact it has on people. I just believe that the musical syntax has a very different semasiology than that of the human language. I can only present the music, describe my intentions and proceed to examine my own actions as part of a culturally biased behavior within society.

² 'The essence of a musical work is at once its genesis, its organisation and the way it is perceived' (Nattiez 1990: ix).

Personal motivation on musical research

Realtime approaches to either compositional or performance issues have a particular, but not exclusive, place in my research. I am interested in exploring alternative ways to communicate with the computer by using some kind of gestural information and to construct software patches that allow for human-machine interaction in realtime. Though the aim is never to build a complex behavioral model without any reference to the musical structure. I am always thinking musically while using dedicated tools to help me realise particular ideas. In this fashion the goal is how and in what terms a specific tool, be it a gestural interface or some lines of code, can facilitate the narrative and the unfolding of a piece.

In my music I am driven by the actual quality of the soundworld and in this sense I am indeed interested in ‘beauty’, possibly contrary to what I might have implied earlier when discussing musical semiology. My motivation to compose may spring from an intuitive reaction to an unconscious impulse, or can rely on an intentional decision to explore particular compositional systems and machines by investigating the use of novel technology in different forms of composition. The portfolio mostly contains works that fall under what has come to be named as computer-generated-music.

For the realisation of a musical work I find no problem in using standardised³ software. The only issue is how flexible the working environment is and the extent to which the software’s design may constrain imaginativeness. Since most commercial products offer few degrees of freedom I am particularly inclined to use custom-built tools⁴. Additionally, there is little value in simply composing with the sole aim being the demonstration of new machinery. I find more interesting the process of examining the different ways a work can evolve through the use of technology and continue to explore aspects of structure, narrative, drama and identity as well as notions relative to growth and expectation.

³ I imply any kind of software that has been designed to carry out something very specific, without allowing the user to work outside of a predefined workflow.

⁴ The SuperCollider programming language seemed to be a beautiful choice for many of the works.

My last words before embarking on the analysis of my own music: I regard composition on the one hand as a playful process and on the other as a means of understanding. With every technological shift there is a change in the way in which we think and create. Yet, at the listening level, technology and theoretic modes do not matter. What is important is only the lived experience of music.

I. Mixed Genre

Chapter 1. Causality, fusion & contrast

Ataxia	marimba, percussion, electroacoustic sound/sensors [& images]
Duration	ca.11:30
Commissioned	Daniella Ganeva
Premiere	Percussive Arts Society International Convention (PASIC), Texas, U.S., 11 Nov. 2006

1.1 Entry

*Ataxia*⁵ comes chronologically first amongst the pieces created for the portfolio. Even though its compositional concerns date back to an older period, it contains the seeds for a much more elaborate exploration which was carried forward in the subsequent works. In this respect it functions as a starting point for the analysis.

The current piece is a mixed work making use of instrumental writing and electroacoustic sound, incorporating also video-playback and a computer-driven system that allows for realtime interaction between the performer and the sonic material. I am primarily interested in investigating cause and effect relationships between the two spheres, instrumental and electroacoustic, the focus laying mostly on the impact of the former to the later. I look at strategies to achieve fusion and contrast between the two and to a lesser degree I touch upon the issue of interaction between the physical gesture of the performer and the resulting sound.

The text that follows adopts a conventional utterance, since it deals with known issues in the electroacoustic literature.

⁵ The whole project that involved the production of a series of concerts for marimba, live electronics and images was carried forward through mutual collaboration with Julio d'Esquivan (composer), Daniella Ganeva (instrumentalist) and Graham Instrall (video-maker). Their contribution to different aspects of this work is substantial.

1.2 Rational behind the project

There is possibly a widespread belief amongst composers that the resources available for sound manipulation in the studio are far greater than the tools aimed for live electronics, or at least that the quality of spectral transformations taking place in realtime cannot be compared to the endless possibilities existing in the studio environment. *Ataxia* sprung from this reasoning which I thought to hold then.

When working within the so-called *mixed*⁶ idiom, it is useful to think in terms of fusion and contrast between the two components. Menezes⁷ (2002: 308) defines fusion as ‘the stage in which one deals with a “transfer” of certain sound characteristics from a sound sphere to the other’. Indeed, the interaction between instruments and electronics is often based on fusion and composers have long used sound *transformation* techniques towards this direction in order to articulate musical gestures. Trevor Wishart (1994: 109) has written that ‘...a musical gesture depends on establishing audible relationships amongst sound materials’ and one of the aims is ‘...how these relationships may be developed to establish larger scale musical structures’. Because transformation is a sort of progression, a transition from one state to another, it is thought to provide a means for the listener to follow the piece. Its origins date back long before contemporary music and has been used in instrumental writing for centuries. I am commenting specifically on transformation because this concept, even though quite vague, plays an important structural role in *Ataxia*. One of the concerns lays precisely on creating source-cause ambiguities between the instrument and the electroacoustic sound, in other words, to prompt the listener to think that the acoustic instrument is responsible for generating a direct impact on the electroacoustic domain⁸.

As early as 1993 Smalley (1993: 293) used the term *instigated transformation* to describe exactly the situation where a physical instrumental gesture ‘appears to provoke (electroacoustic) consequences which go beyond the acoustic boundaries of the

⁶ I shall be using this term to refer to the format of pieces incorporating both instrumental and electronic resources.

⁷ Also in Menezes (1998: 15).

⁸ Here I am only describing my intensions without touching upon the issue of perception.

instrument (voice)'. Later (1997: 110) he introduced the known term *source bonding* to refer to the 'natural tendency to relate sounds to supposed sources and causes, and to relate sounds to each other because they appear to have shared associated origins'. These concepts are principal in understanding the underlying logic that runs through the spine of this chapter. In *Ataxia* I often rely on this 'natural tendency' to link the electroacoustic effect to the instrumental source by making use of specific sound-design techniques. Below I proceed to demonstrate the poietic process in more detail based on the previous discourse.

1.3 Compositional method

In order to merge the instrumental with the electroacoustic some kind of spectral transfer from the one to the other is desirable. Therefore the source material from which the transformation begins is of great importance. While working on fixed media it makes sense to use sound material that share similar spectral characteristics with the acoustic instrument in order to achieve fusion. In general, the more distant the departing sound is, the more the 'perceived' contrast between the instrument and the electronics. Though clearly this will always depend on the signal processing and the way the materials are juxtaposed in the piece. It is only reasonable to assume that by starting with sounds that originate from the actual instrument it is more plausible to develop a homogeneous soundworld than with dissimilar material⁹.

For the current work, prior to making any structural plans, I worked towards constructing a sampler with sounds derived from the acoustic instruments. This process involved sampling the marimba note-by-note with three different dynamics (*p*, *mp*, *f*) in order to create a faithful virtual representation of the original. Additionally, a sound library consisting of musical gestures performed on various cymbals was built. Both the marimba and the cymbals sampled were the same exact instruments used during the performances. In this manner it was thought to be easier to achieve fusion since the

⁹ See Menezes (2002: 308) for more on this.

spectral characteristics of the instruments would be inherent in the resulting electroacoustic textures.

The marimba-sampler facilitated the compositional process by providing the opportunity to practice ideas by means of a midi-keyboard and to obtain aural feedback not only of the instrumental part but with the electronics and ultimately of the piece as a whole. Allow me a brief parenthesis: I mentioned in the introduction that in order to compose I am always driven by the actual sound quality: be it an acoustic instrument, a software synthesiser or more complex signal processes. In this respect I need to be able to have a faithful representation of the final outcome while working in the studio. I have often felt sceptical with a compositional practice that results in the creation of an electroacoustic part in isolation from the instrumental, without the composer being able to judge how the two can go along together. Though many would put together a score and afterwards construct an electronic counterpart separately with the hope that the two will mingle well during the performance.

The issue of having aural feedback is particularly important in mixed and open works. How can a composer attempt any modifications during the different stages of the composition if he/she is unable to appreciate the quality of the sounds? How deep is his/her aesthetic approach influenced by the inability to experience the soundworld as a whole? How does this influence the work's development? Surely in the case of pure instrumental pieces a well-trained composer can achieve a certain amount of consistency with a conventional score. On the other end, an acousmatic composer is able to filter-out the element of performance¹⁰. Yet, in mixed pieces the inability of the composer to have aural feedback may result in the loss of control upon the sonic material and ultimately upon the entire musical structure. I believe this to be a central issue which acquires even more importance when dealing with works that incorporate live electronics. I deal especially with this subject in the following chapter.

¹⁰ I refrain from expanding on a discussion about diffusion practice.

So, closing the parenthesis, the marimba-sampler provided not only an elegant way to experiment with the instrument and its color, but often offered the source material for the electronics. The computer realisation of the percussive part provided an adequate representation of the performance¹¹, while functioning as the departing sound for much of the electronic gestures. In order for the electroacoustic sound to spring naturally as a spontaneous transformation of the instrument, certain ‘key’ notes and phrases of the computer performance were initially exported to individual soundfiles, manipulated and afterwards placed in the score at the contentious moments.

This process was easily applicable and in practice proved to work well, since the tape part does not comprise of a single soundfile which is played-back on top of the instrumental performance, but consists of individual files (Cues) triggered in realtime by means of a foot-pedal. In this manner the electronics can be thought to function as an extension of a particular instrumental gesture, for it is the spectral characteristics of a particular instrumental gesture that have been modified and transferred to the electroacoustic domain.

So much for fusion; the previous approach is not exclusive in *Ataxia* and even though working with the actual sounds of the acoustic instruments in the studio does help in retaining some spectromorphological qualities when moving from one sphere to another, sometimes it is more suitable to use other sound material if a more obvious contrast is needed¹². Even if fusion helps in creating a sense of cohesion between the instrumental and the electroacoustic, it is through the binary opposition of the two (fusion and contrast) that the piece hopefully evolves in a more interesting way. In §1.5 I exemplify this in more detail while dealing with the structural aspects of this work.

¹¹ On the support media I have included a computer realisation of *Ataxia*’s first figure as an example. This version was initially handed to the performer along with the score in order for her to have a grasp of the instrumental score in conjunction with the electronics.

¹² There is no such thing as true independence between two musical events anyway, since by ‘placing them together in a musical context confers connection upon them’ (Smalley 1986).

1.4 Notation

The piece is scored for a single percussionist mostly by using standard notation. The electroacoustic part has no graphic representation or other information to describe the spectral evolution of the sounds. Instead, there are a series of number-boxes below the marimba stave denoting the relevant cue to be triggered by the performer. This is a conscious choice and was jointly decided with the instrumentalist. The idea being to create a score where only the absolutely necessary elements are depicted, since the performer would have to perform over a number of different instruments and the layout ought to be clear from a distance without redundant indications. This is also the reason why there are very few legati curves.

Figure C is scored differently than the rest of the piece. It is a guided improvisation that calls for a more imaginative reading than the other figures. In this case the performer is free to interpret the score according to her taste by following the suggestions provided and shaping a personal aesthetic approach. It should be viewed as a set of possibilities appealing to the initiative of the performer and not as a definite ‘finished product’ to be approached as such. This is interesting because in a way this figure contradicts the idea of causality as being an important concern of the piece, reaching the notion of the so-called ‘open work’: A work that is incomplete, open to interpretations by individual performers where ‘every performance explains the composition, but does not exhaust it’ (Eco: 1989). I have often gravitated towards systems that allow some unpredictability in the route of the performance, thus, having the option of moving forward in more than one direction and opening up possibilities I was unable to foresee. I am discussing this issue briefly at the final chapter when analysing an interactive installation for painting and sound. For now, it is only appropriate to say that even though *Ataxia* is a well-determined composition in many respects, it leaves some freedom to the individual performer to hopefully enrich (or maybe unfortunately diminish) with her own ideas the realisation of the piece.

1.5 Overall form and structural aspects

The piece comprises of 5 figures. Below its overall structure is depicted along with the duration of each movement.

Audio	0	ca.2'40"	ca.4'50"	ca.8'10"	ca.9'27"	ca.11'30"
	Fig. A Fast centre of harmonic gravity Exposition	Fig. B Slow harmonically stable Drones	Fig. C Varied percussive Guided Improvisation	Fig. D Ad.Lib harmonically unstable Sensors	Fig. E Fast harmonically ambiguous Recapitulation	
Bars	68	95	100	117	136	

Figure 1. Overall structure | Ataxia

The instrumental part was composed in a more or less improvisatory manner and in most cases preceded the electronics, as it regularly provided the source material for the tape. For example, at the opening of the piece, in Cue-1, the first chord (A-flat, E, F, E-flat) was performed on two different samplers, the original marimba one and that of a prepared piano. The resulting soundfiles were then manipulated further in order to provide a rich harmonic block lasting for 25 seconds upon which the first 12 bars of the instrumental part are superimposed.

The musical score shows the opening of the piece. It features two staves: Marimba (top) and Mar. (bottom). The Marimba staff begins with a 'Stand Still ca. 7sec.' instruction, followed by a triplet of notes (A-flat, E, F) marked *sf*. The tempo is indicated as 'A Tempo/ Mechanically con fuoco'. The Mar. staff starts with a 4/4 time signature and a *mf* dynamic, playing a rhythmic pattern of eighth notes. The Marimba staff continues with a triplet of notes (A-flat, E, F) marked *mf*.

Figure 2. Opening | Ataxia

These bars can be thought to have a centre of harmonic gravity. By this I mean that without an explicit tonal centre existing, there is still an underlying harmonic feel. The

initial dissonant¹³ chord gives immediately its place to a rhythmic pattern around G that gradually increases tension by adding a minor 2nd (F#, G) for the right hand and a major 2nd for the left (F, G). These intervals expand to opposite directions, arriving on bar 9 at a new centre of harmonic gravity (C, G, F#, B) and joining again on bar 11 just before the ‘cadence’. At this point, both the instrumental and the electroacoustic part move together towards the end of the musical statement. It may be instructive to see what is happening in the first 5 cues as an example on how the piece works with the electronics.

After the very first cue, which provides the harmonic background until the resolution of the phrase at the end of bar 12, for the most part the following cues comprise of percussive sounds with sharp attacks, aligned to the strong marimba hits. A careful listener might identify that the source material of Cues 2-5 are very distant from the timbre of the instrument. These sounds work in parallel with the instrumental part but with a very distinct color, demonstrating an increase in the dynamic and spectromorphological complexity while reaching Cue-5 when the tension resolves. This process is indicative and shows how the piece progresses through the opposition of fusion and contrast. Similar structural approaches are to be found throughout the work.

Figure B is built around C-minor. The long drones on the electroacoustic part (constructed from various samples of the instrument) and the harmonic tremolos on the marimba provide the chance for the listener’s ears to rest before the oncoming improvisatory movement. The electronics sustain the background for the instrumental harmonies. Cue-19 though is different. Here the soloist’s playing has a direct impact on the electroacoustic domain, or to be more accurate there is a more profound ambiguity regarding the true nature of the electronics: The performer initiates an electronic texture of marimba attacks that start from the same note as the one played on the instrument (D). These attacks drop in pitch and density as the gesture dies out. The affinity between the instrumental gesture and the resulting electroacoustic sound exemplifies the immediate cause and effect relationship that often exists between the two domains.

¹³ The word ‘dissonance’ is used only to emphasise the juxtaposition of a colorful chord with respect to the ‘monophonic’ pattern that follows.

Figure C is the improvisational section. The previous well-defined figure is followed by this loose percussive section providing the opportunity for the performer to demonstrate her skills. Structurally it functions as an intermediary and I have already commented on this in §1.4.

In figure D, Cues 24-26 demonstrate again the same cause-effect logic, while the sensor costume functions as an extension of the instrument, allowing for realtime manipulation of the pre-constructed sounds. Bars 104-107 are stochastically generated pitches and create a contrast with the one-note melodic patterns that are broadly used throughout.

The final figure E is a recap of the initial 'theme' without substantial electroacoustic elements and relies on the virtuosity of the performer. The piece ends after 32 cues with a sound transformation to a sea wave.

1.6 The human-computer interaction

Apart from investigating cause and effect between the instrumental writing and the electronics, another concern of *Ataxia*, yet to a far lesser degree, is the performer-computer interaction. I have always found interesting the idea of allowing the instrumentalist to have physical control over the sound material. As Blaine and Fels (2003: 130) have pointed-out 'most computer-based instruments do not provide direct means for audiences to see how players' gestures affect the music and instead rely upon indirect means, such as explanation of the interaction or visualisation'. In the current piece the theatrical aspect of the sensor-costume plays a role, but the purpose is not primarily visual. It is a means to go beyond the standard format for mixed pieces by taking into account the actual movements of the performer and to consider how this can affect a musical gesture.



Figure 3. **The A/D convertor attached on the performer's waist | Ataxia**

The sensor-costume was entirely finished after the completion of both the instrumental and the electronic part; consequently its implementation did not influence the compositional process deeply. The system consists of two 2-axis accelerometer sensors (measuring tilt) attached on the performer's wrists, an A/D¹⁴ convertor receiving the information from the sensors and a Max/MSP patch that maps the data to sonic processes. The left hand is responsible for diffusing the sound in a quadrasonic format simply by moving the wrist in a two-dimensional plane and the right hand is responsible for adding reverb and altering the speed/pitch of the soundfile.

With this simple architectural design the physical world of the instrument is linked to the virtual. The system grasps the movement of the performer and uses it to add a layer of control over the electroacoustic sound by allowing for realtime manipulation of the pre-composed elements. Even if the current system is not particularly complex, it requires considerable effort in order to learn and appreciate its capabilities and limitations. Part 3

¹⁴ Both STEIM's JunXion board and Dan Overholt's CUI were tested.

of the thesis looks specifically at issues relative to the human-machine interaction and the use of physical controllers. Hence, I shall not expand on this subject for the time being.

1.7 Images

The visuals function only to complement the music and are optional. So far the piece has been performed with two different sets of moving images that correspond to two different ways of implementation. On the supporting DVD exists a live performance by Daniella Ganeva at the Cambridge Music Festival. In this particular case the Jitter patch simply plays-back Caroline Bem's pre-constructed footage. The video is triggered on specific cues along with the respective soundfiles by means of the footpedal. A different version (not included) utilised a video-player programmed by Julio d'Escrivan along with footage by Alan Frank. In this case there were always images projected on the screen that looped between specific points if the instrumentalist failed to arrive on time for a specific cue.

1.8 Observations

Proceeding in an evaluation of an artwork is a pretty oracular process and I am definitely biased already in trying to substantiate my own work. Nevertheless, I can still attempt some remarks.

Regarding causality, the piece hopefully establishes audible relationships between the instrument and the electroacoustics. The intention is not to create doubts concerning the nature of what the audience is listening and to fuse the marimba with the electronics; at least this is not always the condition. The tape part often gains autonomy and builds textures without the intervention of the live performer. It is through the opposition of the acoustic with the electroacoustic that the piece progresses, often keeping some features unchanged and altering others.

The instrumental part has a strong rhythmic¹⁵ element and often seems to incorporate patterns that gravitate around a single note. This approach is to be found in all my mixed works and is exemplified more in the following two chapters.

The sensor-costume adds an additional level of interest to the work, yet its implementation mainly provided the background knowledge for more in depth explorations in the future. In the next chapter I proceed to examine aspects of live interactivity in the computer-composer and computer-performer situations.

¹⁵ I regard that many contemporary composers still view repetition as a disease, especially within the serious institutions. As Emmerson (2008) observed ‘Stockhausen rejected periodicity as a reflection of synchronised marching [...] while Trevor Wishart heard regular repetition as the metaphor for an industrial machine and hence imprisonment of the human body and spirit [...]’.

Chapter 2. Live interactivity

Πλάγιος Β'	kanun & live electronics
Duration	ca.8:00
Premiere	Sonic Arts Research Centre, Belfast, N.I., 7 May 2009

I embark on the discussion about live interaction by carrying forward the arguments presented in §1.3. There, I questioned the compositional practice that yields an electroacoustic part which is created in isolation from the instrumental score in the case of mixed pieces. I also argued that the potential for the composer to have aural feedback during the compositional process is of great importance especially in the case of mixed works incorporating live electronics.

The current chapter comments on *Πλάγιος Β'*¹⁶ (Plagios Beta), a work for kanun and live electronics running on the SuperCollider programming language and examines issues relative to live interactivity both from the composer's and instrumentalist's perspective.

2.1 Computer-composer interaction

For a composer the word *interactivity* would possibly be linked to a technology that accepts some kind of input from the instrumentalist and responds accordingly based on pre-constructed schemas. In this section I am primarily interested in the interaction between the composer and the material during the compositional process. I proceed directly to describe the poietic process of *Πλάγιος Β'* and attempt any comments that relate to the subject along the way.

Πλάγιος Β' shares few compositional methods with *Ataxia* but elaborates more on the electroacoustic part which is generated almost exclusively in realtime during the performance from the sound of the kanun. To begin with, the kanun was sampled note

¹⁶ I am grateful to Sofia Lampropoulou for her trust and effort in performing and recording this work.

by note with different dynamics and a sampler instrument was made that allowed (as in *Ataxia*) for a faithful representation of the acoustic instrument. Kanun is non-tempered and it was sampled every $\frac{1}{2}$ a semitone, allowing for more timbral possibilities than the tempered system, which was still considerably less than what the instrument can offer¹⁷.

Since the electronic part is generated live I needed to have a system that could simulate a performance scenario competently in order to be able to monitor the piece's progress and act accordingly. That, would not only guarantee a musical work closer to my intentions, since I would be able to adjust both parts by attempting corrective changes, but also prevent errors that could emerge during the performance, possibly due to computational errors. In this manner the piece would be continuously tested while being built. It is of no secret that the main reason for computer crashes during the presentation of live works is the insufficient time for testing. Because Murphy's law for composers has it that 'if something can go wrong, it will go wrong during the performance', I decided to avoid turning a dress rehearsal into a troubleshooting session by working in an environment that allowed me to rehearse things beforehand. For this reason it is instructive to describe the system, for it has proven to be fruitful in many respects. Its setup is illustrated in figure 4.

The kanun sampler runs within a sequencer program. The instrumental part is assembled and depicted as midi data and the audio is fed to another computer¹⁸ for processing running SuperCollider¹⁹. In the sequencer an additional midi track is used whose only job is to send midi values to the second computer. A routine within SuperCollider looks for a particular midi value (127) in a designated channel and triggers bundles of code through a simple Cue-player.

¹⁷ Ordinarily a kanun allows each semitone to be divided into 6 commas.

¹⁸ The same setup can be realised using only one computer by re-wiring the programs together. I have found it a lot easier to work in parallel with two different computers at the same time, one dedicated to the instrumental part and one to the electronics.

