Perspectives of electroacoustic music : a critical study of the electroacoustic music of Jonathan Harvey, Denis Smalley and Trevor Wishart.

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PERSPECTIVES OF ELECTROACOUSTIC MUSIC

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Thesis submitted for the degree of Doctor of Philosophy
1992

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CONTENTS

Declaration: None of the material offered has previously been submitted by me for a degree in this or in any other university.

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PAMELA ALCORN

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ABSTRACT

This thesis presents a study of the electroacoustic music of three composers living and working in Great Britain - Jonathan Harvey, Denis Smalley and Trevor Wishart - in the broader context of issues raised by the application of technology to music. The thesis has two main aims: to celebrate the diversity of musical languages to which the electroacoustic medium lends itself, as illustrated by the works of these three composers; and to discover and establish themes which suggest the existence of a common compositional aesthetic underlying these developments. To this end, the writings of each composer are discussed and compared in addition to their compositions. The particular question of the influence of technology on musical material and musical language, as illustrated through the works of Smalley, Harvey and Wishart, is examined, and related issues such as the effect of the mechanisms involved in the human perception of sound on the understanding of musical structure are discussed.

Specific musical examples for chapter three (Denis Smalley) are presented on DAT tape, and listed in Appendix 1. An additional cassette is included, illustrating the analysis-by-tape method described in chapter three, preliminary sketches and melodic material for Jonathan Harvey's 'Ritual Melodies' (chapter four), and MIDI sketches for Wishart's orchestral dances (Conclusion); these are also listed in Appendix 1. All source material is listed in Appendix 6.

INTRODUCTION

> It is certainly a major part of the purpose of art to be a self-referential organ of culture, and self-reference cannot be limited and still be alive. In fact new conceptions and perspectives in art seem to arise synchronously as new understandings of our nature and the world arise in other disciplines. It is within the field of art that these new concepts are used to examine the human condition and its collective counterpart, human culture.[1]

In the current political and economic climate, art and the study of art seem to be in need of constant justification. This is especially ironic given the fact that we face the prospect, thanks to staggering technological advances, of the destruction, or at least modification, of the work ethic on which our culture has been largely based, and the creation of the very leisure time that is the prerequisite of such pursuits. Art is the manifestation of our deepest human consciousness; almost all artists agree that the greatest human profundities are revealed through its various codes and symbols. This is not to imply that art has a 'story' to tell, nor that a study of the codes will yield instant access to the message contained therein; nevertheless it is through art that we glimpse the truest picture of ourselves, or at least see the reflection of the potential of the human spirit.

This is particularly so of music. Whether as a simple means of social bonding, or on the level of high art, music has always been acknowledged to be the most powerful of the forms of formalised human expression. Its components are comprehensible at the very lowest level of human perception: its rhythms relate to those of body movements; its pitches to those of human (and other) utterances;

its timbres to the way in which we dissect and analyse the world aurally. Involvement in music, or the production of sound, according to David Burrows, is both 'a message of self-confirmation and self-sufficiency'[2] and a means of bringing scattered individuals into a community; at the same time, 'it may even be that sound, with its potential for conveying the notion of one-ness that derives from its vagueness about the distance and direction of its source - together with the quality of mystery that is one possible consequence of its independence of the appearance of things - is the most important single contributor to our notion of the other-worldly'.[3]

If we are to accept Gareth Loy's definition of the purpose of art (quoted at the beginning of the chapter), it is evident that the function of the artist, whether he or she embraces it consciously or not, is to study and shape the raw materials of our consciousness, to re-evaluate and cast new light on them, and thereby to participate in a kind of self-discovery on behalf of fellow human spirits. The importance of this function crosses all cultural boundaries; even in cultures where there is no concept of the artist in the Western sense, his place is filled by some equivalent guardian of mysteries, be they to do with magic, ritual or religion.