¹⁹ In the developers' words 'SuperCollider is an environment and programming language for realtime audio synthesis and algorithmic composition. It provides an interpreted object-oriented language which functions as a network client to a state of the art, realtime sound synthesis server. SuperCollider was written by James McCartney over a period of many years, and is now an open source (GPL) project maintained and developed by various people.' <http://supercollider.sourceforge.net/>

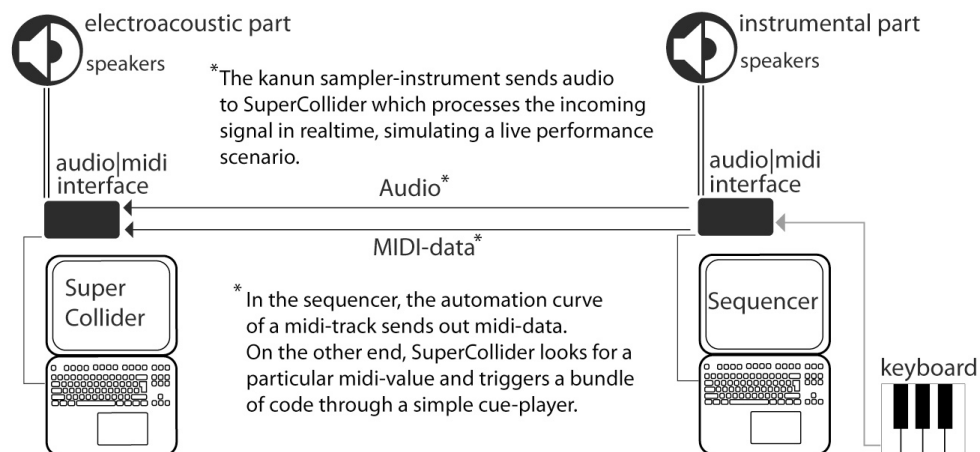


Figure 4. Πλάγιος Β' workflow environment | Πλάγιος Β'

All the processes happening in the piece are divided into cues similar to the approach followed in *Ataxia*. Only this time, instead of triggering a soundfile the Cue-player evaluates lines of code, manipulating in realtime the audio of the kanun. The midi track used to trigger the individual cues simulates the footpedal, while the virtual sampler the acoustic instrument. In this manner we are able to lay out the piece on the computer screen and practice processes with comfortable accuracy regarding timing and timbre. This design overcomes the adversities of working in an environment where no aural feedback is available, leaving the composer to the mercy of chance, particularly when building the electronic part. It also fights programming drawbacks since the code can be tested sufficiently and minimises the risk of losing valuable rehearsal time for debugging purposes. I find that the value of the approach lies especially on the responsive nature of the setup, allowing the composer to interact with the material fast, freeing time for the exploration of sound and the musical narrative.

Every instrument, technology or system, inevitably imposes some constraints on the compositional process and it is often interesting to explore creatively these limitations. My concern is the extent to which a composer is willing to let his/her creativity be restricted by technological shortcomings. I have always been attracted by flexible systems that allow for greater control over the composition. This is why I have chosen to

work with an open source programming language instead of standardised software, which inevitably tend to push towards some sort of mannerism²⁰.

2.2 Aesthetic approach, notation and structural aspects

The kanun part of *Πλάγιος Β'* is based exclusively around the homonymous Byzantine mode²¹ that lends it a traditional flavour, apart from the obvious folkness due to the instrument itself. The intention was that the piece should approach the logic of a singsong in the style of a traditional Eastern improvisation. The piece is like a *ταξιμι*²², i.e. an introductory piece in which the instrumentalist improvises (usually within a specific harmonic environment) demonstrating her craftsmanship. In *Πλάγιος Β'* the kanun relies more on a loose gestural sounding than on concrete melodic motives.

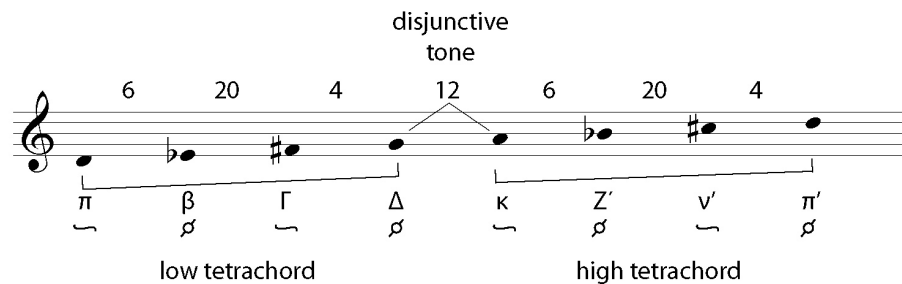


Figure 5. **Byzantine mode** | **Πλάγιος Β'**

Figure 5 shows the scale upon which the whole piece is based. It comprises of two symmetric tetrachords (D-G and A-D). Normally a semitone in Byzantine music would

²⁰ For example the widely used GRM Tools by INA-GRM have become a standard amongst composers of electronic music and possibly their usage nowadays defines a school of composition. Many of the pieces using extensively these indisputably beautiful plug-ins carry apparently the color of the same processes. I look at the identity of a musical work in chapter 5 and discuss the issue of flexibility anew in the following chapter.

²¹ In Byzantine music every scale contains 2 tetrachords, the low and the high and is divided in 72 moria, 30 for each tetrachord plus 12 for the disjunctive tone in the middle of the scale. The interval between 2 adjacent notes is called a tone and the number of moria between 2 tones defines the pitch distance between them. The Byzantine system is non-tempered and the intervals have different ratios than in western music. For example a perfect 5th in western music would be $3/2=1.5$, whereas in *Πλάγιος Β'* $(72+42)/72=1.58$.

²² *taksim* in Turkish.

consist of 6 moria²³. Hence in this scale the distance of the intervals F#-G and C#-D is less than a semitone (4 moria), therefore increasing the attraction between the two tones. Contrarily the distance between E-flat, F# and B-flat, C# is somewhat more than a minor 3rd (20 moria instead of 18), thus increasing the tension.

Even though the piece is scored using standard western notation, a kanun player would most likely pass byzantine elements intuitively for embellishment. In the piece there are no explicit indications regarding the use of microtones. These are left to the discretion of the performer. In fact, the entire kanun part can be interpreted freely. A more loose approach would probably yield a better result. The instrumentalist is more or less exhorted to perform a *ταξίμι* by adapting to the score, while drawing from her own musical vocabulary.

Πλάγιος Β' consists of 5 figures, but these are only marked in order to denote a change in mood or for rehearsal purposes. Its overall structure can be seen in the following figure.

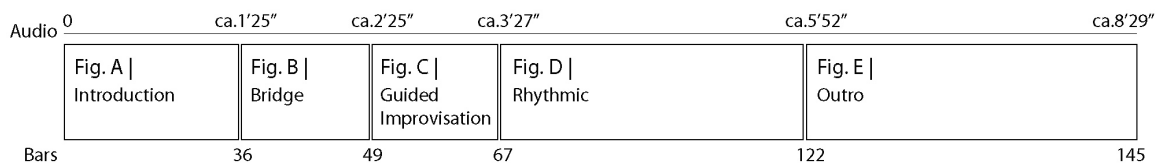


Figure 6. Overall structure | Πλάγιος Β'

Figure C has a similar function to the middle section of *Ataxia* and urges the performer to improvise on the given structure. In this passage, an excerpt of which is shown in figure 7, the note G is the centre of melodic gravity and the rest of the notes can be thought as deviations from an equilibrium point.

²³ Moria (μόριο [singular]=molecule) could be thought as the metric for microtonal subdivision of the intervals.

4 53

Comp.

Καν.

Συνεχίζεις παρομοίως. Κράτησε έναν εσωτερικό παλμό.
 Η διάρκεια των φθόγγων είναι ανάλογη της απόστασης μεταξύ τους.

55

Comp.

Καν.

accel. SubJ = ca. 65

sf

mf rit.

Figure 7. **Bars 53-56 | Πλάγιος Β´**

The persistence with a single note is a structural device I often use and in this case it is underlined with the respective use of electronics. Cue-15 marks the beginning of the figure. Within SuperCollider the live signal of the kanun is passed through an ‘IF-statement’ that chooses between two different processes (figure 8).

The algorithm initially searches for the existence of pitch: if a pitch is found the audio is sent through a series of granulators; if it is not, the signal is passed to a pulse wave generator. These two distinct processes behave like an On/Off switch while accompanying the instrumentalist’s improvisation, who also imitates this Boolean logic gravitating around a single note (True=G, False≠G). During the improvisation new granulators are launched at different rates (pitches) resulting in a dense noisy texture resolving on Cue-17. find

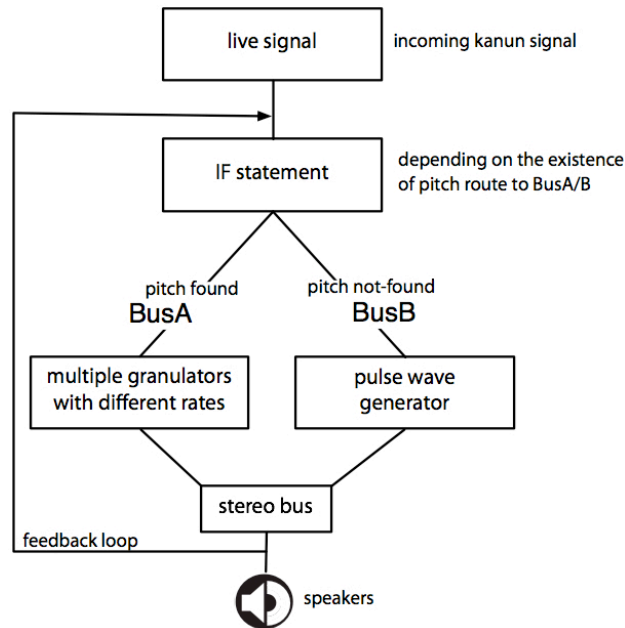


Figure 8. Schematics of the SuperCollider code in Figure C | Πλάγιος Β΄

The subsequent figure D has a strong sense of pulsation. The bars of small ratio (e.g. 1/16, 1/8, 3/16) found throughout the score drag the rhythmic feel out of tempo and are aimed to be interpreted loosely. The electronics construct a harmonic background by triggering grains of audio sampled from the kanun at specific moments. These long evolving envelopes, built from multiple granular synthesis engines, function like a pedal upon which the kanun part develops.

Even though there is no straight recapitulation in the piece, since that would place it structurally closer to an ABA form, still, the last figure contains similar material as the first one. In fact figure E is actually a retrograde of figure A as can be seen in figures 9 and 10 taken from the beginning and end of the piece.

Figure 9. Bars 9-19 | Πλάγιος Β´

Figure 10. Bars 126-136 | Πλάγιος Β´

2.3 Computer-performer interaction

Let us change perspective and look at the interaction between the performer and the electronics by examining whether the system applied in *Πλάγιος Β´* provides a means for active engagement. Allow me a few preliminary remarks on the subject: Technology is not intuitively applied to the skills of a traditionally trained musician. It is understood that the acquaintance a composer may have with his/her machines and processes cannot be compared to that of a performer. In practice this unfamiliarity with the machinery, the often-encountered technological difficulties (such as computer crashes) and the

concentration of the composer on the electronic part at the expense of the interaction with the instruments, make many mixed works uncomfortable to the performers, resulting not only in poor performances, but also in problematic collaborations between composers and performers. I think that it is not unusual for the performers to feel unable to engage with the music due to technological shortcomings or because the design of the piece does not allow sufficient freedom for expression²⁴.

Consider the following hypothetical rehearsal scenario that Puckette and Settle envisaged as early as 1993:

The composer, who usually arrives in town a day or two before the performance, must first assemble the combination of local and flown-in gear which will permit the piece to be played. If time remains, the piece is rehearsed and adapted to whatever hardware changes were made. It is at this moment that the player meets her accompanist, or even encounters the instrument that she will operate for the first time. A new version of the piece is put together. The software is modified and recompiled, pedals are added and deleted, and a playing style is developed which is compatible with the requirements of the performance monitor (score follower, input parser etc.), and the specific effects box, microphone, or other element in the audio chain that was changed in the previous step. [...] Sometimes microphones and other detectors are attached to the performer's instrument. Part of the rehearsal is taken up by an extraordinary soundcheck in which sound engineers push the outputs all the way up to listen to hisses and hums. For the above reasons, the performer cannot move while this is being done. The computer software and hardware extend the soundcheck into a debugging session. The computer is rebooted again. Will it work this time?
(Puckette & Settle 1993: 136).

This description viewed from the performer's perspective is terrifying and it is even more embarrassing if we consider that it is more or less a typical scenario even today more than 17 years after these lines were written. The design used in *Πλάγιος Β'* tried to avoid this situation and to enhance the instrumentalist's role so that she does not feel an accompaniment to the electronics.

²⁴ See Riikonen (2003) who interviews three flutists that have performed Saariaho's NoaNoa and discusses their opinions.

In particular:

- i. By constructing an initial computer realisation of the instrumental and the electroacoustic part the performer can have a reasonable idea of the electronics and what to expect.
- ii. Using only a simple footpedal minimises the insecurity that a traditional performer may have with technology.
- iii. By using cues the instrumentalist is not chained to the electroacoustic part, having a certain amount of freedom between the moments of strict coordination.
- iv. Direct consequence of the above is that the instrumentalist has some control over the flow of time and avoids the rude click-track. McNutt (2003) has beautifully written that ‘for the player, performing with fixed accompaniment is like working with the worst human accompanist imaginable: inconsiderate, inflexible, unresponsive and utterly deaf’.
- v. By using mostly the instrument’s sound as a source for the live electronics the performer has control not only over the timbre of the electronics but of the dynamics as well.

There is plenty of literature around the field of live electronics in computer music, both for and against²⁵. My opinion is very close to McNutt’s in that the notion of interactivity in mixed works is important and should rely not on the adjustment of the performer to the computer, but rather the other way round. From my perspective the medium of a composition is not the main issue. I am more interested in the structural values of the work, its soundworld and identity. I would rather find an elegant way to enable the performer to engage with the music than neglect her.

2.4 Synopsis

In *Πλάγιος Β'* I have acknowledged the folk color of the instrument and tried to retain it. The exploration of timbre is not so much of an issue in the acoustic domain as it is in the

²⁵ Even Risset (1999) has been skeptical in the past about the use of realtime systems in computer music.

electroacoustic, where still the timbre of the instrument is usually identifiable. The work is actually the first one realised by utilising almost exclusively realtime electronics within a programming language. The working environment²⁶ has proven to be stable and sufficiently facilitated the composition. Hence, the same strategy was adopted to a subsequent work for live electronics and santur which is described immediately afterwards.

²⁶ Before arriving at the setup described in §2.1, I experimented in various ways trying to come up with a system that would combine the flexibility and processing power of SuperCollider with the graphic environment of a sequencer. A design which was tested could map the data of individual midi-tracks (in the sequencer) to synthdefs' parameters (in SuperCollider), controlling the powerful audio engine of SuperCollider with automation curves in the sequencer. Even though this design proved to work adequately I decided to opt for the simpler strategy described in chapter 3.

Chapter 3. Compositional strategy for thematic evolution

το Χάος!	santur & live electronics
Duration	ca.10:00
Premiere	Sonic Arts Research Centre, Belfast, N.I., 7 May 2009

*Το Χάος!*²⁷ (Chaos) is part of the same project as *Πλάγιος Β΄*. Both pieces incorporate traditional instruments from the East and live electronics and were premiered on the same day at the Sonic Arts Research Centre.

This chapter exemplifies a particular compositional strategy as applied to the specific piece. A detailed analysis of the theoretic mode can be found in Appendix II which examines the motivation, perspectives and deficiencies of the strategy in depth in a much broader context. The reader can either go through that analysis first and then return to the current chapter or proceed immediately to the presentation of the piece below.

In short, what the strategy suggests is that when working on the electroacoustic part, envelopes can function as motives similar to the old traditional fashion. A particular energy-shape, especially within a programming language environment, can be viewed as the common denominator around which complex gestures can evolve and group together forming higher-level structural blocks. The transformation of these shapes and their merging into an architectural whole takes after the homogeneity of traditional musical forms, yet the thematic evolution using electroacoustic techniques provides an entirely different musical utterance for the composer.

²⁷ I am indebted to Ourania Lampropoulou for her commitment and for performing and recording this work.

3.1 Extra-musical references

Before exemplifying the use of shapes with reference to *Χάος*! I would like to rely on some extra-musical experiences that have found their way into this composition.

‘Χάος’ in Greek means chaos. I am not trying to use a catchy name; there is a motivation behind the decision. In the island where I come from, in the Aegean Sea, exists a very big cave which is actually an old mine. One of the stories in the village says that the depth of the cave is so big that it meets the sea. It is a place we were not allowed to go as children, but exactly because it was forbidden, we would often go secretly and explore as much as we could and usually throw stones while paying attention to the sound they made when landing somewhere in the womb of the cave. The name of this cave is Χάος.

Χάος has always been a magnetic place that captured my imagination. It is enormous, silent and powerful. I think I have come to realise that I both love and fear it. In my late twenties I decided to visit the cave again by myself and throw some stones for old times sake, but this time carrying with me a set of microphones and a portable recorder.

In the piece the sonic material originates either from the Santur or from the recordings I made in the cave that afternoon and earlier the same day in an old abandoned residency. Both places were ‘no man’s land’ when we were kids in the village. Almost all of the DSP happens in realtime in SuperCollider.

3.2 Overall structure and the instrument

The piece comprises of three figures and is close to an ABA' form.

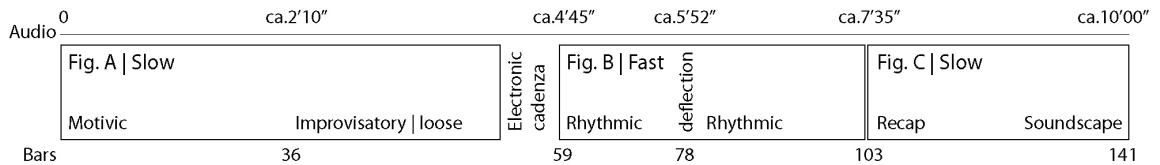


Figure 11. Overall structure | Xóος

The instrumental part starts with a short isolated phrase built around two notes (B and F#), which could be thought to be the motive. It is heard in different ways in the first figure (bars 1-30) and also returns in figure C (bars 103-132).

The middle part, starting immediately after the electroacoustic cadenza, makes use of a pulsed repetitive pattern built around a nine-note-tuplet. This figure continues to explore the one-note development idea found to a lesser degree both in *Ataxia* and *Πλόγιος Β'*, considering B to be responsible for maintaining the melodic stability and the rest of the notes to be deviations from the 'equilibrium note'.

Cue-21 at bar 78, in the middle of figure B, interrupts the development of the pulsed repetitive pattern with a pre-recorded sound of a sea wave suggesting a new direction in the work's evolution. This perceptual shift from the one unfolding process to the other is never fulfilled since the instrumental pattern resumes at bar 81. The electronic part accumulates more low frequency content as the figure moves on and gradually dissolves towards the resolution of the movement at bar 100.

In the final figure C the instrumental part returns to the initial motive which now is presented somewhat masked. The use of live electronics is more moderate and the acoustic instrument is juxtaposed with ambient recordings. Eventually all die out slowly within a quiet summer soundscape lasting 45secs.

3.3 The compositional strategy in short: focusing on the electronics

The piece utilises the concept²⁸ that an *envelope* can function as a musical *motive*. I view the shape of an envelope as a means to shape energy over time and then proceed to explore this. The entire electroacoustic part of the piece is actually based on the shape of a single envelope that I regard to be my motive. I am using one envelope, reversed, flipped, mirrored etc, but each time mapped to different parameters throughout the piece. For example the energy shape of the density of a granulator through time could be the same as the movement of the index of a pointer while scrubbing through a soundfile.

The piece also utilises the idea of ‘statement’ and ‘response’ by using envelopes. Apart from the basic envelope, which is the main motive, there exists a secondary that functions as the response, being a variation of the original. What this process yields is that time can be shaped always differently but at the same time similarly, possibly providing the listener with a means to follow the piece²⁹. At the same time, from the composer’s perspective, I am able to work a lot faster as soon as I have decided on the basic motive. Practice revealed that the piece could develop fast by intuitively assigning the shape and its transformations to different processes and reacting to the result.

3.4 Strategy applied

The performance setup of *Xáoc!* is exactly the same as the one described in the previous chapter. The performer communicates with the computer running SuperCollider with a simple USB footpedal by means of which the individual cues are triggered. Each cue-number constitutes a series of signal processing functions that manipulate the sound of the instrument, or any pre-recorded elements in realtime.

²⁸ The theoretic mode can be applicable to tape, mixed or live electroacoustic pieces. I feel that there is hopefully some value in the approach and that is why I devote some space to illustrate its logic in the Appendix. I would rather describe my findings (if any) and the know-how of a particular compositional strategy, than put together an extended commentary on the composition, which in fact I do anyway.

²⁹ The truth is that this is a rather optimistic statement and its validity is questionable. I only attempt to approach this complex issue in the Appendix.

The basic shape of figure 12 was drawn by hand using a GUI widget in SuperCollider that displays nodes at x/y coordinates and stores the values in an array. The horizontal axis is always mapped to time and defines the duration of the gesture, while the vertical axis is mapped to the desired musical parameter.

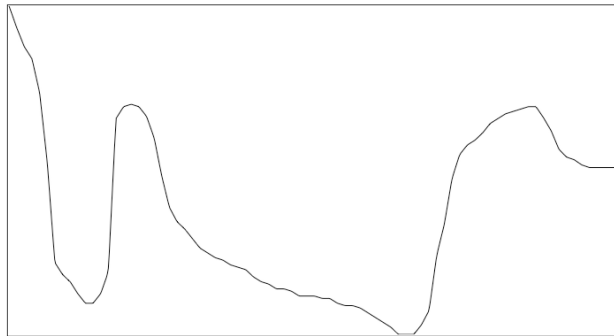


Figure 12. **Basic envelope shape | Χάος!**

In order to exemplify the use of shapes I proceed to analyse the opening of the piece. *Χάος!* starts with the pre-recorded sound of a stone thrown on rocks (ca. 3secs) granulated in realtime (Cue-1). The basic envelope is mapped to the Position of the pointer scrubbing through the soundfile, scaling the vertical axis to the total duration of the soundfile and the horizontal axis to last for 14 seconds. At the same time a secondary envelope (very similar but not identical) is applied to the Density of the grain cloud³⁰. Additional curves are also used to shape the granulator's Amplitude and Rate (pitch).