However, the truths contained within art (or religion) are not always self-evident. It follows that, if there is a need for art in our culture, there is also a need for analysis and discussion of art. While the great works of the past continue to provide a rich source of inspiration to new generations of listeners, performers, composers, musicologists and

analysts, it is arguable that contemporary art is in even greater need of such attention, especially as it becomes further and further removed from the everyday experience of the majority of people. In the case of electroacoustic music, even the composers themselves have needed time to grasp the potential of the new medium, as two of their number have suggested:

> In the past two decades a new kind of musical instrument has been invented. It is so different from its predecessors that musicians may need another two decades to learn to play it. In the future, it will be considered the outstanding musical innovation of the twentieth century.[4]
>
> ...the loudspeaker and the computer together have the potential to be the most general and flexible musical instrument developed in the twentieth century.[5]

Both of these statements sum up concisely and eloquently the allure and the controversy surrounding the world of electroacoustic music. In an age when almost every aspect of human endeavour is aided by computers and computer-related technology, the application of this technology to music is one of the areas which inspire the most interest and fascination, which arouse the most heated debates;[6] this despite the fact that music has always depended, directly or indirectly, on technological innovations, whether in instrument design or means of notation and storage, and that electroacoustic music itself is not a new phenomenon so much as a progression from a musical revolution that was taking place as far back as the 1930s and 40s.

Due partly to the technical nature of much of the research, and partly to the emotive nature of the subject, there has been no lack of literature pertaining to electroacoustic music. This century has witnessed a great flourishing of musical and artistic debate, whether at conferences and festivals or in learned journals, and composers, performers,

researchers and technical experts have all seized the opportunity of airing their discoveries, predilections and opinions. Until fairly recently the findings of technical research dominated the literature with detailed and lengthy descriptions of high- and low-level programming languages, graphics interfaces, implementations of new chips in hardware configurations, portable software packages, not to mention new synthesis methods, notation devices, and so on. Research and documentation of this kind, while integral to the development of the genre, has to focus on immediate projects and usually leaves aesthetic considerations in the background. However, electroacoustic music has now reached an interesting stage where, although there is still much potential to be tapped and many goals to attain, enough has been done already for it to be possible to step back and survey the scene with a more dispassionate eye. By and large, the fundamental aesthetic problems of electroacoustic music have been identified and aired in the existing literature, and demonstrated in the repertoire. There are instances of short-sighted research and questionable artistic objectives, just as there are mediocre composers and compositions to hinder the progress of the genre, and it is inevitable - not to say desirable - that with so many different perspectives expressed, few compositions or computer music systems will be destined for universal approval. However, basic problems such as man-machine communication, computer-literacy of musicians, understanding human perceptual processes and the nature of the sonic continuum, interdisciplinary collaboration, technological obsolescence and others, are now widely recognised and challenged, albeit with hesitant results, by serious and far-sighted research projects, and dedicated and mature musicians.

While the potential of electroacoustic music continues to inspire and fascinate a devoted circle of followers, however, the larger musical community has been slow to embrace the innovations and challenges it has brought. One can understand the fears of performing musicians when confronted with the phenomenon of concert-giving without instrumentalists, or, at best, with instrumentalists who have chosen to specialise in 'modern' music and extended performance techniques. One can also sympathise with those composers for whom traditional instrumental resources are by no means exhausted, for whom, in Alexander Goehr's words, 'composing the new means dealing again with the old'.[7] Any artistic revolution, especially one with such far-reaching musical, artistic and even social implications as electroacoustic music, is bound to suffer a difficult period when its public struggles to identify and comprehend its basic precepts. This is particularly so if the new art confounds even the most basic expectations of its public; in the case of music at the turn of the century, these had stood firm throughout almost three hundred years of change and innovation. As Gaboury has said:

> ...habit is necessary to understand a language or a piece of language...as a 'whole'.....Newness prerequesites a minimum of non-newness.[8]

Without too much speculation, it is possible to suggest at least two reasons for this scepticism. First, there has been little or no critical analysis of the music itself. The serious listener has had to content him or herself with sketchy reviews, programme notes, or, if lucky, commentaries written by the composers themselves pertaining to certain works. It is perhaps with this in mind, in contrast with the wealth of technical and aesthetic literature which exists on the subject, that Simon Emmerson has warned:

> Immediate academicization is dangerous, especially when applied to artistic forms; all information is afforded a veneer of neutrality, all events treated as equally worthy of analysis; webs of historic reference are established: who was first or who influenced whom; even though details of a style or technique may be examined, no real evaluation of the music is made, and the emergence of a true critique is stifled.[9]

The task of discovering an accurate or meaningful perspective on new works is difficult, though not without its rewards. A true critique, as Emmerson describes it, need not be stifled by establishing influences and cross-references, however, despite the fact that these may be re-defined many times over the years: rather, it should profit from them. In the case of electroacoustic music, which challenges some of our most basic musical assumptions, many of the issues which first confronted composers in the 40s and 50s have been tackled repeatedly by succeeding generations of composers, and an understanding of the pioneering work is therefore essential for an evaluation of more recent electroacoustic music. The kind of musical knowledge and understanding needed to bridge the gap between electroacoustic composers[10] and their audiences involves not only repeated performances of the music but also continuous study and explanation, and takes many years to acquire on a collective level (it is very different therefore from the 'immediate academicization' so feared by Emmerson).

Second, there is a tendency among the initiated and uninitiated alike to regard electroacoustic music as separate from the body of mainstream compositions, reserved for the select few who know how to understand and enjoy it. By contrast, Jon Appleton's visionary idea, expressed in 1979, presents a more optimistic future:

> Some styles are unique to electronic music because of the nature of the medium; others are common to instrumental music as well. The two media continue to create possibilities for each other and will, no doubt, ultimately become indistinguishable.[11]

Both of these present difficulties can be overcome in time. The inclusion of programmes of electroacoustic music in the Henry Wood Promenade Concerts (1982: Boulez Repons; 1988: works by Denis Smalley, Jonathan Harvey, Alvarez, Viñao and Sciarrino; 1989: Trevor Wishart VOX) has been a significant step forward in the promotion of the medium, giving exactly the kind of recognition which is needed to confirm electroacoustic music as an integral part of contemporary musical life. However, performances are not enough by themselves: they must be supplemented by education. At one level, the new school curricula are beginning to introduce the concept of electroacoustic music to children at a desirably early age; at a more advanced level there is still a large gap.

The work of electroacoustic composers must be subjected to the kind of study and criticism from which masters in the conventional sphere of instrumental composition have profited and continue to profit. Such is the purpose of this thesis, which looks at the electroacoustic music of three composers living and composing in Britain: Denis Smalley, Jonathan Harvey and Trevor Wishart.

Each of these three composers has followed a markedly different path from the other two. Jonathan Harvey, for instance, came to electroacoustic music having had an established background in instrumental writing, and much of his output is still in that conventional sphere.

Denis Smalley, on the other hand, has written almost exclusively electroacoustic music since his early participation in the composition course run by the Groupe de Recherches Musicales in Paris. Trevor Wishart differs from the other two not only in having a more mathematically oriented understanding of electroacoustic music (he has been an active contributor to the York-based Composers Desktop Project), but also in the fact that much of his compositional experience has come from 'environmental', educational or theatrical musical projects which have contributed in a very direct way to the development of his personal compositional philosophy.

A chapter is devoted to each composer in turn. These three chapters themselves are placed in the context of an overview of technical developments and aesthetic considerations (chapter one), as well as a summary of each composer's written theories about music, both published and unpublished (chapter two). While the different musical languages of the three composers demanded different approaches to the analysis of individual compositions and the evaluation of each composer's output as a whole, the discussion presented in each composer-chapter (chapters three to five) follows a rough pattern: detailed commentary is provided about several key works, with more general reference being made to aspects of other pieces from the composer's repertoire by way of additional illustration.

In each case, the discussion is shaped by particular features of the composer's music. Chapter three focusses on Denis Smalley's re-use of sound material between compositions, in the context of his stated belief that the morphology of any given sound has structural implications.

An investigation is made of his use of specific sound material, both in particular groups of compositions, and in general across the range of his output, with examples provided on DAT/cassette. The chapter also uses Smalley's preference for the electroacoustic medium as the basis for a discussion of the problems encountered in devising appropriate analytical methods for electroacoustic music in general. Observations are made regarding the traditional relationship between notation, performance and analysis (or composing, performing and listening) in conventional Western music and the lack of a similar tradition in the electroacoustic medium, and some conclusions are drawn from examples of Smalley's music about the implications this has for the listener's understanding of electroacoustic music.