The Santur plays immediately after the first bang and replies to the granulated stones (bar 4) while the gesture concludes, reaching the end of the envelope. In Cue-2 a different soundfile (again of a stone thrown on the rocks) is manipulated using a granular scrubber, mapping anew the basic envelope to the position of the pointer. Only this time the pitch parameter is different and the timescale smaller (12 sec.), resulting in

³⁰ The Density is defined as the number of grains per second. In Cue-1 the vertical axis of this envelope is scaled to 100. If we define the Fill Factor (FF) of the grain cloud to be the product of the Density and the Grain Duration, then with a fixed FF of 6 the minimum Grain Duration of this gesture is $6/100=0.06\text{sec}$. For a thorough investigation of the Microsound see Roads (2004).

a similar but faster gesture than in Cue-1. Still, the overall energy-shape of both gestures is quite close hopefully starting to develop an identifiable shape.

The figure shows a musical score for 'Opening | Χάος!' with four cues. Each cue consists of a Computer part and a Santur part. Cue 1 starts at bar 1, with the Computer part lasting approximately 8 seconds and the Santur part starting at bar 8. Cue 2 starts at bar 4, with the Computer part lasting approximately 7 seconds and the Santur part starting at bar 4. Cue 3 starts at bar 9, with the Computer part lasting approximately 11 seconds and the Santur part starting at bar 9. Cue 4 starts at bar 13, with the Computer part lasting approximately 11 seconds and the Santur part starting at bar 13. The Santur part includes various time signatures (5/4, 4/4, 1/6, 4/4) and dynamics (mp, sf, quasi mf). The Computer part includes instructions like 'Ad Lib Sempre' and 'Γλυκά. Με αυτοσχεδιαστική διάθεση στο χρόνο'.

Figure 13. Opening | Χάος!

The Santur replies again to the electronics (bar 8) and develops the melodic material. In Cue-3 a chunk of the live sound of the instrument is recorded, stored into a buffer and passed through two granulators with different rates. The grain-Density and pointer-Position is controlled by new envelope shapes that again resemble the basic but have different endings. Both processes develop simultaneously creating a harmonic field spanning over the next 20 seconds. Even though the timbre of the gesture is very different than the previous ones, the resulting texture shares some attributes with the previous schemes.

The piece, lasting circa 10mins in total, continues to unfold linearly in this way by repeatedly applying the envelopes to various parameters providing a means for thematic evolution in an effort to establish cause and effect relations and hopefully construct memorable musical statements that can stimulate the listener's interest.

3.5 Remarks

The idea of using envelopes as musical motives might suggest a solution to the problem of unity and recognition. It could also provide a means to structure the piece in the macro-scale and help in the unfolding of the narrative. We are back to the basics but in a slightly different way.

The grouping of gestural shapes to longer phrases may also provide an alternative method when compared to more abstract electroacoustic idioms where often something happens, something else happens, then something else happens ... etc. The current approach applies a stream organising principle. The compositional issue is how can the sequential (horizontal) and simultaneous (vertical) dependencies among the layers form meaningful statements. 'Stream form' is also the subject of the oncoming chapter.

By looking back at the three mixed works presented so far the reader might have noticed that the music is characterised by the use of gestural melodic structures, yet rarely motivic. In other words the instrumental writing develops more through melody, which is the case for much Eastern traditional music, than harmony as in the West.

II. Acousmatics

Chapter 4. Kung-fu versus stream form

Kardaş	stereo tape
Duration	9:01
Premiere	Days of Electroacoustic Music, Rethimnon, Greece, 26 October 2008

Along *Πλάγιος Β'* and *Χάος!*, *Kardaş* is the third and last piece of the project involving the use of traditional instruments from the East and electronics. It was jointly presented on 7 May 2009 in the Sonic Lab as part of the 'Music at Queen's' series, even though its premiere took place earlier the year before. Contrary to the format of the two previous pieces this work is on fixed media.

The current chapter focuses on the analysis of *Kardaş* by discussing aspects of its form relative to the acousmatic idiom.

4.1 Kung-fu versus stream form³¹

krrrrats gdounnnn sat krrrrrrrrrrats krroooon sattttttt trrrrrrrrrrat sat
vzin vzoun vzin krrrrrrrrrrats gdoun wham sssssssssss ssssss
ssssssssssss ats sat vzin vzoun gdan gdin gdin - gdin - gdin -
gdin gdin - gdin din-din-din-dinnnnnnnnnnnnnnnnnnnnnnn kkaouuuuu krrrrats
gdounnnn sat
....tet - tet - tet - tet - tet - teeeeeeeeet.-

The onomatopoeia of the *acousmatic norm* often sounds like the sound FX of a kung-fu action movie. I use the term acousmatic norm to denote the stylistic approach, within the

³¹ The opposition of these two forms is a concept by J. d'Esquivan and was put forward in a personal conversation with the composer.

broad aesthetic spectrum of acousmatic music, that follows faithfully the Schaefferian tradition. The kind of concrete (fixed on a medium) music that relates primarily (and broadly speaking) to the academic community and to the serious research institutes and which is characterised by the desire to explore space and timbre above all, often at the expense of other qualities. It could be described as the form that engages with the fundamental stylistic elements of *musique concrète* using mostly standardised tools without often attempting to put the art to test.

The description of *Kung-fu*³² form is a crude simplification and in fact the previous lines do not aim to provide a definition, but to describe in intuitive terms what many people have come to observe within the realm of acousmatic³³ music. I view this form more as the dominant stylistic approach that holds the reins than a school of thought. Without doubt there can be no clear cataloguing of an artistic style and there is always a plethora of people with a distinct voice. Here, I am referring to a statistical tendency existing amongst many composers, where the notion of ‘structural complexity’ often takes prominence over aesthetic judgment³⁴.

Having said this, I wish not to embark on a critic about computer music. This would fall greatly outside the concerns of the thesis. I have gone through this reasoning in order to oppose a logic that may be slightly different and which runs through the spine of some of my compositions. This approach relies on applying a stream organising principle to the musical material. Let me define *Stream* form as opposed to *Kung-fu*: Initially I understand a stream³⁵, in musical terms, to be characterised by a continuous flow of identifiably similar material that relate to each other not so much in a cause and effect

³² Zicarelli in his keynote speech at ICMC 2001 used the term *sword fighting* to describe metaphorically a particular computer music structure which is somewhat close to what I define here as *Kung-fu*.

³³ As Francis Dhomont (1996: 24) put it ‘the term ‘acousmatic’ refers to a theoretical and practical compositional approach, to particular listening and realisation condition, and to sound projection strategies’. I would stress that it is primarily the listening conditions that make a piece ‘acousmatic’ rather the use of specific tools or the medium itself.

³⁴ Also see Milicevic’s (1998) critical article.

³⁵ According to Chambers 21st Century Dictionary stream is ‘anything that moves continuously in a line or mass’, it can be ‘an uninterrupted and unrelenting burst or succession’, a trend or tendency. Additionally, in the field of computing, according to the New Oxford American Dictionary, it is a ‘continuous flow of data or instructions, typically one having a constant or predictable rate’.

relationship, but as if all springing from the same source and moving continuously in a mass³⁶. Under this scope *Stream* form could feature multiple musical streams, exploring the sequential and simultaneous relationships among the different stream-layers.

Assuming that *Stream* and *Kung-fu* forms exist and that we can distinguish between them, then, in what sense does one differ from another? Kung-fu is often identified by an accumulation of abstract (often percussive) sound material, stripped from their sources (disembodied), which succeed fast one another in an effort to develop causal associations. The gestural aspect is regularly on the foreground and any harmonic or pulsed material function complementary to the complex³⁷ juxtaposition of the abstracted elements. It functions more in terms of ‘blocks’ possibly also due to the graphic display method that exists within sequencer programs: A recorded sound in an audio-track is depicted as a block-waveform. When composing within a sequencer software the easiest thing to do is to move those blocks around and hope that some kind of structure will emerge. At the listening (the esthetic) level I have often felt a structural inadequacy in many kung-fu pieces. As I already mentioned, ... often something happens, then something else happens, then something else, and so on... I am often induced to expect anything, but at the same time nothing at all, for all the possibilities are so vaguely open³⁸. There is a difference with *Stream* form. As soon as a stream has been presented and established, it helps in preserving syntactic continuity and its interruption is not that easy. In fact the interest may lay exactly on finding strategies to resolve and/or break the stream. There needs to be a reason why a deflection might happen, since that would yield a perceptual shift, introducing new material and distorting the flow³⁹.

Evidently, making use of a stream organising principle does not presuppose that the form takes priority over timbre. Most of my works on fixed media make use of harmonic/pulsed streams, referential/natural and abstracted sounds, each playing its role

³⁶ Inevitably this definition relates to Xenakis’ stochastic approach.

³⁷ Every idiom presupposes a different way of listening and ‘more complex musical material demands a more detailed listening mode to extract its salient features’ (Emmerson: 2001: 19).

³⁸ Certainly this is not a characteristic of a specific idiom but of the not-so-successful works regardless of the stylistic approach

³⁹ I feel that the sequential nature of musical streams facilitates especially the use of pulsed, harmonic and melodic material.

in the musical narrative. I wish not to claim the superiority of this organising principle over nonfigurative structural forms, but rather to suggest an alternative way to view and work with the material which has proven to be fruitful in my own work.

In *Kardaş* the streams spring either from sound synthesis or manipulated kanun recordings and are combined with referential sounds of human origin and abstracted elements in an effort to create a piece which is hopefully not just a collage of sound design techniques in an episodic fashion.

4.2 Extra-musical references on Kardaş

The word *kardaş* in Turkish means brother, but we use it in Greek as well to denote a brotherly friend. Most often culturally Greece is linked to the ancient times, usually to the golden age of the Athenian dominancy. For foreigners, but probably also for modern Greeks, the whole culture seems to be focused around the marbles and the ancient texts dated around 500 B.C. The truth is that the contemporary culture of this country passes through the Ottoman Empire, a fact very little discussed. It seems as if we are trying to shake off the remains of the Ottoman influence and create an idealised view where the indigenous Greek culture is only based on the ancient times, neglecting the fact that the two people (Turkish and Greek) have been living together for many years and that the cultural exchange has defined both sides. The current piece draws upon ideas from the latter context. Among others, it makes use of kanun recordings, a traditional instrument used in both countries' folk music.

Around the first quarter of the 20th century the two countries decided on a population exchange. As a result around two million people were forced to leave their land in order for an ethnic homogenisation to be accomplished. Interesting enough the piece was realised in Belfast where a dichotomy is still apparent between two 'different' populations.

4.3 Structural aspects

The core of what would turn out to form the first part of the piece was born by chance. *Kardaş* is the first work I made use of SuperCollider and at that time I was primarily experimenting with the programming language and its synthesis capabilities, looking also at ways to physically control its powerful engine. Upon experimenting, a simple program was built, allowing a midi-interface to control various parameters of sound modules in realtime and to record the output to individual soundfiles. At the heart of the design were 4 resonators of fixed-frequencies and a series of granular synthesis generators patched in a way that the signal could be re-routed to various FX units and the parameters altered by means of physical interaction from the controller. This straightforward design, which was based on sound-synthesis and is shown in figure 14, provided the initial material for the piece.

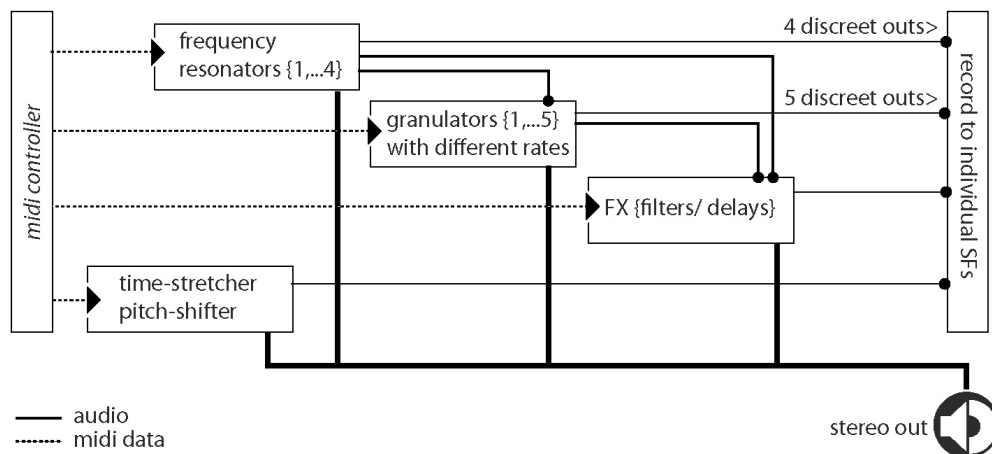


Figure 14. Flow diagram of the SuperCollider code | *Kardaş*

Allow me to deviate for a moment. With every musical work I engage, I often get attracted by something simple. It can be the timbral quality of a synthetic sound, such as in this case, a snippet from a natural recording, the soundworld of a particular instrument, the timbre of a sculpted gesture etc. I tend to find an interest in a musical molecule that sparks the creative process and proceed to explore aspects of its quality in a larger scale. It is as if I am trying to identify within an isolated moment the

characteristics that can help me built an entire musical work. That said, a piece is never restrained from this first idea. It only functions as the creative spark. To return, the ability to act on the sound and respond accordingly by using the controller influenced the development and the structural organisation of the piece. Additionally, by allowing each stream to be recorded to a distinct soundfile I was able to handle the morphology of simultaneous processes individually and control more efficiently their timbre and temporal placement during the mix.

As discussed in chapters 1 and 2, *Πλάγιος Β'* and *Χάος!* both carry a distinct Eastern flavour due to the traditional instruments and the byzantine mode used throughout. *Kardaş*, even though assembled on fixed media, shares a similar flavor. Let me briefly go through some key moments of the work⁴⁰.

The harmonic streams, mostly found in the opening and the first section of the piece, have been constructed by means of irregular excitation of the 4 banks of fixed frequency resonators with pitches drawn exclusively from an equal-tempered B-minor harmonic scale (figure 15). Each bank of resonators is a harmonic block excited at its own pace without any frequency modulation, providing a background stream for the more complex gestures.

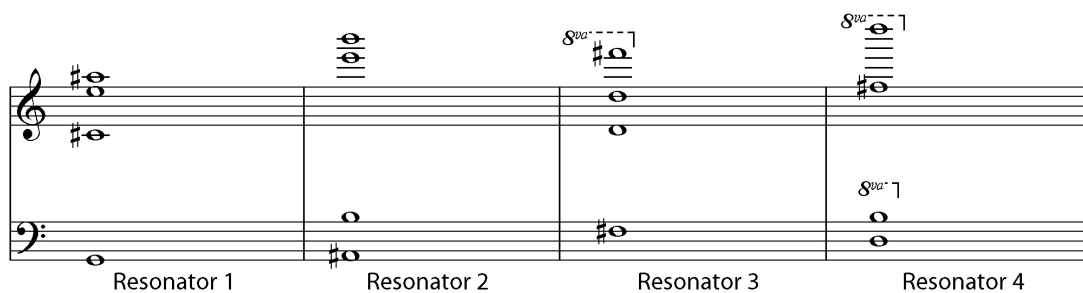


Figure 15. **Harmonic structure of the frequency resonators depicted in the equal-tempered scale | Kardaş**

⁴⁰ A loose representation of its overall structure is shown on a separate page at the end of this chapter.

After the opening which sets the mood by making use of resonant random impulses and a series of abstract material of transitional function that gradually build up [ca. 0:40-1:10], a bass hit marks the beginning of the first section [1:28]. It is immediately succeeded by a phrase of a descending minor 3rd in the low register. This material, originating from an instrumental gesture performed on the kanun, returns again transformed and at different registers at [2:48], [3:04] and in section B at [5:22], [5:42] where it finally reveals its instrumental origin. Within section A the resonant streams continue until [2:20] when a deflection breaks the flow. The environment suddenly changes. Within the next 9 seconds a quasi-folk gesture seems to emerge (again referencing the instrumental material of the third section), but is cut short anew before it succeeds to develop and reveals its identity. The syntactic process established by the use of streams possibly invites the listener to think that the flow will continue in a similar way, yet the sudden shifts at [2:20], [2:29], [2:35] provoke new hypotheses about the work's evolution.

Observe the spectrogram of the respective excerpt in figure 16. The streams are clearly identifiable as the parallel lines along the time axis. The block that breaks the flow can be seen towards the right hand side of the figure⁴¹.

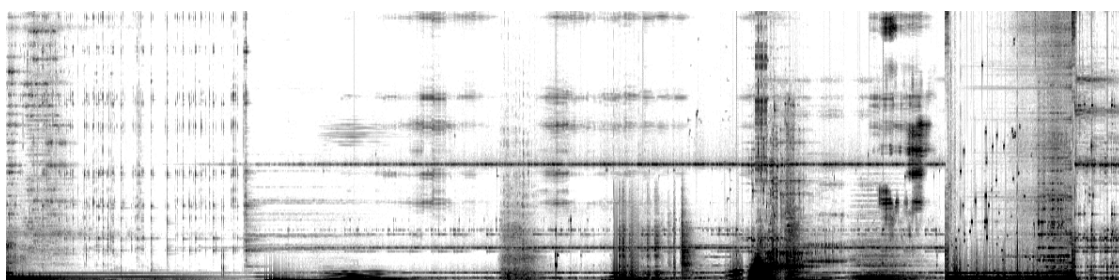


Figure 16. Sonogram (1:10-2:35) | Kardaş

The transition part starting at [3:28] with pulsed/glitch material develops quickly towards an increasingly dense harmonic texture consisting of spectral manipulations of

⁴¹ This structural logic is somewhat different to the 'bell-shape' form (the Normal Distribution Curve): Highs↔Lows, Loud↔Soft etc, instead of an instant switch between the two states.

the kanun recordings. The harmonic mass decays from [4:00] onwards until its final resolution at [4:24], when the sound of a closing door ‘shuts it outside’. This is the first time where a sound carrying an identifiable human activity is clearly exposed. Up to this point the material has been nonfigurative with little use of referential sounds and inevitably it could be argued that the door sound (apart from being a stereotype) is alien to the piece’s soundworld. I feel that the decision is hopefully justified in the sequel, as exemplified in the following paragraphs:

The fade-out of the harmonic sounds which starts at [4:00] does not simply feature a decrease in amplitude. This gesture was initially played-back from a stereo speaker setup and recorded anew binaurally with a dummy-head in the studio. While the part played-back, the dummy-head would be moved outside of the room, along a corridor and up the stairs until a door would shut outside the remaining gesture. The recording was put back on the mix and assembled along with the original material. The intention was to achieve a more interesting transition and, if possible, to create the illusion that the listener is walking away from the listening space where the piece is happening.

Yet, I am not interested in the exploration of space per se and this becomes evident in the bridge section [4:30]-[5:10], starting with the sound of an opening door, again transferring the plot to a different environment. There, three distinct layers exist in the same space without attempting to interact with each other: The ambience of a traditional market, human activity in a reverberant space, few delicate electronic gestures commenting on the human liveliness. Any cinematic images, which could be associated with the sounds of this virtual space, are simply open to interpretation.

The last section of the piece demonstrates excessive use of harmonic material originating from the kanun. The instrument is now easily recognisable, at least by a listener who is accustomed with its sound. Any instrumental materials, muffled up to now, as in [2:20] for example, are presented here in full scale. The individual streams move in congruency towards a climax of vertical integration. A persistent low frequency hit functions as the metric upon which the harmonic mass develops. From [7:33]

onwards the density drops, leaving spectral space for the remaining streams to breathe and develop each on its own merit. The piece ends with a series of bass hits on an F# while some granular high-pitched material⁴² (also to be found in the very opening) is brought to the foreground.

I have to acknowledge that in this section the hierarchical organisation of sounds possibly functioned at a subconscious level. I do not mean that the horizontal and vertical relationships are arbitrary, rather that I have worked more intuitively, as opposed to a pre-constructed structure. Aural experience can be more valuable than formal planning. While composing this part I was immersed in the rich spectrum that yielded the signal processing of the instrument and maybe this is a reason why the piece ends with what in my ears still has a feeling of longing.

4.4 Outro

In this chapter I initially followed an elliptic utterance to demonstrate a possible stylistic difference between the main trend of institutionalised acousmatic music that may reach a certain mannerism, and an alternative organising principle based on musical streams, close to which lies the philosophy of *Kardaş*. It could be that the difference depends on the angle under which one views the discourse. Next, I proceed to look at issues relative to goal oriented syntax and cultural content; an interesting trend that recently started to expand more within the acousmatic realm.

⁴² These are actually underwater recordings made with a hydrophone in a small beach in the Aegean Sea.