Chapter four looks at Jonathan Harvey's electroacoustic music from the point of view of his background in instrumental composition, and in the light of his spiritual convictions which are shown to have influenced the development of his compositional technique. His use of technology is discussed in relation to his use of serialism and his attitude towards the traditional concepts of melody, harmony and timbre. In particular, his use of a variety of different technologies is examined with regard to the musical functions fulfilled by each in selected works, and the effect that each imposed upon his compositional methods (including his need for collaboration with technical experts, for example at IRCAM and MIT[12]).

Chapter five singles out Trevor Wishart's interest in the concept of the Acousmatic, or the understanding of sounds without relation to their source, a phenomenon perhaps of peculiar interest to electroacoustic composers.

In the context of Wishart's frequently expressed anti-intellectual stance towards the understanding of music, this interest is shown to have influenced the development of his theories of 'landscape' and 'utterance' (summarised in chapter two), and to have contributed to his particular fascination with concrete and vocal sound material. The constraints which such ideas and material have imposed upon his use of technology are discussed, as well as the implications they have for the listener's associative response to his music.

The three different musical languages which emerge during the course of the thesis reveal the scope and expressive potential of electroacoustic music and also shed light on many of the fundamental questions posed by the medium. Many of these questions arise from the possibilities offered (or denied) by the technology available to composers, and comments are offered in the Conclusion regarding the degree to which the musical language of each composer under discussion is defined by the resources at his disposal.

At the same time, links and comparisons are drawn between the work of Smalley, Harvey and Wishart, and between their work and that of other electroacoustic composers. Common musical preoccupations are found, some of which are peculiar to the electroacoustic medium while others are of a more general nature and apply to composers in the conventional sphere as well. The prime aim of the thesis is to provide a belated starting point for more detailed study of the works of electroacoustic composers. It is hoped that the broad overview presented through the works of these three different composers will help to give a meaningful context for the application of technology to music and, in however small a way, to assist in the establishment of

electroacoustic music as an integral part of the contemporary music scene.

CHAPTER ONE

Tools and Aesthetics

To make a critical study of electroacoustic music it is important to have a basic understanding of the technology available at the time of the music's conception, and an awareness of the techniques and procedures which have been developed. The choice of computer system, analogue technique or synthesis method made by a composer governs to a greater or lesser extent the kinds of sounds and compositional devices which will be suggested to him, and therefore both reflects and influences his own conception of his music. The equipment in the early studios of Paris and Cologne undoubtedly played a significant part in shaping the compositional aesthetics which evolved around them, and the same is true of today's technology, which, through its various designs and implementations, continues to exert an influence on the composers who use it, while further technological innovations may themselves be modified by composers' ideas and requirements. The relationship between a composer and the technology he uses is complex, and varies from one composer to another: for example, some are "seduced into programming"[1] and become intimately bound up with the designing of software specifically suited to their own needs, while others prefer to leave such working to technical experts, with whom they might collaborate over a period of time to create the final work. An awareness of this relationship can give useful insights into the

works of individual composers, as well as providing a general context of related issues in which to evaluate them.

The application of technology to music has taken many forms, and has created a wide variety of new tools[2] for composers to use in conjunction with, or instead of the traditional pencil and paper. Changes in fashion and aesthetic, and the rapid rate of technological progress make it difficult to trace a consistent path of development in the genre of electroacoustic music; in spite of this, many of the issues which are raised by the use of technology in music, in composition, performance and for the listener, have remained the same since the early experiments of the 40s and 50s.

The invention of recording made the whole repertoire of natural and man-made sounds, not just instrumental or vocal sounds, available for musical treatment and research. In doing so, it proved to have significant implications for the field of electroacoustic music. The early work done by Schaeffer with recordings of acoustic sounds, both in his research and in his compositions, did much to expose the complexity of the relationship between sound and the human perception of sound. His experiments highlighted not only some of the most significant characterising features of natural sounds (for example, the importance of the attack part of a sound's envelope) but also several crucial aspects of the way we hear and listen. For example, sounds are characterised in the listener's mind not only by their timbre but also by their associations: this presents no revolution in instrumental music, since instrumental sounds are automatically associated with music. *Musique concrète*, on the other hand, may make use of sounds which have no immediate musical associations whatsoever to the listener, but

which have other associations strong enough to overwhelm the composer's attempt to use the sounds as 'abstract' components of a musical structure. Schaeffer's own work 'Etude aux chemins de fer' (1948) is a good example: its material consists entirely of a succession of recordings made at the Gare des Batignolles in Paris and the effect, despite the composer's efforts to transform the source sounds, is of a picture in sound of the activities of a railway station rather than a study of the sound events in their own right.