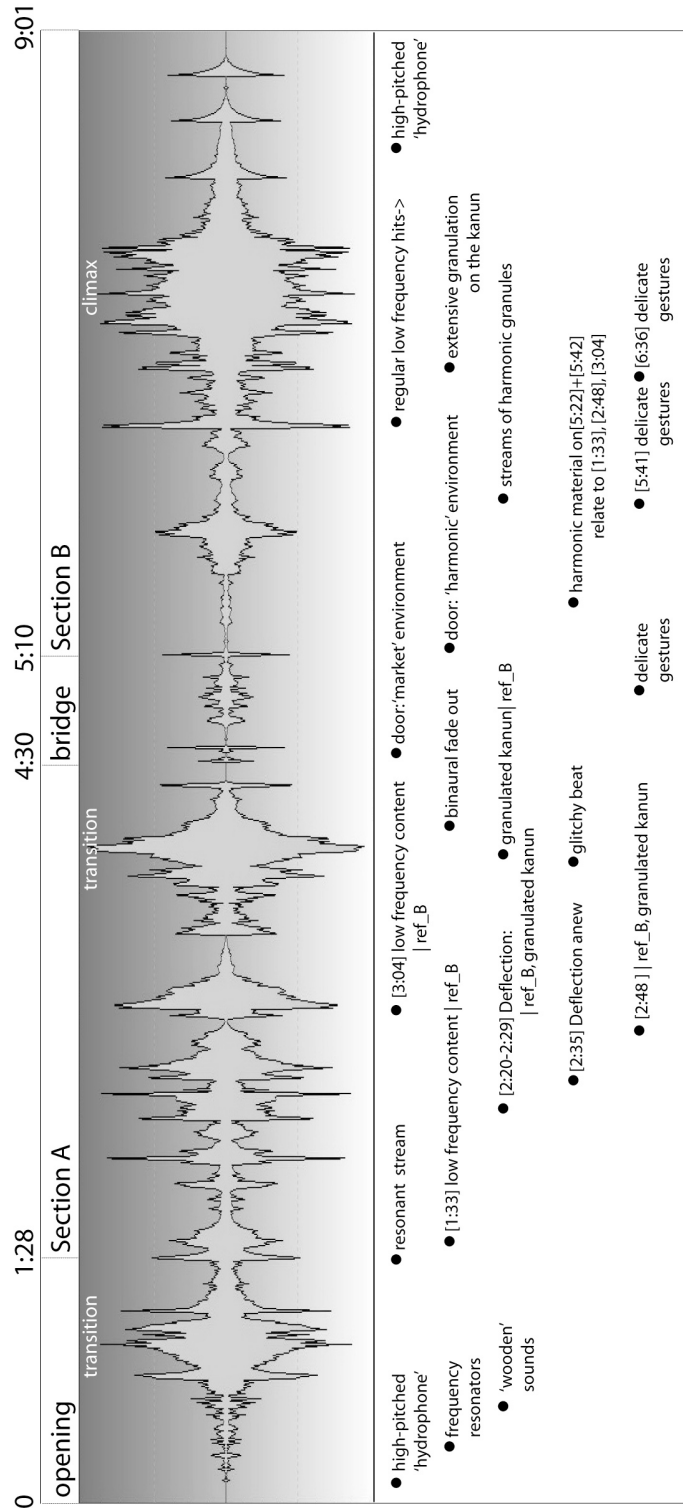


Figure 17. Overall structure | Kardaş

Chapter 5. Goal-oriented syntax, cultural content & identity

This chapter discusses two multichannel works. The first part is devoted to *Acqua Alta* (in 5.0 surround) and mostly looks at the concept of goal-oriented syntax. The second part comments on *Στέρφος* (Sterfos), a large-scale work (in 8.0 surround) and discusses issues relative to its cultural content and identity. The two works share common technical characteristics and in this sense the first one is the precursor of the latter. This is why both pieces are under the same thematic umbrella, even though their aesthetic concerns differ substantially.

5.1 Why multichannel?

Initially, it makes sense to comment on the decision to use a multichannel format. Very often an acousmatic work exalts the exploration of space as its central concern, devoting considerable attention to strategies dealing with the hows⁴³ and whys of sound localisation. However, I am not entirely confident with this stylistic approach. As early as 1986 McNabb (1986: 148) would argue that ‘I am no longer convinced that this aspect of ‘moving sound’ holds a great promise of added expression as other unique aspects of computer music, even when the effect is perfect’. Much technological progress has happened since then, but I am still somewhat suspicious as to the reasons why space needs to be an essential aesthetic parameter for a piece. I do understand the origins of this attitude and that the acousmatic tradition is trying to create a kind of a ‘cinema for the ear’⁴⁴ situation, but to my ears the spatial configurations function only complementary to the other values of a musical work. I do not rely on space to follow the musical narrative and I have to confess that I neither listen at that level.

⁴³ There are three main devices that sound designers use in order to create a ‘virtual place’ and situate objects within it: amplitude modulation, low-pass filtering and reverberation. The excessive use of reverb in the electroacoustics originates from this desire to explore space, but has been used as a gimmick so often that tends to acquire a kitsch dimension, like the reverberant sound of a snare drum in the 80s pop-ballads.

⁴⁴ Dhomont (1996: 24).

Though for *sound-diffusion*⁴⁵, the ‘art’ of moving sounds in the performance hall, I feel somewhat differently as opposed to the exploration of *internal space*⁴⁶. I do enjoy the act of moving faders on a console to spatialise the sounds, since this is the only⁴⁷ thing to do in order to add a kind of ‘live’ element during the performance; however my interest stops there, without drawing any philosophical arguments around the validity of space-sculpting. To me it is simply a playful activity for the performance hall, albeit the only gestural possibility for an acousmatic composer.

So, why are *Acqua Alta* and *Στέρφος* presented in a multichannel format then? An obvious answer is to do with clarity. A piece composed in stereo (or even in mono) when spread to more channels will appear to be clearer. Obviously a muddy stereo mix will remain problematic if re-mixed for multiple channels, but a carefully designed work will benefit from the use of more speakers especially in the case of dense textures. The second reason is that, even though the creation of virtual places is not the principal aim of both pieces, still, the localisation of sounds in the 2-dimensional plane provides an additional parameter which can be used creatively, allowing for more structural options.

For example, high-pitched material that features gestural characteristics would often be moved across the speakers and may be juxtaposed with low-pitched material coming from fixed directions and referential sounds. I would try to achieve a balance between the theatrical and static elements as well as the natural recordings that carry cultural allusions, paying particular attention to the spatial trajectories of moving objects so that they would complement one another. When using soundscapes I would initially identify the spatial characteristics of the recording and then proceed to re-construct a sound-scene by exploring possible interactions that could emerge in relation to the rest of the material. The structuring of space would depend on the plot of the piece, and I would put effort into accomplishing a spectral equilibrium across the multichannel layout. Hence, I

⁴⁵ My practice during the past years with the beautiful 3-dimensional speaker layout in the Sonic Lab at SARC showed that the realtime sound diffusion of stereo pieces (using a mixer) would often yield better results than with multichannel works.

⁴⁶ The term refers to the spatial dimension within the piece itself. See also Chion (1991).

⁴⁷ In chapter 6 I discuss an alternative controller able to manipulate and diffuse a swarm of sounds in the 3-dimensional plane.

view *internal space* as a consequence of the work's narrative, rather than of a conscious decision to explore space itself.

The two pieces were initially composed in stereo and then remixed in multichannel. Especially in the case of *Στέρφος* the 8-channel mix added significantly to the storytelling. Since the work's narrative is closely related to its spatial properties, the stereo reduction now provides barely an approximation to the full version.

Acqua Alta	5.0 surround
Duration	4:19
Commissioned	Paul Stapleton
Premiere	Sonorities Festival of Contemporary Music, Belfast, N.I., 8 May 2009

5.2 Background | Acqua Alta

Acqua Alta uses as source material the MiSS audio sample library along with some ambient recordings made in Venice. Paul Stapleton, who is responsible for commissioning the piece, constructed and made available under a Creative Commons license a sound library consisting of recordings of his ‘modular sound sculpture’; an unconventional instrument constructed of different pieces of metal assembled in a square formation. The aim of the commission was to create a short piece in the electroacoustic idiom making use of the timbral possibilities offered by the source sounds.

Around the same period of the commission I had visited Venice and I was fascinated by its beauty and the fluid element as the city’s dominant characteristic. I decided to investigate compositionally whether the alien metal sounds of the MiSS library could live side by side with soundscape snippets of Venice. I was interested in situating some of the abstract elements close to the *glitch*⁴⁸ idiom while utilising the concepts of *deflection* and *implication* for goal-oriented syntax. The last two notions are central in the analysis of Leonard Meyer (1973) from whom I have borrowed the terms which he applied to tonal⁴⁹ music. In the author’s words an *implicative relationship* is one in which ‘an event [...] is patterned in such a way that reasonable inferences can be made both about its connections with preceding events and about how the event itself might be continued and perhaps reach closure and stability’ (Meyer 1973: 110). The reasonable

⁴⁸ ‘The concept of glitch refers to an error in the production chain resulting in various sonic “disturbances”: distortions, buzzes and hums, clicks’n’cuts and scratches, produced by overloaded or otherwise misused operating systems and sound cards, non-audio files opened in audio editors and the general subversion and misuse of audio software and hardware’ (Vanhanen 2003: 46).

⁴⁹ Roy (2003) has applied Meyer’s implicative method to the analysis of acousmatic works.

interferences are the ones conducted by a listener who is accustomed to the musical language of the piece. Hence, the *implication* is the hypothesis that a listener is making relative to the past, present and future of the events. On the other hand, a *deflection* would interrupt a process and imply an alternative route to the evolution of the work⁵⁰.

I am drawing from these concepts in an effort to describe my compositional intentions rather than to conduct an analysis at a musicological level. Thus, I interpret the terminology loosely; Meyer's approach relies heavily on perceptual criteria in any case. Next, I illuminate on how I have made use of the previous concepts at the structural level and how these have shaped an aesthetic.

5.3 Structural aspects and goal-oriented syntax

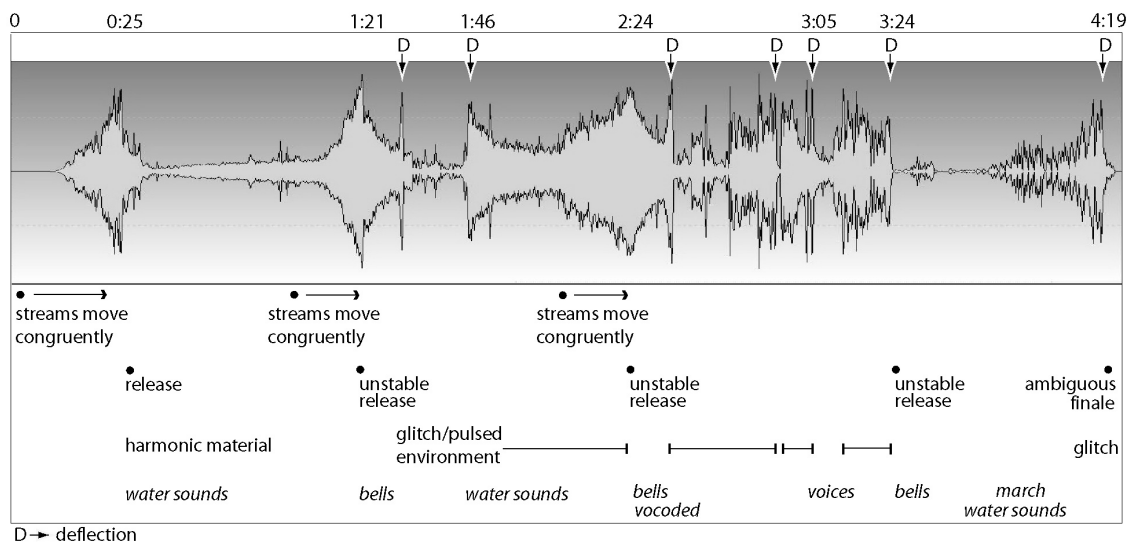


Figure 18. Overall structure | *Acqua Alta*

As mentioned in §5.2, the composition makes use of two different kinds of source material, the MiSS library and the recordings made in Venice. Though at the listening level there are possibly three different categories of interest: The granular/harmonic textures, the glitch/pulsed abstracted material and the ambient referential sounds.

⁵⁰ See also Roy (1996: 30).

The MiSS samples provide the source for all the harmonic drones and granular textures. Usually four different harmonic streams would be created from a single soundfile by means of granular synthesis at different rates and the resulting sounds would be stacked one upon another in order to construct a rich harmonic layer. This is also the case, for example, in the opening of the piece where four granular streams of increasing amplitude and density resolve at [0:25] into the sound of water. The same device is used later two additional times in the work. Always, this process of increasing density of the granular textures is succeeded by referential sounds. The build-up granulations at [1:00-1:21] and [2:02-2:24] hopefully invite the listener to formulate hypotheses about the possible evolution of the patterns. The musical parameters of these streams move congruently towards a climax that strives for a resolution. A resolution suggested by the functional parameters of the streams (amplitude and event-density) that rise until the limit of mechanical distortion ([1:21] and [2:24]). A competent listener who is following through these syntactic processes may eventually realise that they are goal oriented. From their genesis they progress towards a goal and aim for a release. The natural soundscapes that succeed them resolve these processes, but embody uncertainty about the cohesion of each resolution. The doubts are verified when both environments are cut short (ca. [1:30], [2:33] respectively) by the intervention of glitch material.

It could be argued that only the transition at [0:25] creates a feeling of stability. Even the ending is ambiguous. The work develops by juxtaposing two worlds, (especially from halfway onwards). On the one hand the pulsed/noisy patterns built from excessive glitch manipulation on the MiSS samples and on the other the relatively unpolluted field recordings. The structuring logic of the sounds does not lay on causal linkages, but on the notion of deflection⁵¹ as described in §5.2. The plan is to establish some sort of patterning rationale and proceed to disrupt this by shifting the listeners' perspective to different environments, suggesting new routes in the continuation of the work and with any luck increasing the emotional tension⁵².

⁵¹ Figure 18 depicts the deflection points with the letter D and a downward arrow.

⁵² That is why I believe that the releases at [1:21] and [2:24] are not perceived as stable.

5.4 Synopsis

Acqua Alta, as opposed to *Στέργος*, embodies no extra-musical references. There are no hidden emotional motivations that have found their way into sound-sculpting. Its concern rests on an effort to work closer to the ‘aesthetics of failure’ by using DSP which takes after the glitch idiom, though more as a signature sound or an effect than a methodology, and to juxtapose these noisy elements with referential sounds of natural/human origin. It incorporates goal-oriented patterning strategies and block-like interruptions of the flow in an effort to bend the listeners’ perception and dash their hopes and expectations.

Στέρφος	8.0 surround
Duration	21:16
Premiere	Days of Electroacoustic Music, Kefalonia, Greece, 15 November 2009

5.5 The rational of the commentary | Στέρφος

By this point it should be clear that the thesis examines every musical piece from one particular angle, which also usually relates to a compositional approach. Upon presenting the strategy and my motivations for working in the chosen manner I proceed to comment on the structure and exemplify how the creative process has been influenced by a particular compositional method. Additionally, any extra-musical references are presented to the extent that they have found their way into the compositions and could explain aesthetic decisions and organisational aspects. Put simply, every musical work has a different point of departure and I am always trying to identify the source of inspiration and unfold the creative process by examining the reasons why an option might have been followed.

For *Στέρφος* I would like to adopt a different route. This is probably my most personal work and I will refrain from commenting on the technical aspects, relying mostly on the extra-musical. The problem is that the more individual the music gets, the more awkward the substantiation process becomes. In the following two paragraphs I present some underlying thoughts that relate to the piece's aesthetic approach and in §5.8, §5.9 I attempt an introspection in order to shed some light to *Στέρφος*'s aesthetics.

5.6 All sounds equal?

The notion that the sounds should be listened to only for their intrinsic characteristics detached from a causal context is the old *musique concrète* approach. Schaeffer's idea (1966) of reduced listening, the phenomenological reduction that yields the liberation of the sound from its cause and communicative signs, runs through the spine of most

acousmatic music. This attitude places the musical work in the abstract, denying any relationship with the physical world. I think that in this position lies the reason why this genre can be characterised as cross-cultural. Unfortunately along with the loss of identity of the sonic material comes a homogeneity that bears no connection to the local conditions that surround the musical work⁵³ and here I see a problem. The cultural stigma lost is substituted by a technological stigma which is responsible for standardisation and uniformity. In other words, the normative electroacoustic practice by detaching the original sounds from their cultural background often imprints the signature sound of global technology.

As a composer, one can go along these lines and reproduce a cross-cultural yet ‘culture-less’ tradition within the established idiom. Yet, I often relate more to music that has a strong sense of local distinctiveness. I rather listen to a piece from Burundi⁵⁴ that reveals a Burundian flavor unique to the local artists, than experience a technically flawless (which is rarely the case anyway) but ‘culture-less’⁵⁵ work.

This is the rationale for choosing to approach the *soundscape*⁵⁶ tradition for *Στέρφος*; not in order to create a collage of environmental recordings, but to work in the middle ground between the abstracted aspects of the acousmatic language and the cultural associations of the real-world sounds.

5.7 Ethics

The piece reflects my emotions about a small coastal village somewhere in the Aegean Sea. It encloses my memories for the place and its people, developing linearly by

⁵³ It is apparent that the economic/cultural globalisation promotes uniformity rather than diversity not only in the arts but in every form of human life from clothing and food to music. See additionally Truax (2008) and Ciardi (2008).

⁵⁴ The argument gets increasingly complex since someone would need to examine if a listener who is not accustomed to the tradition will be able to identify the signs.

⁵⁵ I have to state that there is probably no such thing as a ‘culture-less’ artwork because by placing the work within the boundaries of a global tradition it can be well defined.

⁵⁶ According to Truax (2002: 6) ‘the soundscape composition always keeps a clear degree of recognisability in its sounds, even if some of them are in fact heavily processed, in order that the listener’s recognition of the associations with these sounds may be invoked’.

combining ambient recordings and spoken stories from the village with folk music and abstract elements. From the very beginning I was confronted with two ethical issues.

The first one deals with the ethics of sampling. It is one thing to work with sounds recorded in a controlled environment like the studio and another to go out and capture events that relate to human activity and nature. I regard sampling to be the art of stealing sounds. Though no matter how painless the process seems when involving human activity it can be an invasion to privacy. These are issues that might be forgotten amongst sound artists where it is believed that ‘all sounds are equal’, disposable, capturable and ultimately usable. I dealt with this issue of ‘sonic surveillance’⁵⁷ mostly by taking permission to use the recordings whenever possible, unfortunately often after these were made which is still problematic. I feel somewhat insecure about capturing few moments without the villagers’ awareness, yet most of the recordings feature social activities and not private moments. Ultimately, I can only hope that I have shown respect for the place and its people through the outcome.

The second issue relates to the ethics surrounding the manipulation and editing of the aforementioned recordings. Whenever sounds that carry strong cultural references are used compositionally they acquire different significations and are recontextualised according to the composer’s will. As Drever (1999: 27) noticed, ‘the artists’ authority dictates that will and will not be included in this fabricated soundscape; filtering through, or imposing, their own inherent or intended ideologies and systems of representation over the soundscape’. While composing I was aware of these issues and struggled to find a balance between the authentic/unpolluted recordings and their processed consequence, to act sensibly with the material that demonstrated vivid cultural references but also to be honest with my intentions about the piece, eventually coming up with a personal narrative about the village and its people⁵⁸.

⁵⁷ Drever (1999).

⁵⁸ The same thing holds for the natural recordings. I have often left them to speak for themselves.

5.8 ‘Catharsis’

In *Στέρφος* I am interested in the dramaturgical structure in the long scale. The primary concern is to move away from a non-differential abstract soundworld and to retain a cultural identity by guiding the listener through a journey of experiences to *catharsis*, without having any metaphysical allusions. The piece functioned from the genesis until its completion as a vehicle for my own personal ‘purging’. During the past years living abroad I developed an uneasy feeling of homesickness, a constant longing. The most vivid memories that crossed my mind were associated with the life in my village. I would often remember not only exact incidents, but recall the sense of being there; the place, its people, the water. Gradually I acknowledged the existence of these memories, embraced them and thought of ways to enclose them into music. I always had the fear of trivialising them or coming up with a self-referential work that would interest nobody but myself. In the end I decided to go along and follow nothing but my consciousness, no norm, no predetermined structure, no Fibonacci numbers, no golden section, no nothing, just intuition.

I genuinely think that on these persistent memories lays the spark of *Στέρφος*’ birth. I viewed the work as a box of recollections. My desire was not to find a language to describe and communicate what I felt, but to reconstruct an emotional world through sounds that I had physically lost. In this sense the process of making the piece had a kind of a *cathartic* effect. I may be unimaginative in using the Aristotelian term, however what it implies is that by permitting myself these feelings in imaginary cases and imprinting my memories, it is as if I was freed from them in the every day life⁵⁹.

⁵⁹ This is a rephrased excerpt from Jacqueline de Romilly’s book *A short history of Greek literature* (1985: 163). By looking back at the works of the portfolio I have to acknowledge that the constant use of water possibly plays a cathartic role in my music at a subconscious level. Seven works of the portfolio reference water and in particular the sound of the sea.

5.9 Drama and cultural content

Let me go through the sequential passages of *Στέρφος* and comment on the extra-musical as briefly as I can, since this is a rather long piece and a thorough morphological study would require substantial space. I believe that by providing some cultural background the work can be approached in its proper dimension, as opposed to attempting an analysis at the structural level.

The work begins with the sound of a bell. It is holy Friday, an autumn noon. The church bell will be tolling for the entire day as a sign of bereavement. There are two distinct layers throughout the introduction lasting until [2:00]: The unaltered soundscape of the village and the abstracted material mostly of liquid substance. These layers inhabit different spaces but still influence each other. The persistent sound of the bell irritates the liquid agents that react and move in an organic fashion in a 2-dimensional plane.

The first section starting after a short transition at [2:01] presents an old native man describing the method of metal-excavation from the mine that used to exist in the village until the 1960s. The harmonic drones provide syntactic continuity while the rest of the electronics comment on the old man's words who carries the sentimental load of the narrative.

The storytelling is interrupted and at [3:34] the plot shifts anew to the first setting, only this time it is quieter, probably late afternoon and the cicadas are resting from their midday singing. The bells are located in the background and we can identify more clearly the sound of the sea. The drones, constructed from the original bell recordings, provide a reference harmony that resolves at [4:45] while the environment starts building up tension.

From approximately [4:20] a long crescendo starts, resolving eventually at [9:24]. These 5 minutes of stress feature heavily processed excerpts of folk music accompanied by natural sounds. The foremost sound appearing in this passage is that of a fretful chicken.

A chicken-snippet had already made its appearance at [2:33] as a deflection in the first section. Then, apart from being humorous, it signalled its importance as musical material and possibly due to its short duration created doubts regarding its true nature. Now it appears clearly from [5:33] onwards. As the texture builds up, it acts both as a reference sound⁶⁰ and as a structural device in purely musical terms, the pulsed pattern of which is juxtaposed with the stretched harmonic streams derived from folk songs.

At [9:24] a chicken-fragment resolves the extended tension. The scenery reveals the sepulchral procession taking place in the evening of holy Friday. In the distance the bells continue tolling. The villagers approach slowly singing the byzantine hymn, first the children carrying the masts with the religious signs, next the priest followed by the rest of the flock.

The procession is gradually drowned into a noisy interference and at [11:20] the setting changes to a peaceful evening, signalled by the sound of the scops-owl. The environment becomes more ambiguous with the introduction of machinery boat sounds from approximately [12:00] onwards, until an evening firework at [12:58] interrupts the linear development. The piece changes direction.

Within the next 15 seconds ca.[12:58 - 13:12] a series of sound events are juxtaposed fast one after the other, each enclosing an entirely different soundworld. Setting off at [12:58] and lasting until [16:21] this section treats the material in a nonrepresentational style somewhat close to the glitch idiom. The old man of the first section returns to narrate a story of a drunken fisherman who drowned in shallow waters. Until [14:20] the passage is organised around pulse-based and organic sounds accompanying the old man's spoken words. From [14:50] the piece uses progressively more gestural material with the abstracted elements taking prominence.

At [16:21] the poly-rhythmic texture that had started building up over the past 20 seconds resolves. The new scene revealed, echoes the chants of the priest. It is holy

⁶⁰ An uneasy animal signals a danger, ..., something is about to happen.

Saturday. The church bells toll festively indicating the celebration of the resurrection. The fireworks heard immediately afterwards set off the noisy elements that move in space interrupting the flow. A fretful chicken appears anew at [17:46]. The underlying harmonic drones gain prominence while suffering severe manipulation as the narrative peaks. At this moment the cluttered-aesthetic of the second half of the piece (after [12:58]) battles the tender harmonies of the first section. Eventually the two become a single mass that dissolves steadily to a few unrecognisable audio fragments.

[18:42] marks *Στέρφος*' last section. The heavily distorted texture gives its place to a soundscape recording. The ceremony is over. People can be heard greeting each other while occasionally several fireworks would remind us of the celebration that has just taken place. Like in the opening of the piece the ambient sounds inhabit a different space as the abstracted material that continue to react to the pyrotechnic bursts. The fireworks take up the bell's role that used to set off the liquid agents in the very beginning. From ca.[19:40] human footsteps can be distinguished. It is the long walk towards the sea ending at [20:31]. Gradually the festive activities of the villagers and any complementary elements fade. The man reaches the sea. Water. Catharsis.

5.10 Note

By looking at *Στέρφος* someone may notice an effort to merge two cultures, the 'indigenous' with the 'post-modern'. The concern is the extent to which someone draws upon his own culture, from the indigenous art that is born anonymously from the guts of a local community and merges that with more contemporary art movements found elsewhere. This dilemma between tradition and modernity has surely been around since middle-war period in Europe and always puzzled artists. I am afraid I have no concrete answer.

III. Physical Controllers & Live Electronics

Chapter 6. Gestural control of sonic swarms and laptop performance

In this chapter I consider two pieces whose realisation and/or performance links to the use of custom-built physical controllers. The gestural control of music is a vast and developing area of research that relates to notions of human-machine interaction, interface design, mapping strategies, sound generating systems, etc. It is evident that the following paragraphs could not aim to tackle these extensively. The goal is to provide an overview of the technical tools used in the realisation of the specific works and to discuss the reasons that have pushed towards the creation of custom-built machines. The design of the musical interfaces and software become part of the poietic process and raise interesting compositional lines of enquiry.

Swarm	stereo tape
Duration	9:00
Unperformed	

This commentary looks at a work for fixed media whose sonic material was processed almost exclusively by utilising the *Sonic Swarm Controller*, an alternative controller capable of diffusing and manipulating a swarm of sounds in the 3-dimensional space. The device was designed and built jointly with fellow researcher Tom Davis at SARC and the findings published at the proceedings of the *SMC'07*⁶¹. The text that follows relies on the aforementioned publication.

6.1 Background | Swarm

Drawing upon the conclusions of an early work (*32.4 Channels for a mono piece*⁶²) regarding systematic composition, I thought of more intuitive ways to interact with the sounds and made some preliminary plans for a controller that could be used as a compositional and performance tool. The actual project, which was carried forward in collaboration with Davis, developed also along the lines of artificial intelligence due to his work on Artificial-life. The initial aim was to create a system that could be controlled live easily by input from a few sensors and a computer keyboard and which could facilitate the exploration of the relationship between the spatio-temporal properties inherent in a self-organising swarm and the timbral transformation of sound objects diffused in 3 dimensions.

My primary plan was to come up with an expressive device, not very difficult to handle, which by means of physical gestures could spatialise sounds and perform transformations of the sonic material at the same time. I initially thought of spatialisation

⁶¹ Davis, T. & Karamanlis, O. (2007), 'Gestural Control of Sonic Swarms: Composing with Grouped Sound Objects', in *the Proceedings of the 4th Sound and Music Computing Conference*.

⁶² *32.4 Channels for a mono piece* is presented in Appendix I.

as being interlinked to timbral transformations, such that one could not be viewed separately from the other. The simultaneous control of both in realtime was believed to provide a flexible and intuitive working environment. This diligence with timbre and space is indicative of my early thinking.

6.2 Sonic Swarm Controller

Since *Swarm* has been defined by the extensive use of the gestural controller it is instructive to go through a description of the device in order to understand how its use has influenced the work.

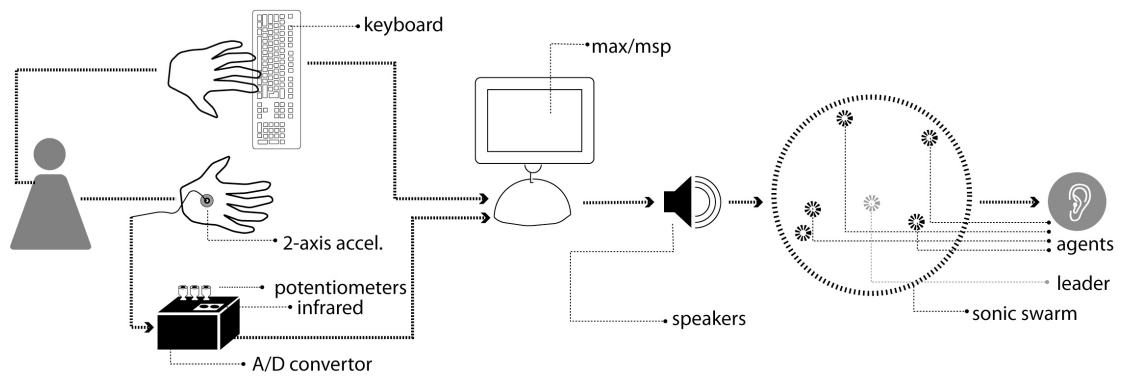


Figure 19. **Simplified design setup | Sonic Swarm Controller**

On the software side the swarm algorithm was implemented as an mxj object in Max/MSP based on Reynolds' (1987) Boids algorithm. In Davis' mxj object the user can alter various parameters such as the number of swarm agents, the speed range for the agents, the strength of avoidance, the strength of flock centering, etc. Each agent of the flock represents a soundfile loaded into a buffer through which parameters such as volume, playback speed/pitch, equalisation, onset time, windowing, grain pitch/size/separation etc can be controlled. These parameters can be turned on and off via interaction with the computer keyboard and can be mapped to the data coming from sensors. An indicative setup for the available parameters and their corresponding mapping is illustrated in figure 23.

On the hardware side, apart from the keyboard, an A/D⁶³ convertor receives data from three potentiometers and an infrared sensor (attached on a box) plus a 2-axis accelerometer (attached on the performer's wrist). The rotation of the joint of the wrist and vertical movement of the right hand, controlling the spatialisation of the sonic swarm, is mapped using Max/MSP to different parameters affecting the individual agents/soundfiles. The right hand outputs only three streams of data at any given moment coming from the 2-axis accelerometer measuring tilt and the infrared sensor measuring distance on the vertical axis.



Figure 20. **Photo of prototype Sonic Swarm Controller**

The idea is that the performer is able to interact with the sonic material in a physical way by manipulating a sufficient amount of parameters but without having to control a great deal of sensors. In order for the device to be expressive and flexible the performer is able to dynamically assign the 3 streams of data to different parameters at the same time by using the left hand on the keyboard. In this way the same sensor can be responsible for manipulating more than one parameter at once but not necessarily in the same way by using different functions. Any soundfile, or even the entire swarm of sounds, can be substituted at any time with a new one. The performer should be thinking in terms of

⁶³ An Arduino board was used with an Atmel ATmega168 microcontroller.

‘families of sounds’ rather than in terms of individual sound objects since the swarm behaves as one entity. As it moves in space, if any of the available parameters is engaged, then spatialisation will bring about timbral changes. A cause and effect relationship can be established in this way between sonic movement and timbre of the swarm. The performer can interact with pre-composed categories of sounds, or even perform realtime sampling. He is able to manipulate the sound in a physical way, to receive immediate aural feedback from a gesture and to interact accordingly. The following figure shows a graphic representation of the 3-dimensional swarm spatialisation as was conceived for the Sonic Lab at SARC.

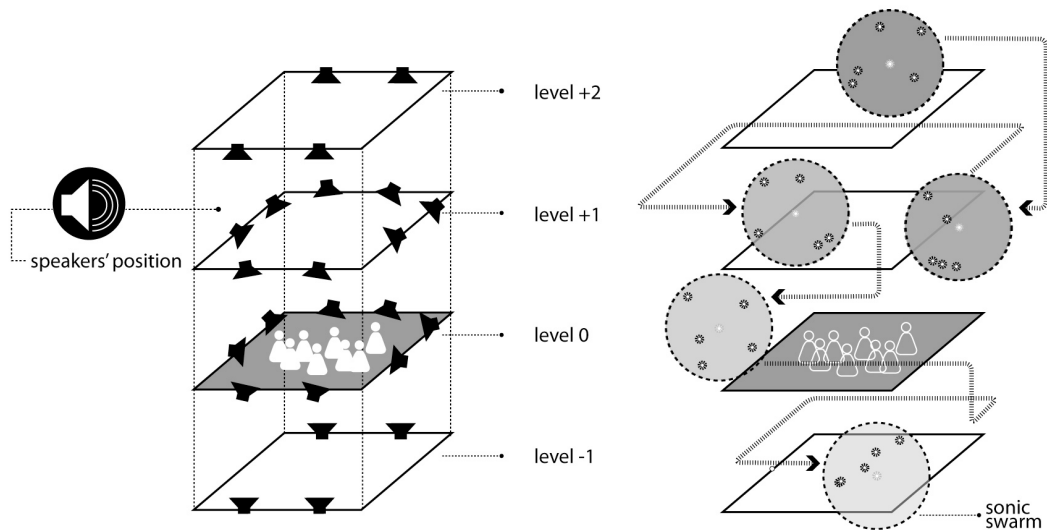


Figure 21. **Sonic Lab speaker layout and 3-D swarm spatialisation | Sonic Swarm Controller**

6.3 Working with the Sonic Swarm Controller

The first issue that needs to be addressed when working with a swarm of soundfiles springs from its very essence. The internal movement of the swarm has a life of its own, behaving as a group and governed by nature-derived postulates. Any attempt to control its spatial movement explicitly fails. It can be thought of as a family of individual soundfiles behaving in an interactive way and sharing common attributes. Consequently,

the choice of working with a swarm of sound objects presupposes that the user is not interested in controlling explicitly the micro-structure of the flock, but is interested in the aggregate impression.

Additionally, even if a single soundfile may have inherently many layers, working with the *Sonic Swarm Controller* (SSC) imposes a multi-layer approach by definition and requires thorough spectral design beforehand and explicit knowledge of the gesture-based device in order to avoid frequency masking. Since no agent, in general, can separate itself from the swarm and adopt a completely individual behavior, the composer is forced to think seriously about the initial material and how the different voices (i.e. agents) will work together. Hardly the operator of the controller can think in terms of only one event at a time, even though this is also possible. In this way the change of the spectromorphology of the sound object through time is equally important to and bound with the polyphonic structure⁶⁴.

6.4 Structural aspects of *Swarm* and the use of the SSC

For the realisation of *Swarm* a stereo version of the SSC was built, unfortunately eliminating its 3-D aspect. Due to the limited performance spaces offering 3-dimensional speaker placement, it was thought that the controller should be tested compositionally in stereo setup initially in order to draw some conclusions, otherwise it might end up as an improvisatory tool applicable only to few performance scenarios⁶⁵.

All the materials used in the composition⁶⁶, apart from the apparent sea sample, were derived from a close-micing recording of a piece of styrofoam. This single recording underwent some preliminary signal processing resulting in more or less six distinct categories according to the spectromorphology of the sound objects. Then, these

⁶⁴ Whether the use of few data streams favors or restricts the compositional/performance process is debatable. It is reasonable to assume that greater physical engagement has an impact on the expressiveness of the instrument and consequently on the actual act of performance; see also Waisvisz (2003).

⁶⁵ The supporting DVD includes, apart from the *Swarm* piece in stereo, a 3 minute video of a performance with the Sonic Swarm Controller for demonstration purposes.

⁶⁶ The idea of composing with categories (families) of sounds, which was implemented systematically in *32.4 Channels for a mono piece*, was also adopted in the case of *Swarm* but in a different context.

categories, each containing multiple soundfiles, were loaded in the *SSC* and represented by individual agents in the flock. The piece was composed by improvising with the *SSC*, exporting the different ‘takes’ to individual files and mixing the resulting textures in a sequencer. Some of the material also underwent further signal processing at the editing stage to accommodate particular compositional needs.

Let me describe briefly the overall form of the piece as emerged through the collage of the improvisations and then attempt to criticise some of its aspects. It can be roughly divided in 4 sections, all sharing a similar timbre.

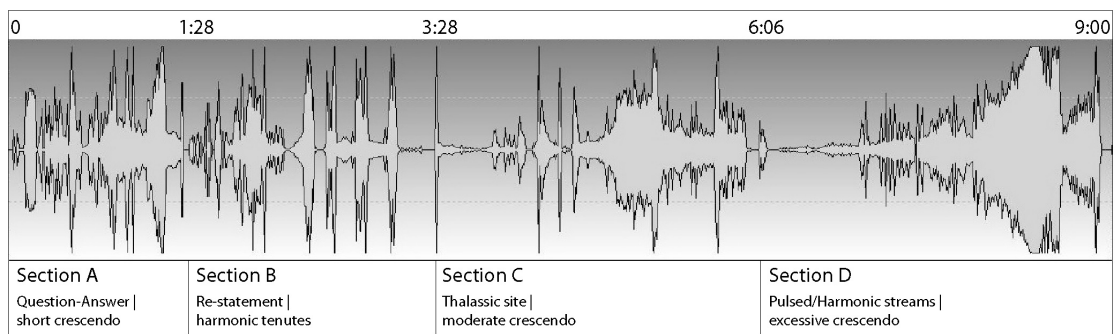


Figure 22. **Overall structure | Swarm**

The first section, which constitutes roughly the first 90 seconds, demonstrates a question-answer logic resulting from a combination of sound-scrubbing and granular-processing. This movement actually concentrates all the sonic material of the piece and relies heavily on theatrical gestures that develop linearly. While some elements (flock members) sustain timbral transformations, forming short/self-contained phrases, others remain constant, providing subtle pulsed or harmonic layers. The section starting at [1:28] could be thought as a restatement, at least until [2:38] when the harmonic tenues are introduced. They seem to be brought about as a result of the organic behavior of the flock. The same cause-effect process between the noisy gestures and the harmonic elements is carried through on the subsequent section. At [3:28] the piece deviates from the established soundworld with the insertion of the clearly identifiable sound of the sea. This seemingly detached layer opens up a new setting and functions as a reference

sound. To my mind the theatrical gestures, which are to be found throughout the piece, could be thought to resemble the behavior of some sort of a flock, whose members interact with each other in a playful way. Hence, the title of the piece (*Swarm*) does not refer to the name of the controller used to process the sounds, but links metaphorically to this ‘swarm of creatures’. The fluid element of the sea suggests a new place for these alien inhabitants. As I have commented, the exploration of space has never been an aesthetic parameter in my music and even in this case there is hardly any effort to create a ‘faithful’ virtual environment. Even if the theatrical gestures interact with the thalassic site, the two elements do not coexist. Only after a moderate crescendo at [5:16] they seem to share some spatial characteristics.

[6:06] marks the beginning of the last section of the piece. Ordered around pulsed impulses and harmonic repetitive material, this section gradually builds up to an excessive climax. Just before its resolution at [8:23] the harmonic layers fuse to one distorted texture where the individual streams that comprise the polyphonic structure can no longer be told apart.

6.5 Remarks

Swarm is a study investigating the compositional capabilities offered by the SSC while limiting the original spectral palette. The exploration of timbre from a single source and the structuring of the material resulting from physical manipulation are the primary concerns of the piece. Since it is in stereo the spatial aspect of the moving flocks cannot be appreciated adequately as in 3 dimensions, yet a relationship between movement and timbral change should be perceptible.

Apart from the technicalities, there is a sensitive question hovering unanswered. What is this piece really about? I made a comment earlier about its title and how it relates metaphorically to the organic character of the sounds, although this does not explain much in terms of emotion. The reality is that I do not actually hold an answer to the question. It is not unlikely that the realisation of the piece has been preoccupied with the

technical side of things at the expense of drama. Nonetheless this is something to be decided at the listening level by the audience. The use of the controller has certainly helped the composition by providing direct means to interact with the sounds, but the choice of the material and their structuring might have yielded an imaginative but emotionally shallow work. This is a situation encountered often in computer music where the notion of originality is highly appraised and often results in music that has little enchantment. Within this idiom ‘the details of each work are typically quite unique, but the metaphorical structures at play remain severely constrained’ (Zicarelli 2001). I can only hope that *Swarm* is not in danger of suffering from similar symptoms by focusing predominantly on timbre and technique and that these ‘deficiencies’ spring out to me simply because I am entirely aware of the mechanisms that gave birth to the work.

I do feel that the piece has achieved its goal of utilising creatively a novel tool. The knowledge gained from building the machine and composing with it proved beneficial along the line of research. It should be appreciated that its functional characteristics have influenced positively the creative process and that the musical work apparently carries the instrument’s distinct identity. After all, *Swarm* could be appreciated for its organic soundworld and detail, beyond the effective use of the gestural device.

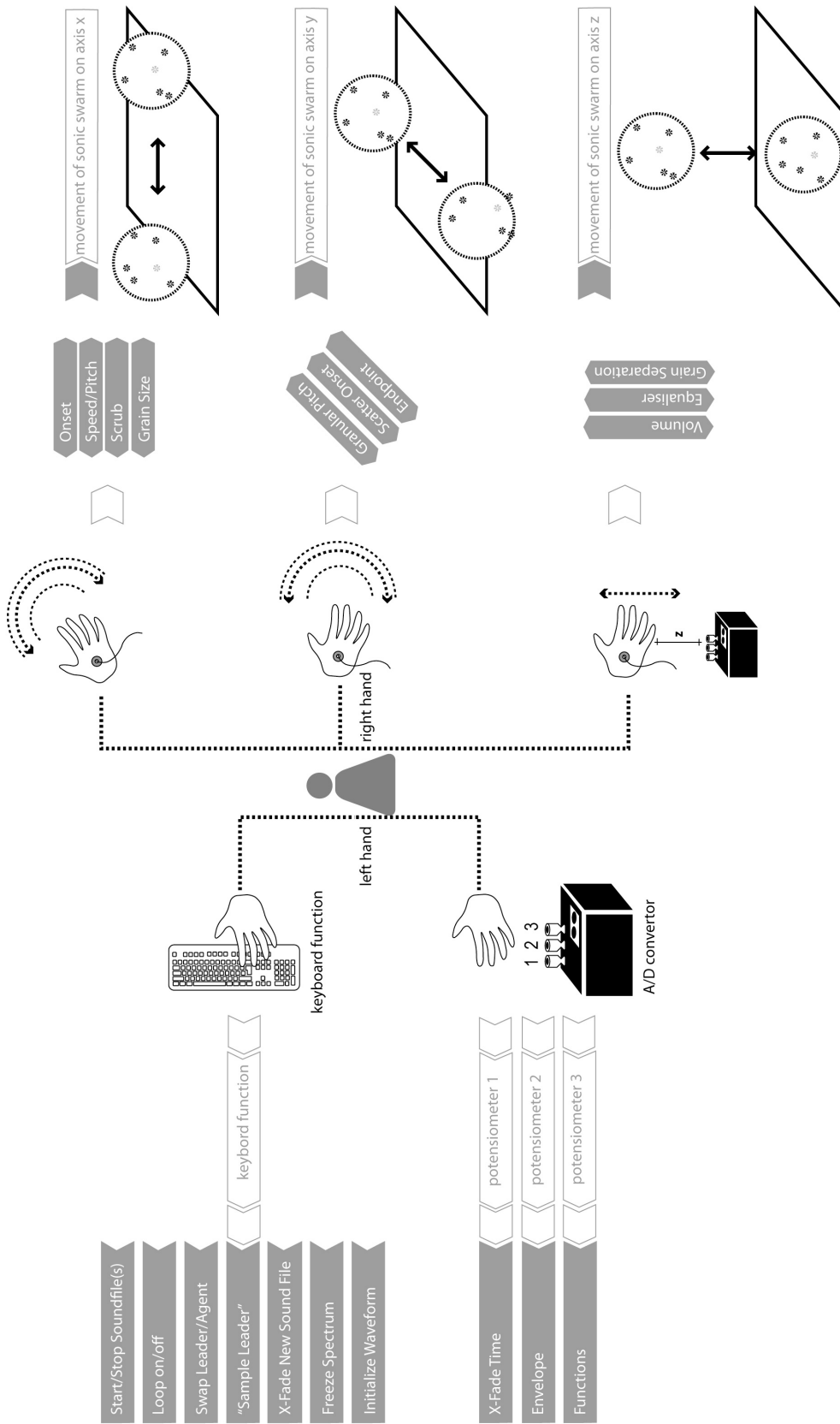


Figure 23. Parameters and corresponding mapping | Sonic Swarm Controller

Transduction	stereo tape networked trio
Duration	8:05
<small>official</small> Premiere stereo tape	CCRMA, Stanford University, U.S.A, 4 April 2008
Premiere laptop trio	International Computer Music Conference, Belfast, N.I., 28 August 2008

Transduction exists in two different formats, one for stereo tape and another for tape and laptop trio using additional pre-composed soundfiles. The piece is most likely to survive as a fixed media work as this version is easier realisable. Up to this point the thesis has dealt with enough fixed works, so I find it informative to focus on the laptop trio scenario. In this manner there will be an opportunity to touch upon new issues that relate to the (anti-)aesthetics of laptop performance. First, I present the overall structure of the stereo version and proceed to discuss *Transduction* as a laptop performance.

6.6 Overall structure | *Transduction* [for stereo tape]

The core material of the piece originates from a recording of a string quartet titled *Self Similarity*⁶⁷ as performed by the Vanbrugh Quartet. This work, which did not find a way into the thesis, was recycled and samples of string phrases were chopped and manipulated to provide the substance for *Transduction*.