Without sound recording there could have been no *musique concrète*, no *elektronische Musik* and no tape composition. Pop music especially would have followed a very different course. The whole social context of Western music making this century has been governed by the ability to make recordings. In addition, tape provides the facility for manipulating the sounds recorded on it, and has thereby offered a resource for an enormously wide range of compositional activity, and engendered many of the techniques associated with electroacoustic music in all its forms. Transformation of sounds has become one of the electroacoustic composer's most important techniques, affording him the chance to explore a whole continuum of related sounds between the familiar and the unknown. Today, sampling techniques and methods of analysis and resynthesis of sounds are some of the most widespread tools used by electroacoustic composers in both 'classical' and more popular fields of music.

Perhaps a more revolutionary contribution still to the evolution of electroacoustic music has been the development of sound synthesis techniques. While magnetic tape opened the door to the whole range of acoustic sounds, direct synthesis puts the composer in the position to

create any kind of sound he wishes. As often as not this is an embarrassment of riches. It is one thing to imagine a sound and quite another to find a way of realising it, without knowing something of the acoustical behaviour of natural sounds or understanding to a certain extent the mental and perceptual processes involved in listening to sounds, not to mention having a grasp of studio or computer techniques. Despite such difficulties, however, composers continue to be inspired and fascinated by the creative possibilities offered by new sounds. Before exploring these and other issues, therefore, it will be worth outlining some of the more common methods of sound synthesis currently in use. The techniques of additive synthesis, frequency modulation, granular synthesis, formant-wave-function synthesis, and acoustic modelling are summarised below.

Synthesis of Sounds

The technique of *additive synthesis* involves creating a complex sound by superimposing several simple sounds (such as sine tones). The frequency and amplitude values of the component sounds are 'added' together in a way similar to the use of octave doublings and combinations of stops on an organ. Since the frequency and amplitude of partials in a complex sound vary with time, it is necessary to specify their values for each component of a new sound independently. This means that a large amount of data is required for the calculation of each complex sound. The technique may be used to create almost any sound, although the process may be time-consuming depending on the complexity of the sound to be calculated and the speed of the hardware.

Frequency modulation, pioneered by John Chowning[3] after research in the 60s by Risset, Mathews, Moog and others, departed from the principles of additive synthesis. It was discovered that by elegant combinations of the frequency of one oscillator (the 'carrier frequency'), the frequency of another oscillator (the 'modulation frequency'), and the amplitude of the modulating wave (which affects the depth of modulation, or 'deviation', created), two simple sounds such as sine tones could be combined to form a single, rich timbre. Many natural sounds, in particular bell-like, brass-like, and drum-like sounds, can be realistically synthesized by frequency modulation so that the spectral components vary dynamically according to the overall shape of the sound's envelope. The technique reduces the amount of data needed for calculation and is thus more efficient computationally than additive synthesis. Commercial synthesizers, such as the Yamaha DX7 and its successor, the SY77, have achieved great success partly by virtue of their pre-set FM sounds which are modelled on instrumental timbres. However, a major difficulty encountered with frequency modulation is that variations between sounds produced are difficult to prescribe accurately in terms of the numerical values of the carrier, modulator, and deviation. Hence, the user is often reduced to adopting a trial-and-error process in order to achieve exactly the richness or morphological complexity he desires. Using commercial equipment does not necessarily ease the situation if the composer wishes to adapt the pre-set sounds,as the machines are not designed to facilitate working at this level.