The piece is in an ABCA' form. It begins with eerie granulations and stretches of the strings recording that construct a multilayered harmonic bedrock. The spectral configuration and development of the opening almost follows the original quartet orchestration. The second section starting at [2:22], juxtaposes a series of percussive material, leaving the backdrop to a subtle slow-evolving drone. The organic sounds in the forefront have been constructed by means of improvisation with the *Sonic Swarm Controller* loaded with string samples of extended technique playing. From [3:37] onwards these percussive/ wooden sounds acquire a pulsed substance. At [3:58] the harmonic materials are brought to the forefront, which lead after [4:30] to the resolution

⁶⁷ See also pg.108.

of the passage. The third section, from [4:35], functions as an intermediate. For the first time natural sounds appear, and some sort of human activity may possibly be identified. This new environment may appear unclear as to how it fits with the narrative, but I would argue that it is exactly this juxtaposition of outwardly foreign material within the piece that dash the listener's expectations and make the sequence of events more interesting⁶⁸. The setting is interrupted at [6:15] by exaggerated string sounds first presented in section A at [1:18]. Elements of other sections are situated later as well at [6:34] and [7:01], which take after [3:58] and [4:26] respectively. The almost straight recapitulation helps in unity and hopefully comforts the listener's uncertainty after the former middle part.

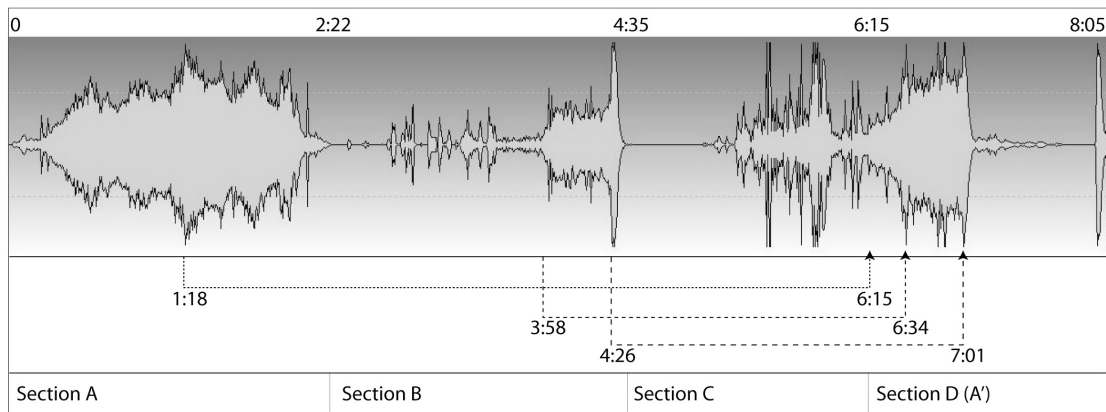


Figure 24. **Overall structure | Transduction [stereo tape]**

The crescendo of section D resolves to a seascape after [7:02] with subtle strings sounds constructing a fluid harmonic counterpart. The piece ends with a gigantic sea-wave cut short by a familiar mechanical interruption, similar to the sounds that comprised the organic gestures in the second section.

⁶⁸ I could have also relied on extra-musical concepts to substantiate section C as I have done previously for other pieces, but I shall refrain from doing so in this case.

6.7 Rational behind the laptop version | Transduction [for laptop trio]

I have often felt sceptical regarding the validity of acousmatic performance. Even though I find rewarding the process of working in the studio and regard sound diffusion as a playful process for the composer, I feel somewhat less happy by pressing spacebar on a computer keyboard in a concert hall. While I may enjoy the act of sound diffusion through a console, I cannot be equally sure about the audience's reception, and I cannot attach further significance to this practice⁶⁹. One of the difficulties regarding the reception of acousmatic music relates not only to the minimisation of human labour, but to the absence of any visual stimuli. John Croft (2007: 60) has rightly argued that 'there have been various attempts to reintroduce the visual, from video projections to focus on the person behind the mixing console as 'diffusion artist'' ... yet 'the music remains, in essence, acousmatic, in the sense that what is known to be the source is visible but remains perceptually detached. This had led some electroacoustic composers to the point of asserting that the ideal medium for listening to such music is on CD, through headphones, alone'. Others have argued that it is the audience's responsibility for not being able to engage with bodiless performances due to the inadequacy to shift the focus from an understanding of the visual to the aural⁷⁰.

This debate is endless and has been going on pretty much since the birth of *musique concrète*. From my view I regard the notion of (aesthetically meaningful) *effort* as a significant parameter that enhances a performance and plays an important role not only in the reception of a piece, but also in the enjoyment and engagement from the performer's perspective. I find useful the existence of transparent causal connections between the gestural actions of a performer and the sonic result, something which is lost not only in acousmatic music but in most laptop performances as well. In the latter case, since there is actually no physical constraint as to the sound produced by a computer and projected from a loudspeaker, the 'liveness' of a laptop performance can be damaged

⁶⁹ See also §5.1.

⁷⁰ See for example Stuart's (2003) article.

due to the detachment between the restrained performer's actions and the rich response of the computer.

Without expanding any further on these issues which are known in the literature, I have already implied the reasons that induced me to imagine an alternative performance scenario for *Transduction* by incorporating some sort of physical activity and human presence as opposed to the standard playback/diffusion practice. The setup involved a laptop ensemble on stage and the use of some kind of gestural controllers to allow for realtime processing and to provide a visual component for the audience. The mapping between the performers' actions and the output ought to be on the one hand perceptible and on the other not too explicit, because in the latter case the listeners' interest might shift from the music to the theatricality of the gestures with the danger for the work to turn into a caricature.

A laptop free-improvisation scenario could have been realised relatively easy. Though my intent was to have an ensemble interpreting a score that would play along with the pre-composed stereo version of *Transduction*. In this case the score could have been constructed before hand and given to the performers. Inevitably this approach bumps into synchronisation issues during performance. It is desirable that all members of the ensemble read the score with time accuracy. The system, which was prepared in collaboration with fellow researcher from SARC Alain Renaud, relied also on achieving precise synchronisation over a local area network. That said, there is no reason why the members of the ensemble cannot be displaced to different venues, receiving information over a wide area network⁷¹. Below I proceed to present the setup of *Transduction* utilised during the ICMC2008 performance.

⁷¹ In the case where high quality audio is needed to be sent over the network a system like JackTrip could be used, but this practice falls outside the concerns of the current work.

6.8 Setup

The ensemble consists of three performers, a ‘maestro’ and two ‘players’. The maestro uses the network to communicate a precomposed score and cue information to each player via the Open Sound Control⁷² communication protocol. They, in turn, interpret them by having physical control over precomposed sound material by means of two infrared sensors mounted on a box and one bend sensor attached on a finger. Each physical controller, which makes use of an Arduino A/D convertor and connects via USB to a computer, allows a player to modify separately the amplitude, speed and pitch of a mono soundfile by using Dudas and Lippe’s phase vocoder as implemented in Max/MSP. The vertical movement of the right hand is mapped to amplitude, the left hand’s vertical movement is mapped to speed, while the bend sensor controls pitch. The computer screen of each player projects the respective part of the score as the piece unfolds. It also provides a visual representation of the gestures made with the controller allowing for a more accurate interpretation of the score. The maestro inspects the full score of the piece and manipulates the sonic output of the players in realtime by means of a simple USB device controlling numerous parameters that relate to amplitude, reverb⁷³ and granulation⁷⁴. Figure 25 demonstrates the hardware setup of the piece.

⁷² M. Wright, A. Freed & A.Momeni (2003).

⁷³ *freeverb~* by Mattes.

⁷⁴ *munger~* by Trueman & DuBois; *gt.stream~* by Wierckx.

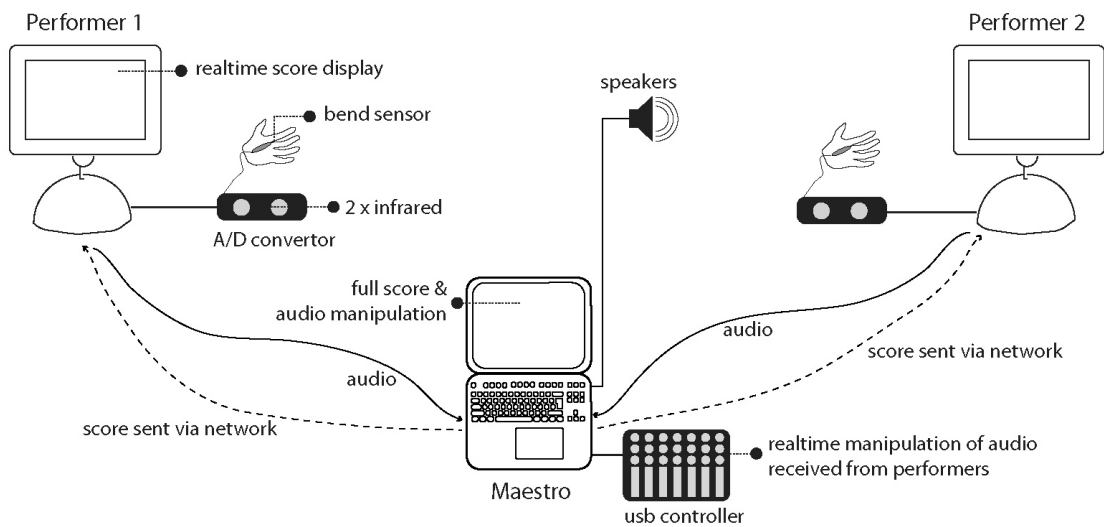


Figure 25. **Hardware setup | Transduction**

On the players' side, the score-display designed by Alain Renaud represents each of the three parameters of interest on separate graphs (amplitude, speed and pitch) measuring intensity on the vertical axis and time on the horizontal. During the performance a bar-line sweeps through the graphic score from left to right which is scaled to 30 seconds segments and shows the values of the parameters the players need to match⁷⁵. Figure 26 depicts a view of maestro's screen. The right hand-side of the screenshot shows the graphic score and the left the maestro's audio controls.

Since the score was aimed to be pre-determined and not just improvised on given rules, the ability for the composer to think, plan and act beforehand was the main motivation for the implementation of the off-line scoring capability.

⁷⁵ The *Frequencyliator*, a software implementation designed for the BLISS ensemble at SARC (Rebelo & Renaud 2003) demonstrates few characteristics similar to the approach described here.

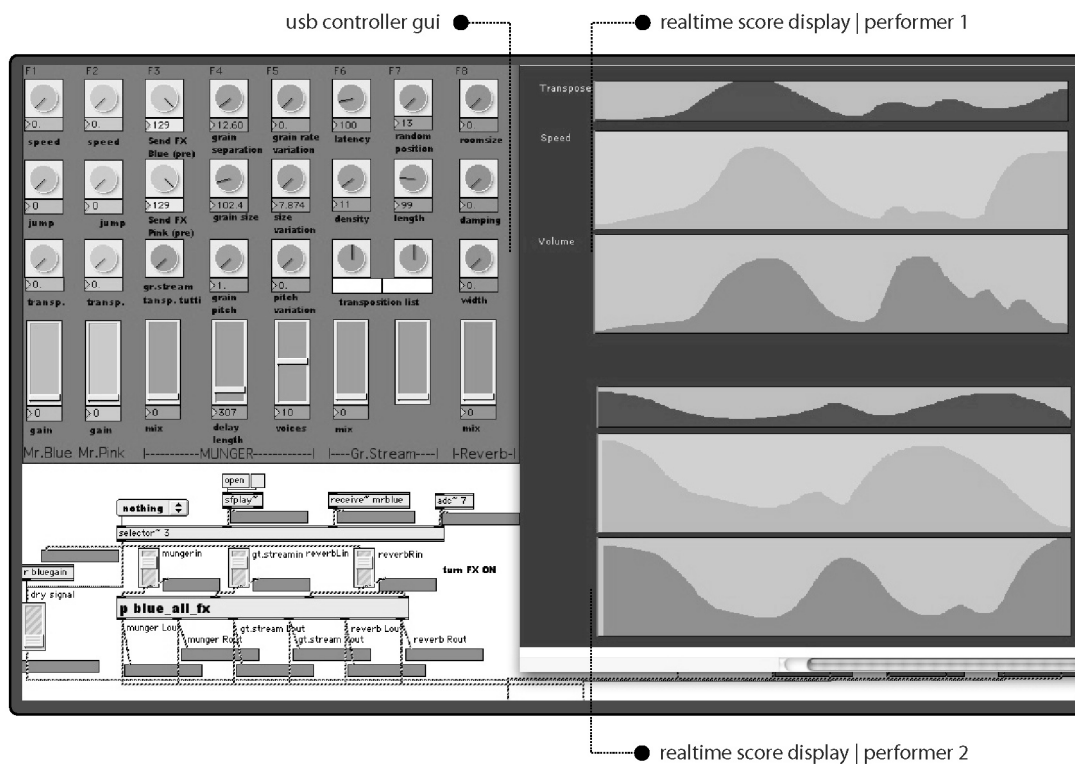


Figure 26. Software screenshot | *Transduction*

6.9 Mapping issues

Contrary to the flexible design of the *Sonic Swarm Controller* presented in §6.2, where a *few-to-many* mapping rational exists, the current system demonstrates a straightforward *one-to-one* mapping behavior between a player's gesture and a control parameter. It is interesting to look at why the specific gestures were mapped to particular processes. The aim of the project was not to construct a versatile and multipurpose controller for use in different performance scenarios, but to see how the laptop ensemble could articulate textures to go along with the tape part and to provide an additional level of engagement for the audience.

In preparing the laptop trio performance of *Transduction* I was interested in enhancing the stereo version with sounds of similar color. I refrained from using sound synthesis and instead provided the players with pre-composed soundfiles to manipulate in

realtime. I thought that the signal processing ought to affect very basic characteristics of the sounds and in a perceptually transparent way in order for the audience to be able to link the energetic and morphological changes of the sounds to the performers' actions. This explains the decision to use a phase vocoder allowing independent control over amplitude, speed and pitch.

I believe that any gestural device needs to facilitate above all the control of amplitude in an expressive way. A system not permitting the dynamics to be intuitively controlled lacks flexibility and is in danger of creating perceptual inadequacies between the performer's actions and the computer's response. The choice to map amplitude to the vertical movement of the right hand was thought appropriate as the upright motion could be easily visible by the audience and the gesture was intuitive enough for the performer. Similar rationale exists for the preference to map the speed of the soundfile to the left hand's infrared. The use of a bend sensor to control pitch was found effective since the finger's movement would not interfere considerably with the other sensors.

6.10 Evaluation

With the laptop version of *Transduction* I tried to add a live element to the fixed media work with the hope to enrich the performance both visually and aurally.

In short, the technical setup proved to be reasonably stable. The ensemble was able to synchronise adequately and to follow the score according to the instructions. Each player could rely on visual cues from other members of the ensemble during short improvisatory moments. Since the piece was mostly pre-composed the simple realtime processing was deemed to suit the aesthetics of the piece. Yet, there is an issue that calls for particular consideration. The mapping of the same (few) parameters to different soundfiles sometimes resulted in a disproportionate computer response to a player's gesture, resulting to a confusion regarding the origin of the sounds. As a consequence

occasionally some hand movements appeared to have no direct impact on the sound texture, thus deluding the performers.

Lastly, the fixed media version alone possibly followed a conventional acousmatic route by relying mostly on what I have described in §4.3 as the ‘bell-shape’ form. Nevertheless, within this idiom the work has succeeded in unfolding a somewhat ambiguous narrative by putting together foreign sound material to aid in the succession of scenes.

Chapter 7. Live electronics & stochastic processes

Absolut Athens	live electronics
Duration	3:30
Premiere	Ars Electronica Center, Linz, Austria, 19 October 2009

This chapter is devoted to a short musical work falling under the genre of live electronics. In the title I am using the term *stochastic* to denote the indeterminacy involved in the evolution of the work as a result of using probability distribution functions. Even if the mechanism for generating the ‘data’ is known and can be described as a formula, the outcome cannot be explicitly predicted and varies between different performances.

Despite the fact that the piece incorporates significant amount of randomness it has been composed in a way that its overall form is fixed. There are simply ‘better’ or ‘worse’ performances. Its duration (ca.3:30) is only indicative. It is generated by code and consequently it can be extended or diminished relatively easy.

7.1 Basic mathematical background

A probability distribution function models the probability of a continuous random variable in the sample space. It tells us how likely an event is to happen when falling within a given set. *Absolut Athens* uses the well-known Normal distribution. Its function can be expressed in terms of two parameters, the *mean* and the *variance*. The mean (μ) is the value around which the data are symmetrically distributed and the variance (σ^2)⁷⁶ shows how far the data spread around the mean. In other words the greater the variance is, the more the data are spread around the mean and vice versa. Its bell-like shape can be seen in the following figure.

⁷⁶ The standard deviation (σ) is defined as the square root of variance.

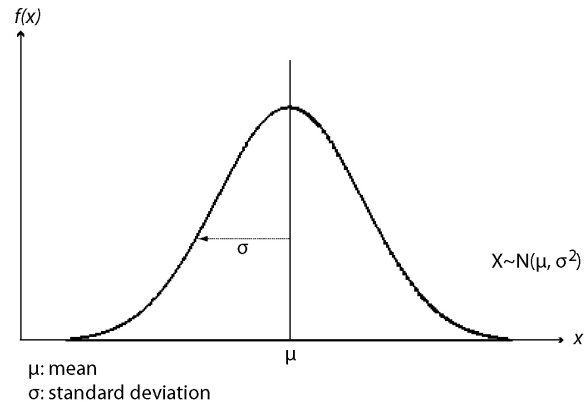


Figure 27. **Probability density function of the Normal distribution**

In the piece the density of the events and their duration is governed by the Normal distribution function whose parameters are modulated over time with the hope to create an always variable yet structured (as a whole) performance.

7.2 Context

On a Saturday night in early December 2008 a Greek policeman shot dead a fifteen-year-old student in the centre of Athens. It was the spark for the riots that broke out throughout the country and shook Europe. *Absolut Athens* was put together in SuperCollider within January shortly after the major events using real sounds⁷⁷ from the demonstrations. The decision to use a programming language to randomly select and schedule the sonic events is straightforwardly related to the nature of the piece that imitates the behavior of an autonomous crowd, trying to convey the anger of the riots.

7.3 Code structure

The soundfiles are grouped in three categories according to the tension they carry. They are loaded to individual buffers in SuperCollider and placed within three different Lists,

⁷⁷ Most of the sonic material were downloaded from an independent web-based channel www.tvxs.gr

such that the first one contains the more mild and the last one the more aggressive files in terms of activity and emotional stress. At the core of the code is a simple algorithm that can draw elements randomly⁷⁸ from a specific List and play back a chunk of audio from the file selected. There is absolutely no timbral manipulation or any other signal processing involved whatsoever throughout the piece (apart from an optional reverb module). It progresses from a condition of moderate stress towards a violent environment by initially sampling audio from the first List and moving gradually to the subsequent two, as each category carries increasingly more tension.

A Normal distribution function with modulated mean and variance governs the *density* of the events (i.e. the rate of sampling from a List). Another Normal distribution is responsible for the *duration* of the events selected (i.e. the amount of audio information heard from a chosen file). In order for the parameters of the distributions to change dynamically and for the transitions to be smooth, envelope shapes are used to control the evolution of mean and variance for each distribution function.

The programming allows the piece to be performed on practically any number of channels, actually the more the better, by producing as many playback modules as the available output channels of the audio interface and spatialising each new soundfile chosen to a different speaker. When using a polyphonic setup it is desirable that the speakers surround the audience but can be in any formation.

Below I look at the structure of the piece as shaped through the use of stochastic processes.

7.4 Structure and stochastic evolution

The piece is divided into eighteen cues. The design is indeed similar to the one applied in the case of mixed pieces like *Πλάγιος Β'* and *Χάος!*, though in this situation a Routine

⁷⁸ The sampling within a List happens without replacement and restarts when all the elements have been selected.

is responsible for scheduling all the steps at predefined moments. The parameters modified are a) the events' mean density and variance, b) the events' mean duration and variance, c) the overall amplitude, d) an ASR envelope. From these, the first three are modified dynamically by means of envelope shapes, while the last one may switch to a new configuration only on a cue.

I shall describe the opening of *Absolut Athens* in order to exemplify how the distributions have found their way into the piece. It starts with unidentifiable grains of audio at a constant rate. The events occur every 0.1 seconds since they are being generated from a Normal distribution with a mean of 0.1 and zero variance. Zero variance means that there is no variability regarding the periodicity of the sound events. Similarly the duration⁷⁹ of the audio chunks is fixed and relatively small following another Normal distribution with constant mean and zero variance.

After the first 8 seconds Cue-2 is triggered, applying an envelope to the events' mean density and reducing its value to 0.05 momentarily and back to 0.1, while the amplitude follows an inverse pattern. In Cue-3, occurring 7 seconds later, the events' duration increases by modulating the mean of the distribution with an envelope lasting in total 5 seconds. Then in Cue-4 the variance of the events' duration is modulated allowing the events to have a greater range of variation regarding their duration.

While the piece evolves, the true identity of the audio clips is gradually revealed. As the duration of the soundfiles sequentially increases, their origin becomes more recognisable and as the variability rises, the behavior of the crowd becomes more erratic. For someone who also comprehends the language there is no need for program notes to aid in the understanding of the work. The sounds speak for themselves.

It is interesting to see the relationship that exists between the variable parameters. The following figure shows the correlation between four variables indicatively for the first

⁷⁹ The variable defining the duration of an audio cut-up is always proportional to the soundfile's total duration. The reader may want to see the respective SC code in the supporting DVD for more on this.

40 seconds of the piece. The correlation coefficient within each box takes values between -1 and 1 and is a measure of independence between a column and a row. The closest the number is to 0 the more independence exists, the closer it is to 1 (-1) the more positive (negative) dependence exists between two variables.

	mean.density	amplitude	mean.duration	stdev.duration
mean.density	1.0000000	-0.7836788	0.2891625	-0.3148651
amplitude	-0.7836788	1.0000000	-0.1272284	0.1800958
mean.duration	0.2891625	-0.1272284	1.0000000	-0.1523449
stdev.duration	-0.3148651	0.1800958	-0.1523449	1.0000000

Figure 28. **Parameter correlations for the first 40 seconds | Absolut Athens**

What can be instantly observed from the table is that there is a clear (negative) correlation (-0.78) between the mean density and amplitude, meaning that for the first 40 seconds of the piece there is a clear pattern, with the mean density always decreasing when the overall amplitude increases. This relationship can be observed as well by comparing the graphs of figure 29.

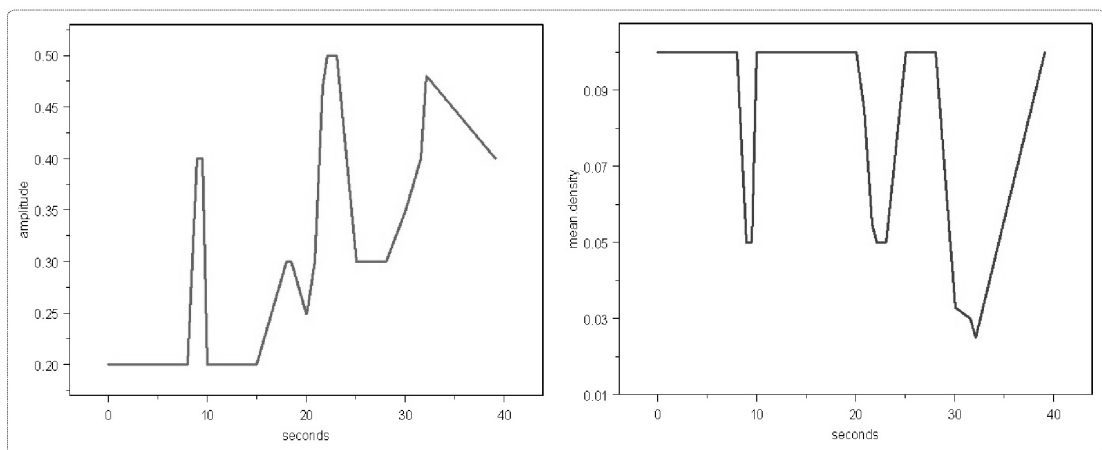


Figure 29. **Amplitude vs. time / mean density vs. time | Absolut Athens**

A similar analysis could have been carried through for the entire piece in order to investigate the relationships between different parameters and how these change in accordance to others. I have presented the correlation table to bring to the reader's attention the dependencies that exist between the variable quantities in order to shed some light to the structural processes that may not be appreciated at first listening.

7.5 Outro

The probability distribution functions did their job in adding a random element to the work's evolution and at the same time assured that the form was determined. The use of envelopes to modulate the corresponding parameters of the formulas proved effective and helped to shape the progression of the events over time through the different environments of emotional tension⁸⁰. *Absolut Athens* is generated live every time by means of the SuperCollider code so that each performance is different from the previous, though all share the same dramaturgical structure. With any luck the piece can communicate the atmosphere of the demonstrations even to the non-native listener.

⁸⁰ The piece may as well include real images from the demonstrations and project them along with the SC code on a screen. I have not included any, for I do not own the intellectual rights for them, but in the supporting DVD I provide a screen capture video which demonstrates this performance option.

IV. Installation Art

Chapter 8. Painting, sound & realtime gesture capture

Imago Dixit	interactive installation
Duration	'infinite'
First Exhibition	Alef Gallery, Athens, Greece, 10-16 March 2009

This part describes *Imago Dixit*, an interactive installation incorporating sound design, realtime gesture capture and painting. The text that follows places the work in context considering some aspects of composition, interaction and perception. Any poietic analysis is primarily conducted from the auditory rather than the visual perspective.

8.1 Compositional process

The project was carried through in partnership with the painter Stefanos Rokos⁸¹. The creative process resembles a game, being a collaboration between two people from different disciplines (painting and sonic arts). Both of us started working individually on the material (color and sound respectively) the same day and with a fixed deadline, each freely creating a work with the sole constraint being that a relationship between image and sound should be clear. Hence, the first step constitutes the creation of a musical piece on the one hand and a painting on the other that have nothing in common. On the deadline the artworks are exchanged and each one creates a new piece based on the work he has received, arranging also a new deadline to reveal the final works. The outcome is two paintings accompanied with their sound sculptures where in one case the sound drove the image and in the other the image drove the sound.

⁸¹ I am thankful to Stefanos for his motivation and input throughout this installation.

8.2 Background

The project could be thought to link to the concept of *heterotopia* as exemplified by Foucault in the late 60s. The term can be used to denote the juxtaposition of many spaces (τόποι) in a single place. The artwork brings together spaces that are foreign to each other in reality. The aim is not to create an illusionary space consisting of the sum of real environments, but to create another (έτερος) space, which is real by structuring the different elements in an artistic fashion. In the current work the idea of many-spaces is linked to many-times (*heterochronia*), denoting the segregation of linear time, which by means of physical interaction is exposed to the viewer/listener.

8.3 Description

The title *Imago Dixit* translates from Latin as *The Image Said*. The interaction between image and sound in a physical way is the primary concern of the work. It comprises of two paintings (135 x 18 cm each) suspended on an empty wall. Each painting is equipped with an infrared sensor at the frame's edge which traces movement along the horizontal axis of the painting. The sensors are connected via an Arduino board to a computer running SuperCollider, the output of which is fed to a quadraphonic speaker setup surrounding the audience.

The participants are free to examine the paintings from any distance they think appropriate. Apart from the obvious visual aspect, the artwork has a hidden aural aspect as well. Every painting has a sonic counterpart corresponding to particular drawings. The viewer becomes also a listener by touching the artwork. Any movement made along the horizontal axis, which is closer than 2 cm from the surface of the painting, is traced by the infrared sensors revealing the appropriate sonic entities that match the exact position of the painting(s). There is always a one to one relationship between the visual and its sonic representation and vice versa. That is, for every texture/drawing of each painting exists a hidden soundworld waiting to be discovered by 'tactile' interaction.

The artwork is considered unfinished without the contribution of the audience. The design of the system allows the participant to unfold the music at his/her own pace, perhaps discovering elements through sound that the eye overlooked.

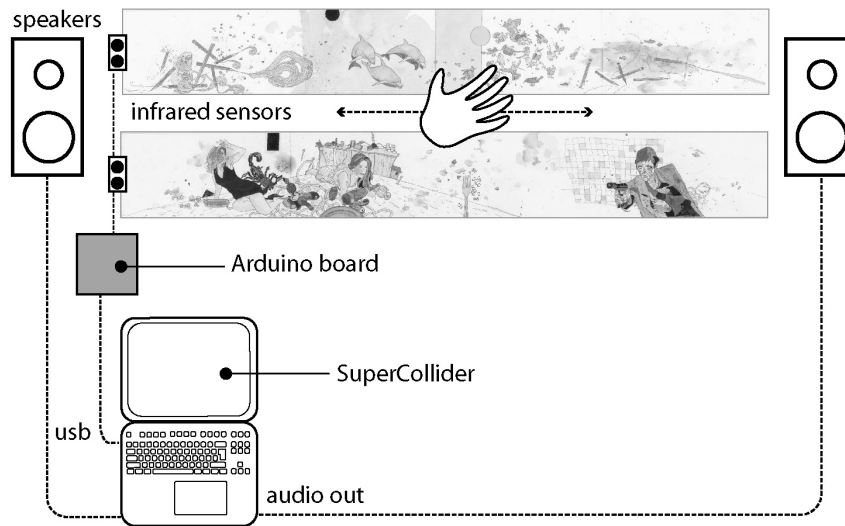


Figure 30. Simplified schematics | Imago Dixit

8.4 Interactivity

In previous chapters I looked at the human-computer interaction from the musician's perspective, here I am interested in the audience's participation. In the current installation I thought that the system should be responsive enough so that a causal relationship between the participant's actions and the corresponding sonic result is clear, making use of a strategy that wouldn't be too complex so as to lose the audience⁸². Therefore, giving the impression that the participant is in command and, with a thorough sound design beforehand, avoiding the mapping being tedious.

I shall exclusively detail the physical interaction of the 'performer' with the artwork, since the current configuration does not embody any behavior that flows from machine cognition. Technically speaking it is simply a matter of assigning the sensor data to

⁸² See Schloss (2003).

sounds. However, the system should not be confused with a gestural interface and understood as such. In this sense it is not a matter of constructing an expressive instrument in order to make a convincing performance. The work is to be viewed within the context of an interactive environment, where the concern is to provide an additional level of engagement with the paintings as opposed to the traditional ‘look but not touch’ behavior in a gallery. The actual process of viewing a painting in an exhibition space has a long tradition in the history of western art and inevitably carries a great deal of social conventions. The installation purposely makes use of the traditional medium of the canvas enhancing the visual clues by adding an audio-haptic layer.



Figure 31. **Imago Dixit**

The system gives the impression of reacting with touch but in fact it does not. As stated earlier it is only the infrared sensors attached closely on the surface of the paintings that trace movement and trigger the sounds. Since the audience has usually little understanding of the mechanics the user develops an idiosyncratic way to play with the artwork and react to the sounds. Experience showed that numerous visitors would

experiment and try to invent a particular technique to bring about new sonic elements attempting to control the work in an unorthodox way. Many participants had the illusion that the degrees of freedom of the system were more than two, one for each infrared sensor being the true case, meaning that even though the design implements a simple human-computer interaction scheme and a straightforward mapping strategy, the work as a whole hopefully provides an engagement at a higher level than what the available degrees of freedom allow. I find the concept of ‘higher-level engagement’ by using simple architecture and easily accessible technology tempting, although in order to evaluate the effectiveness of such a design a thorough statistical analysis of the participants’ behavior would be needed.

8.5 Designing sound objects: On the verge of acousmatic

Being a composer of electroacoustic music I cannot resist viewing the sonic material through the lens of the theory of the sound object in the acousmatic fashion. There are though two fundamental differences in the way the current installation contextualises the notion of the sound object:

- a. The 1960s period at the Group de Recherches Musicales in France is marked by the concept that sounds can be used with no relation to meaning⁸³. This attitude had an impact on the theory of listening as well, where the audience should listen to the sounds as sounds and try to enjoy their morpho-typological properties than assigning extra musical significance that could pollute the perception (Schaffer, 1966). In the case of *Imago Dixit* even if the true source of the sounds is hidden, ‘cause and effect’ relations develop between the participant’s gesture and the sonic equivalent and extra musical references spring either from the images or the sounds themselves. While interacting with the artwork the listener relies heavily on vision and he/she is intentionally modifying the soundworld in realtime with his/her actions. It is the drawings on the painting that help the audience to relate the ‘sounds to supposed sources and causes, and to relate

⁸³ See also §5.6.

sounds to each other' appearing to have 'shared or associated origins' (Smalley 1997: 110).

- b. Next, in *Imago Dixit* the listening mode of the audience shares some properties with the composer's mode. By this I mean that the process of *reduced listening*, the concentrated and repeated listening of a sound over and over again, which is a privilege of the electroacoustic composer when building a musical piece, is also available to the audience. A static touch on a particular point on the painting will only trigger the specific sound objects and will continue doing so until there is a change in the user's action. In the same way that the timbral qualities of a particular sound can be revealed to the composer through concentrated listening, the audience has equally the ability to dive into the process of microscopic listening/seeing, since a gradual disposition of the hand will slowly reveal new sonic material accompanied by their drawings. All the same, it should be made clear that this investigative process of playing with the artwork does not require from the participant to concentrate on the morphological qualities of the sounds but only enjoy the interplay.

With regard to the notion of musical narrative it has been recognised that 'hearing on the level of the object cannot be the same as hearing on the level of the work' (Nattiez, 1990). The sounds reflecting the drawings on the paintings in many cases resist segmentation and their perception depends on the energetic shape of the performer's action through time. But within the context of the current installation the sounds' temporal evolution dissolves; what is heard 'before' can also be heard 'after'. The manifestation of sounds within time is not a linear process. There is a significant difference between the interactive narrative of the installation and the supposedly linear narrative of a musical piece.

8.6 Drawing and sound

There are a few things taken into account prior to the compositional process that deal with the relation between sound and image specifically from the sonic perspective. These issues can be summed up as follows:

- i. Classification of figures/shapes and sounds and their relationship.
- ii. Developing a dialogue. Sound driving image versus image driving sound.
- iii. Notions of proximity, polyphony, transformation, growth and expectation.
- iv. Representation of ‘unknown sounds’ and vice versa representation of ‘unknown drawings’. Influencing the audience’s perception about the quality of the sound objects and drawings.

Here I am more interested in polyphony and transformation; i.e. how can multiple shapes on the canvas be represented at a given time and how can their evolution on the painting have a meaningful sonic counterpart. A painter has the ability to draw objects on a 2-dimensional terrain. A composer can regard the horizontal axis of a painting as time, which is the most obvious case, and the vertical as pitch. Still, there is simply not enough spectral space for everything if someone is indeed interested in representing multiple objects and developing simultaneous processes. Additionally, there is probably little value if the painting simply functions as a spectrogram of the music. In the current installation the sonic counterpart primarily comments on the most important elements of the painting, either being discrete objects or more abstract textures, while the temporal boundaries of the sounds are determined by the spatial boundaries of the drawings. The pitch boundaries of the sounds are arbitrary and depend on the amount of ‘polyphony’ on the vertical axis of the painting. By adopting the convention that the total length of the painting in centimeters is equivalent to the total duration of the sounds in seconds (135cm → 107.5sec), the sounds corresponding to an image should last for the ‘duration’ of the image. The overall form of the painting is broken down into groups of textures that blend together while the participant scrubs through the sound sculpture.

The viewer/listener needs to be able to find similarities on the actual drawings in order to establish a link between the visual and the auditory. Experience showed that no matter how strange and alien to reality the musical material was, the audience was still able to engage and enjoy the interplay between the music and the images, probably considering the whole process as a game. From this it springs that the often-encountered inability of the audience to follow an acousmatic piece (projected over loudspeakers) would not be associated to the nature of the sounds themselves, but probably to the way the piece is presented, or to the absence of visual queues or even to the structuring of the materials. But, I wish not to expand towards this direction, for I have dealt with this subject in previous chapters.

8.7 Exit

In *Imago Dixit* the paintings are not the listening score for the electroacoustic sounds. Furthermore, there is no intention to guide the audience to a particular mode of listening and/or interaction with the artefact. There are indeed ‘performances’ that work better but there is no expected type of behavior that relates to the design of the system. The interactive environment is simply open to interpretation and play. In this sense the process of discovering the artwork is part of the reason of its existence.

Coda

“To my distress and perhaps to my delight, I order things in accordance to my passions ... I put in my pictures everything I like. So much the worse for the things - they have to get along with one another”.

Pablo Picasso

This is the end of the main body of the thesis. I went through a journey of thoughts on my music composed over the past three years at the Sonic Arts Research Centre in Belfast and attempted to show the methods I have deployed on my work and to see how these reflected back on particular aesthetics. I tried to be sincere and criticise any aspects of the pieces I think may be tricky or appear fussy and to acknowledge in what terms and why they might have succeeded. Since the works were grouped in thematic unities according to their format or the means needed, they were not presented in chronological order. I hope the reader was able to follow the thread of thinking without incoherence.

Most likely, the pieces of the portfolio that worked best are the ones that I refrained from making any conscious efforts to establish formal conceptual processes. The connection with the material was emotional and their success had little to do with the methodology or the systems deployed, as if I was digging deeper into my memories devoid of justification.

I have found improvisation to be a vehicle for musical expression as long as a technical understanding of the applied processes is gained (as in the case of using physical controllers). In saying this, I do not mean to suggest that I compose impromptu, without any planning. Usually upon sketching out the overall structure of a piece, building the necessary tools and making preliminary choices about the elements to be used in the composition, I proceed to respond intuitively to the sonic stimuli; thus becoming a listener to my own actions and reevaluating at every stage. Hence, any preparation that precedes the music provides only a compositional framework, and during the act of composition itself I am usually working without any fixed constraints. This is especially the case in the mixed instrumental and acousmatic works.

On the other end, the portfolio also contains pieces that have made use of formal structural devices. In *Absolut Athens*, for example, the use of stochastic processes assured structural coherence but at the same time facilitated the unfolding of the piece in an unpredictable manner. I have found devices that incorporate some sort of chance to be more fruitful in my music than deterministic compositional systems⁸⁴.

As time went by I developed an interest in a soundworld that had a ‘locality’ by drawing inspiration from social conditions. This is especially the case for *Στέρφος* which is the last piece composed for the portfolio. Gradually, I started being less concerned with the exploration of timbre and more aware of the importance of drama.

Nowadays I am closer to believe that the pursuing of the ‘original sound’ from the composers of serious music has yielded in the creation of perceptually similar works over the past decades, thus marginalising this art-form to a small group of audience who are usually also practitioners and most often males... I do not wish to imply that the upcoming generation of composers should fold back to a conservative musical language, but suggest that there is no reason why more accessible idioms should not be embraced. There is actually no point in discriminating between high and low art-forms and in this sense the ‘new’ in computer music might spring from an amalgam of the acousmatic with more well-liked expressions of electronica. Back to composition. -

Orestis Karamanlis
Belfast, November 2009

⁸⁴ As in *32.4 Channels for a mono piece*, a commentary of which can be found in the Appendix.

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Appendix I

Form and systematic composition

32.4 Channels for a mono piece	32.4 surround
Duration	10:45
Unperformed	

32.4 Channels for a mono piece is an early work coming after a period of interest in aesthetics and art theory. I was naïve in my willingness to formulate a compositional method that could structure the musical material efficiently in an automatic way. I thought of composition as a problem I had to solve and proceeded to devise a method to fit on multiple cases. The outcome of this process was unfortunately rather unsatisfactory, since the highly systematic approach was not able to guarantee the musical success and in fact it yielded exactly the opposite results, as most would expect.

Hence, this chapter details what things not-to-do with reference to the current piece. Even if the system has failed to provide interesting results, the value of the work hopefully lays exactly on the knowledge gained there. Awkwardly, I had to go through this process, which was in fact rather lengthy, in order to realise what many composers intuitively know: that there can be no prescribed method for a musical piece; that composition is a tiring and troublesome process exactly because it forces you to make situated choices. It is not a mathematical problem where someone has to go from here to there in the most efficient way. It is about exploration and choice⁸⁵; it is about identifying a whole within something small.

⁸⁵ To paraphrase Stravinsky, ... to be perfectly systematic is to be perfectly dead.

Basic concept

Close to the end of 2006 one of the basic issues I was confronted with was the infinite potentialities that the acousmatic medium offers, not only structurally, but also regarding the plethora of DSP tools existing at the composer's disposal. I felt uneasy within this fluid environment and worked towards a system to help me narrow down the possibilities at every stage and guide the creative process.

I returned to an old method used during the era of the fine art of tape composition. The process involved working with different categories of sounds. I used the term *categorical sound objects*⁸⁶ to refer to sound objects that demonstrated discernible timbral qualities and which belonged to different categories according to their timbre. By viewing the material in this way I focused on what could be called *timbral variability*. The *total timbral variability* of a musical piece might be thought to be partitioned into two parts: one reflecting the timbral variability *between* the distinct categories of sounds and one reflecting the timbral variability *within* these categories⁸⁷. The exploration of the relationships between the two parts is the actual goal of a composition.

Methodology explained

I shall attempt to describe the system by envisaging a rather restrictive compositional scenario, which is in fact very close to the working method adopted for the creation of *32.4 Channels for a mono piece*. The strategy considers first of all that some sort of transformation of the sound material is beneficial.

Let us assume that we are working only with two sounds: one with a very distinct timbral quality and another which is a mutation of the original. We can regard these to belong to different timbral categories. Let us also suppose that we are not allowed to use

⁸⁶ I have additionally used the term *grouped sound objects* in (Davis & Karamanlis 2007).

⁸⁷ This analysis may be thought to resemble an Analysis of Variance model. See also Montgomery (2004: 66).

any other sounds, neither to manipulate the timbre of these two elements individually. This rationale limits the compositional options and urges us to seriously consider the choice of the original source. The aim is to link together the two sounds with the faith of creating a musical piece. Obviously by simple juxtaposition nothing particularly interesting could happen. A somewhat more interesting option could be to present the first sound, interpolate between the two elements and finally arrive at the second. By interpolation I mean any type of gradual transformation that could help us move from one state to another⁸⁸.

Since we are not allowed by our set of constraints to manipulate the sounds any further, and we do not have at our disposal any alternative material, the only thing remaining (after completing the first transition from sound-A to sound-B) is simply to move back to A. In other words, the first step may consist of presenting the first sound (A), interpolating to the second (B), presenting B and interpolating back to A. *Ceteris paribus*, the additional parameters we can modify are only the duration of the sounds and their amplitude. By inventing a model to govern the temporal relationships between these three states (object A, B and their interpolation) we may start creating minimal expectation.

I will use the term *Layer* to refer to the particular category to which a sound belongs and *Step* the process of moving from one layer through interpolation to other layer(s) and back again. The piece unfolds always by following the iterative process described earlier: layer A to layer B via interpolation and back. We can express the first step as follows:

A_1-I-B_1-I , where A, B are the layers, I the Interpolation between them and the index number denotes the step.

In order to make this process more interesting assume now that the duration of each layer is variable throughout the piece and that if a particular layer is long enough we

⁸⁸ Spectral morphing is an indicative tool.

may allow it to encompass another layer within it. This new layer will be a new timbral category (sound transformation) of the original material. If in our example layer B is of a particular long duration we may involve a new sound of distinct timbral quality, which is a metamorphosis of B, and perform a gradual transformation between layer B and the new layer C in a similar way as between A and B. This second step can be expressed as:

$$A_2-I-B_2-I-C_2-I-B_2-I-A_2$$

Additionally, we can apply a model to define the duration for each layer. This process can be generalised so that whenever the duration of a certain layer is long enough then it can incorporate a new one and so on. The following figure shows an indicative graphic representation of this structural process.

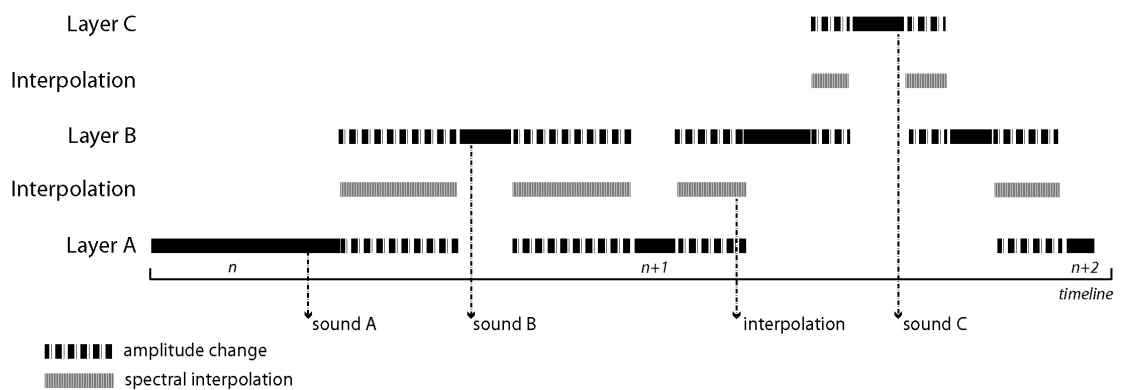


Figure 32. Exemplary graphic representation of layering

Notice that layers do not co-exist, or to be more precise that one always leaves its place to the next gradually during the interpolation stage. The reason for adding a layer within a layer is to retain interest, since otherwise we would have long passages of fairly static textures. Practically, upon deciding the overall structure many different sounds can be stacked following the same logic, each belonging to a certain category. The piece progresses by constantly interpolating between the different timbral states in the aforementioned manner, the same structural model governing all the elements.