Risset's statement that:

> timbre is mainly characterised...by a property, a law of variation, a relationship between physical parameters, rather than by a physical invariant such as a spectrum.[4]

defines timbre as a dynamically changing property rather than a static one. A similar view was behind the development of *granular synthesis*, a method of synthesis involving the generation of densely packed 'sonic grains', typically 1-50 msec in length, to form larger sound events. Although proposals for using quantum representation to describe sound date back to the 1940's, Xenakis , in his book Formalised Music was the first musician to recommend such an approach to composition, using mathematical procedures to produce composing models for what he named Stochastic Music:

> ...when linear combinations and their polyphonic superpositions no longer operate, what will count will be the statistical mean of isolated states and of transformations of sonic components at a given moment. The macroscopic effect can then be controlled by the mean of the movements of elements which we select.[5]

He also described natural events, such as the sound of rain or insects, in the same terms:

> These sonic events are made out of thousands of isolated sounds; this multitude of sounds, seen as a totality, is a new sonic event. This mass event is articulated and forms a plastic mold [sic] of time, which itself follows aleatory and stochastic laws.[6]

Early computer implementations of granular synthesis, as suggested by Xenakis, were carried out by Truax in his POD system[7] and by Roads[8] from the early 1970s. The complexity of calculation required for this kind of synthesis tended to demand a non real-time approach, although both POD 5 and POD 6, two of the three main versions of Truax's

early system, were real-time, interactive programs. Truax subsequently investigated the possibility of real-time granular synthesis using a digital signal processor (a DMX-1000, one of the earliest DSP's) in conjunction with a PDP 11 minicomputer. In this version, three instruments are available, each providing a different unit grain as the basis of synthesis: simple oscillator, frequency modulation oscillator pair, and sampled sound. The instruments comprise banks of envelope generators controlled by a scheduler program on the PDP which initiates and terminates each grain. The number of envelope generators, or 'voices' determines the maximum vertical density of the sound; the length of the grain determines the overall density of grains per second. The composer controls the parameters of the grains by means of four variables: centre frequency and frequency range, number and range of samples (for sampled sounds), average grain duration and duration range, and delay time between grains. The first of these relates to the pitch-noise continuum: depending on the size of the frequency range around the centre frequency, pitch, narrow band noise, or broad band noise will be perceived (this concept of a pitch-noise continuum has interesting parallels with Smalley's idea of the 'pitch-effluvium' continuum, discussed further in chapter two). Whether the sound is heard as a continuous texture or as a succession of discrete events depends on the average grain duration. Thus the control variables correspond to certain basic psychoacoustic phenomena with which composers are familiar irrespective of their degree of experience with computer music systems.

A more recent technique developed during the late 1970s and early 1980s at IRCAM by Rodet, Barrière and Potard[9], and more recently still by Clarke[10], involves what is called *formant-wave-function*

synthesis (FOF), as for example used in the CHANT program. The starting point for FOF research was the analysis of natural sound, in this instance the singing voice:

> The choice of the voice as a model of production was imperative because of its extreme richness. By the wealth of its output and the variety of musical and linguistic uses to which it gives rise,the voice inspires a more general and fertile approach than the study of any other instrument - no matter how complex. It is the need to account fully for the complexity of the variations in the vocal model, and more particularly, in the resonator, which obliges us to reach a level of generality that has also enabled us to move toward quite different models.[11]

Analysis of the voice has shown that vowels are characterised by particular formant structures. That is to say, certain combinations of higher partials remain relatively constant in frequency and amplitude for a given vowel regardless of the fundamental frequency of the note: this ensures a consistency which enables the ear to distinguish a vowel. It follows that this is a feature of special importance perceptually as the ability to recognise vowels independently of inflection or register is vital for the purpose of language and communication. The description of sound in terms of formants would thus appear to be a powerful way of achieving coherence. Hence a synthetic sound or family of sounds having a characteristic arrangement of formants is likely to be perceived as having a uniformly recognisable quality and therefore should be amenable to permutation and transformation within a musical composition.

Another approach to sound synthesis has been to focus attention on the physical properties of natural resonating bodies - for example, musical instruments - in order to understand the workings of the mechanisms which produce sound, on the assumption that an electronic model built on the same principles will produce sounds of 'life-like' richness and

complexity. Research into acoustic modelling has been carried out in both the analogue and the digital domains and started to become significant in the mid-1970s, since when simulations of almost every kind of instrumental sound have been achieved effectively.[12]

In acoustic modelling, approximately the same method is used for any instrumental type. An explanation of the basic principles behind sound production from an instrument may be helpful here. In the case of a trumpet, air is blown from the mouthpiece to the bell in the form of airwaves. When a wave reaches the bell, it undergoes a rarefaction corresponding to the decrease in impedence. This effect sends a wave back along the tube where it encounters another change in impedence depending on the position of the lips of the performer (open/shut). This in turn sends a wave back towards the bell. At each change the air wave loses energy until it disappears completely. As air continues to be blown down the tube, the returning airwaves mingle with the new ones, but slightly out of phase, according to the distance travelled along the tube (sound travels at approximately 1 foot per msec). This time difference is too small to be perceived as a pulse and is perceived instantaneously instead, as an enrichment of the timbre. It follows that the length of the tube, the size and shape of the bell (impedence), and the movements of the 'exciter' (eg. lips), as well as the materials used, have a direct effect on the sound produced.