Put differently, the polyphonic structure is comprised of individual lines. In the case of *32.4 Channels for a mono piece* all lines develop congruently. The sounds move from one state to another simultaneously and one of the goals is to explore the complexity emerging from the respective layers of sound. Following the terminology of §1 we may identify two kinds of *timbral variability*: the *within-layer-variability*, referring to the variation of timbre of particular sounds with respect to their category and the *between-layer-variability*, referring to the variation of timbre between different sound categories.

To sum up, the methodology assumes that the composer works only with different categories of timbre and their transitional interpolation to create the fundamental structure of the piece. After the basic form has been constructed additional elements may be introduced according to specific compositional needs. The idea is that initially we are regressing between limited categories of timbre to aid the compositional process and to give a certain form of direction; we then return back to evaluate the result. Still, the definition of *category* can be as broad as one desires.

In theory, we could be infinitely creating layers within layers. This process would create a self-similar structure resembling that of a fractal. The middle-thirds Cantor⁸⁹ is a well-known example.

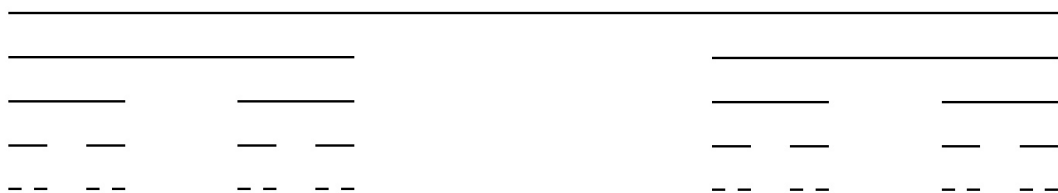


Figure 33. **Cantor's Dust**

⁸⁹ Its construction 'begins with removal of the open middle one-third of the unit interval. That is, the initial set is $[0, 1]$, and the first step is to remove the open interval $(1/3, 2/3)$. On the next and succeeding steps we always remove the open middle one-third of the closed intervals at the current level' Crownover R. (1995).

Inevitably by creating layers within layers, when working with categorical sound objects in the aforementioned method, a self-similar shape emerges. The Cantor Dust is a self-similar fractal and its geometry resembles the structure of figure 32.

System applied

32.4 Channels for a mono piece is a site-specific multi-channel work for the Sonic Lab at SARC and was initially composed using only one ATC SMC50 speaker. All the sound materials originate from an early 20th century recording of a folk tune whose sound quality was rather poor⁹⁰. It comprises of 8 steps incorporating up to 3 layers in the way defined earlier and a coda. In every step the duration of the first two layers was defined by applying a logistic curve and for the third layer it was calculated proportionately. In this manner the duration of the individual parts and ultimately of the whole work was preplanned⁹¹.

Initially the original 1936 recording was divided in 32 frequency bands, as many as the channels to be used later in the diffusion. All the sounds, regardless of their frequency band, underwent similar DSP. For example, layer A would always yield a smooth repetitive texture and layer B a granular cloud of unidentifiable pitch material. A logistic curve was used anew to define the order of introduction of these processed 32 bands. This is the reason why the spectrum of the piece becomes gradually denser, since more frequencies are included in succession. Even though the working method was planned before hand, the actual compositional time spent was substantial. The reason being that each group of frequency bands introduced would have to be interpolated individually at every step; hence while the piece advanced and more bands were launched, the compositional process would become more and more lengthy. The following table shows the sequential order of frequencies introduced for every step.

⁹⁰ The hiss of the recording became an essential building block, which is actually how the piece starts.

⁹¹ The overall form of the piece is shown on a page at the end of the chapter. It is instructive to observe the similarities that this graph has with the representation of layering presented in figure 32.

step-1	step-2	step-3	step-4	step-5	step-6	step-7	step-8	coda
5019*	307	711	98	35**	181	393	632	56
	1835	3738	139	223	498	1286	1630	
		1448	442	349	1142	265		
			1014	560	2066	800		
				901	3320	4209		
				2326	4738			
				2949				

Numbers show the centre frequencies of the band-pass filters

* high-pass / ** low-pass

Figure 34. **Sequential order of frequency bands | 32.4 Channels for a mono piece**

Since the procedure was more or less prescribed there was not much spectral space for additional information in the middle bands. Any new elements (foreign to the model) would usually occupy the higher range of the spectrum. Yet, there are instances where the piece drifts away from this structure with the hope of enhancing the element of surprise. This happens for example at [6:53] and [7:54] when the stream-like form is interrupted, or at [8:59] with the introduction of distorted material which seemingly bear no connect to the rest of the piece's soundworld.

Upon completion of the work in mono format, the final mix was split into 32 individual files corresponding to the same exact 32 frequency bands as the ones used to divide the original folk recording. The final stage of the piece consisted of routing these 32 tracks to 32 individual speakers spread among 4 levels in the Sonic Lab at SARC and mixing them together with the mono version.

The idea is that by assigning to each speaker only one frequency bandwidth the overall spectrum of the piece is divided and diffused in 3 dimensions. By allowing the listener to move freely in the performance hall he/she is able to explore the piece as a sound sculpture from different angles. The next figure shows the Sonic Lab's layout indicating the speakers' placement and the respective centre frequencies of the band-pass filters.

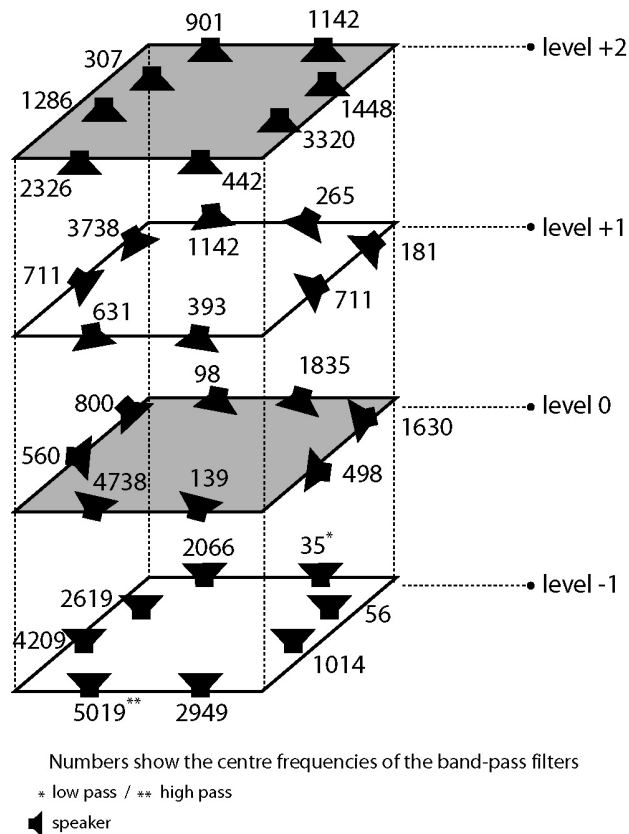


Figure 35. Sonic Lab diffusion layout | 32.4 Channels for a mono piece

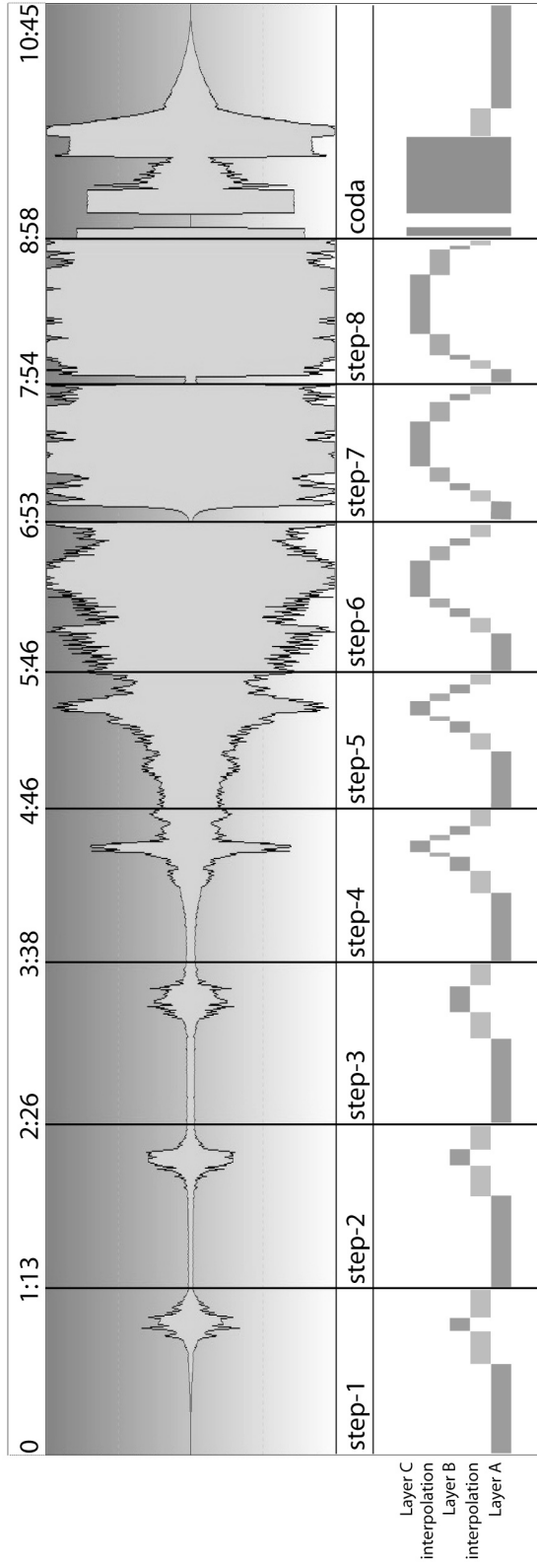
Evaluation

The system provided a theoretical manner of viewing the sound material and a highly systematic way of structuring a piece. As stated earlier the strategy was unable to facilitate a meaningful and enjoyable narrative by imposing a rather stiff compositional framework.

My aim was to discover some rules, utilise them and then proceed to explore whether and in what sense these constraints may be helpful in the creative process. I have found that I would not wish to exchange uncertainty with determinism neither choice with process. Inevitably I have to assume that the structural aspects of the current system inhabit only the compositional stage and cannot be identified at the listening level.

However, the experiments carried out during this work provided really useful alignment for thinking and re-evaluation, the results of which fed into future projects⁹². Needless to say that after my experience with process-based music I turned to more intuitive compositional tactics, as becomes apparent by observing the rest of the portfolio works.

⁹² The respective system was not given up effortlessly. It was additionally applied to an instrumental context in a work for string quartet, titled *Self Similarity*, which is not included in the portfolio. There, the structure is very similar to that of the multi-channel work. Within each layer the *overall timbral quality* of an instrument does not change for a specified duration. During the interpolation subsets the performers try to make smooth transitions from layer to layer by blending the timbres. Each performer is free to choose his/her own internal rhythm. The transformations start and end roughly at the same time for all the instrumentalists.



The diagrammatic representation of the layering is approximate

Figure 36. Overall structure | 32.4 Channels for a mono piece

Appendix II

How something is born, lives and dies: The strategy for thematic evolution in detail

Background

I was always interested in the birth and death of a musical event and its hierarchical place within a composition. In the micro-level composers are occupied by how a musical gesture will be articulated and in the macro-level by when and why it will occur. It is of no secret that many working in the studio compose in a fairly intuitive fashion. Upon deciding on the source material and going through some preliminary plans, examinations and transformations, they sculpt the sounds by constantly reacting to the soundworld, thus, becoming listeners in relation to the result and re-evaluating at every stage.

One of the advantages when working with digital technology is the ability to visualise data. Indeed many composers when working with computer music software make use of breakpoint files and graphic curves to shape the spectrum of the sound through time, and even though the ears should be the only judge of the success or failure of a particular musical gesture, it is inevitable that the visual representation of some processes influence the way we think. This is a rather complex issue to deal with: the affinity between the aural and its representation on a computer screen and how a composer's actions are influenced by this relationship. In the following paragraphs I exemplify the use of envelopes as thematic entities and the structural possibilities they offer mainly in a programming language environment.

On motive

Western tonal music considers the basic motive to be the germ of the musical idea including elements of the subsequent figures, being in a sense the 'smallest common multiple' (Schoenberg 1967: 8) ... the features of which are combined to form higher level structural units. The organisation of phrases to greater blocks enables composers to

construct larger passages and movements with audibly coherent formal organisation (Hatten 2004: 240). The unity and thematic consistency resides in the use of a musical entity that functions as the foundation on top of which the whole piece is constructed. On the surface the elements may appear contrasting but in reality they are manifestations of the same idea. ‘In fact, it is this being “different on the surface but alike in kernel” in which is centered the inner process of musical structure of the last centuries’ (Reti 1978: 5). Smalley (1997) observed that the gestures in electroacoustic music do not possess the same hierarchies as tonal music and consequently often resist segmentation. I will demonstrate that viewing envelopes as a means for thematic evolution provides an additional structural dimension, at least from the composer’s perspective.

Applying musical shapes

In computer music software a breakpoint file⁹³ is not a musical sign, neither is an automation curve altering the values of a variable parameter within a signal-processing tool. It is not intended for the performer, it does not carry any symbolic connotation and contains no reference to any form of human performance. It simply provides a means to communicate with the computer in a graphic environment while representing an energetic shaping through time⁹⁴. It is plainly a representation of a gesture, a graph, a shape, a scheme, or in other words an envelope⁹⁵ that can be as large as anyone wants and which can be easily mapped to any musical parameter. It can tell us how something is born and evolves, how something lives and dies. Being only a series of numbers usually defining energy along the vertical axis and time along the horizontal axis it can be viewed as a structural building block through the prism of a musical motive. A basic envelope-shape can function as the smallest common multiple for a whole piece. The idea of viewing a shape as a musical molecule does not make complete sense in electroacoustic terminology since the segregation of a texture is often impossible. Yet, the purpose here is not to provide a comprehensive methodology for analysis of

⁹³ I prefer the term breakpoint file to breakpoint function since I am thinking more in terms of curves drawn on a graphical oriented interface, and maybe stored as arrays of numbers within a file for example, than of mathematical functions.

⁹⁴ Adopting Reti’s terminology for defining the musical gesture (1978: 95).

⁹⁵ The concept of envelope is used in a broad sense and should not be restricted to a simple ADSR model. It is preferable if viewed as a musical pattern related to the concept of variation.

electroacoustic pieces, but to demonstrate the specific strategy from a composer's perspective.

Let us suppose that we are working within a programming language⁹⁶, such as SuperCollider, and create an envelope-shape by drawing on a graphic window, by algorithmic generation, or by importing pre-existing data from a file. This envelope can be as complex as one wishes and can evolve over any duration. The levels of the breakpoints and the durations of the segments can be easily scaled. It can accommodate the duration of a few milliseconds resembling a grain-envelope, it can have the duration of a longer gesture, a passage, a movement or can provide the overall shape for a whole piece. We can consider an envelope to be a fundamental building block and proceed to explore this compositionally. Since it is simply an array of values, the data are liable to any kind of transformation (inversions, augmentations, retrogressions) and in general any numerical processing that can resemble the manipulation of a musical motive. Hence, within a musical piece, a basic energy-shape can be presented, varied and grouped to form higher-level structural units providing a means for 'thematic' evolution and resolution.

A step further might be to use the shapes within the context of statement and response, constructing apart from the one 'basic motive' and its variations a counter scheme, indeed similar to a sonata-like form and proceed to explore the affinities between full themes, 'shapes of considerable length and weight forming in themselves complete musical statements' (Reti 1978: 193). By applying the same envelope to different processes, i.e. mapping the same data to different parameters, a composer is able to shape time always differently but at the same time similarly. The kernel of the musical

⁹⁶ The reason for choosing a programming language and not a sequencer to exemplify the use of envelopes is flexibility. A Digital Audio Workstation is a closed program designed for commercial use and even though it is an essential tool for editing and assembling musical gestures, it can be very restrictive when designing patterns and it is impossible to accomplish processes that fall outside the designers' intention. Restricting a composer's options may be beneficial in providing a certain form of direction and focus under a particular aesthetic. Nonetheless, as I have already argued, it is desirable to allow a significant degree of freedom and at the moment of writing these lines all sequencers provide a decent but restrictive way to structure a musical piece.

gesture is always the same but the result can be endlessly varying timbrally, texturally, and rhythmically.

Patterns and hierarchy

Treating envelopes as musical motives and exploring their affinities within the whole of a composition is not as restrictive as it may seem. It does not necessarily presuppose a thorough formal planning from the composer's point of view even though the decision is entirely a matter of preference. The sonic possibilities within a programming language environment are so rich and the mapping strategies so extensive that the model most likely encourages the artist to work with the material in an experimental and intuitive fashion. I view the process as a bottom-up strategy for an intuitive exploration, providing as a starting point a structural block on top of which a passage or even a whole piece can be built. Like that, a composition acquires an additional structural level. Not that this has anything to do with the quality of the work, but it can prove beneficial from the composer's perspective, ensuring unity of method when considering notions of gesture, transformation, expectation, tension, release and so forth.

As mentioned, one of the most important concepts of this strategy is the mapping of the same data to any variable quality. For example, the energy-shape of the grain-size of a granulator could be similar to the behavior of a variable cut-off frequency of a filter; thus, both processes would share the same morphology. The results obtained from very distinct DSP using the same energy-shape can be greatly varied and consequently the perception of these phenomena need to be evaluated. When considering the transformation of musical motives in the case of tonal music, defined in terms of pitch and rhythmic patterns, the composer would often identify the elements that constitute the core of the idea and proceed to alter the secondary ones, always retaining something

from the original quality of the motive, while also creating variations to move the piece forward⁹⁷.

If we are to consider envelopes as a means for thematic evolution then a similar approach could be adopted. If the processes applied are complex enough and the mapping to different parameters is somewhat sophisticated it would be difficult for the listener to follow. This becomes more apparent when considering simultaneous processes and polyphonic structures, making recognition almost impossible. In this case, there is a need that the composer decides on the kernel of the soundworld he wants to retain and proceeds carefully to transform and develop those elements that will increase the chance of creating a memorable shape and can be identified in a different context later in the piece. It may be also helpful if the quality of the departing sounds possess some common spectral attributes in order for the listener to perceive the energetic flow as a meaningful scheme and to be able to follow the individual lines in the case of a polyphonic design. Additionally, there needs to be a clear affinity between the time-scaling and level-scaling for the schemes to result in a coherent form.

The notion that an envelope can be treated as an ‘open gesture’ and mapped to variable parameters is not novel⁹⁸. Farnell (2008: 83) wrote that ‘a nice way of dividing events and flows into meaningful frames is to consider the change of energy occurring within a system’. The strategy is also very close to the d’Escrivanian concept of Adaptable Gestures⁹⁹. Julio d’Escrivan suggests that while working in SuperCollider ‘gesture sets can be abstracted into patterns that can be endlessly adaptable through the use of live coding techniques ... also enhancing the workflow to strike an interesting balance between prediction and surprise’. In our case it is the idea that envelopes can be viewed as a means for thematic evolution that opens a small window for composition. Namely,

⁹⁷ To quote Smalley (1993: 280) ‘...certainly, since thematic development became a preoccupation in Western art music, transformation has become a growth industry, associated as it is with notions of development and form, unity and coherence, indeed traditionally speaking, with the concept of the musical work’.

⁹⁸ Especially within the field of computer-aided composition composers have widely used shapes to control various musical phenomena.

⁹⁹ As was exemplified in an informal correspondence with the composer.

one of the strengths of the strategy is its application to the electronic domain while composing mixed pieces using live electronics, incorporating both instruments and electronics that run on a programming language for realtime composition and performance. In this case the mapping could be applied equally well to pre-recorded elements or instrumental gestures in realtime, developing accordingly a thematic homogeneity between the instrumental and the electroacoustic part. The energetic dependencies between the two parts provide an elaborate method for unity and cohesion and endless possibilities to structure the piece in the micro and macro-scale.

A note on perception

So far I have suggested that the scheme→motive concept is helpful from the composer's perspective to structure the piece, neglecting the listener's side. Inevitably, we should also question whether the audience makes any sense of the strategy. It is one thing to provide a structural model to build a piece and another to investigate the impact it has on the listener who makes use of numerous musical concepts while listening to music.

With complex patterns the horizontal and vertical dimensions of the organisation of sound may be difficult to be perceived even by the experienced listener. Ideally we would need to address the following issues: How can an energetic shape of sound be perceived as a complete entity? How can the streams be kept distinct from one another in the case of simultaneous processes? What are the factors affecting the perceptual grouping when dealing with shapes of energy? Is it possible that the sequential organisation of envelopes can teach the listener something about the structure of a particular gesture-based strategy? There are indeed indications (Bregman 2001) that sequential similarities in timbre, spatial separation and asynchronous onsets can favour the distinctiveness of a musical layer, but, in order for the listener to predict the grouping of a shape he/she needs to be able to find some similarities in the sound.

On ahead, some effort is required from the composer if he/she is indeed interested in working with identifiable behavioral relationships. The envelopes on a computer screen may be intellectually interesting for a composer, providing aliment for discussion amongst musicologists, but they cannot function in an equivalent way as melodic or rhythmic motives do¹⁰⁰. Quoting Hatten (2004: 239) ‘as a more general principle, sufficient regularity of patterning enables us to take isolated events as units in a continuous chain at the next higher level’. Even if the previous statement appears to hold for tonal music, it would require a study to examine the extent to which a listener is able to identify and recall a pattern mapped to different parameters, thus engaging in the perceptual present and longing for the future. It is logical that the result will depend on the deviation between the original morphology of sound and its transformations. Taking this into account we may be able to develop further compositional strategies where the listener is guided through processes of mutations from the most apparent to the most distant interpolations.

Discussion

In the previous paragraphs I discussed how treating envelopes as musical motives may suggest a solution to the problem of unity when composing electroacoustic works, shaping time always differently on the surface but similarly in kernel and adding an additional level to the hierarchical organisation of the piece. I viewed the discourse from the composer’s perspective. Another study could reveal whether the compositional mode facilitates the unfolding of the narrative from the listener’s perspective.

¹⁰⁰ D’Escrivan has identified this issue in a personal correspondence.