The specific physical properties of the resonator of an instrument will have the effect of enhancing some frequency components of the sound and suppressing others. In acoustic modelling, this is simulated by a technique known as *subtractive synthesis*, whereby a complex sound is filtered to boost certain component frequencies and remove others.

A simple electronic model of such a sound is constructed by means of loops, delay lines and filters. A signal is delayed and looped several times, with a specific decrease in energy before output, in combination with the continuous signal to produce a modulated, out-of-phase effect. Other factors determining the timbre, for example in the case of a trumpet, the size of the bore and shape of the bell, are accounted for by the use of filters. The model becomes increasingly complicated as attack transients, random air fluctuations or vibrato, and other subtle acoustic phenomena are taken into account.

A combination of signal and delay with modulation functions may be used to construct a model of almost any instrumental sound. Interesting results may be achieved by combining one kind of signal with the model for the body of a different kind of instrument (for example a speaking trumpet) or by altering the modulation effect to transform one sound into another. If it is possible to control precisely any of the parameters of the model, a continuum of sounds should thereby be available ranging from direct instrumental simulation through subtle modifications, to completely new sonorities.

* * *

The sound synthesis techniques used today, including those mentioned above, have developed as a result of a common desire to find ways of producing new sounds which have the complexity and richness of acoustic sounds, static combinations of sine tones having proved to be artistically and perceptually unsatisfying. As suggested, some of the research is still aimed at producing convincing copies of existing instrumental sounds, on the basis that the tools designed to achieve this

effectively and the knowledge gained through such experiments will facilitate the production of satisfying new sounds. Techniques such as additive synthesis, FOF synthesis and acoustic modelling are all based on research carried out on natural models; even granular synthesis, which is a highly elaborate artificial concept, owes its origins (at least in its musical application) to the perceived behaviour of natural sound masses and is often used to create sounds which have similarly elemental qualities.

While such techniques have been designed, and continue to be improved, to maximise the possibility of producing interesting sounds, however, it is still the composer who must specify the characteristics and parameters for the sounds he desires. The technology is musically neutral - it neither lends itself to, nor denies the possibility of musical application - but it is functionally biased, which means that characteristics inherent in the design of any particular piece of equipment may facilitate one method of working rather than another and even lend a uniformity to the end product regardless of the individual style of the composer. Part of the learning process for the composer of electroacoustic music is thus to determine which kind of technology is most suited to his musical purposes and to his compositional methods.

This is by no means a new problem. The equipment in early studios had not been designed specifically with creative musical use in mind, so composers working with it had to redefine their musical criteria if their music was to have any artistic validity. Pierre Boulez identified the problem as early as 1955 when he wrote:

> What previously had been fixed limits are now suspended; they even become a sort of negative cliché: everything which was limited becomes unlimited; everything which was 'imponderable' can now be subjected to precise measurement. Furthermore, this very idea of precision, which has for so long been sought after, has now become a myth; the more one seeks to limit possible sources of error, the more limitless they seem to become... Here [in electronic music], from a world undifferentiated in its timbre, pitch, intensity and duration, we are required to create a composition which is coherent not only in its internal structure but also in the constitution of its actual sound material. Rarely in the history of music has the musician found himself in a more radical position, faced with as unaccustomed a task as the creation of the very sound itself.[13]

While tape recorders and tone generators were useful in creating new sounds for composers, they did not lend themselves to the production of sounds traditionally thought of as musical. Their use, therefore, implied a reappraisal of what constituted music, not an unprecedented phenomenon in itself since there have always been musical revolutionaries, but, as David Keane has pointed out:

> Electroacoustic devices offered opportunities not only for the radically expanding expression of the mid-twentieth century, but also for disconnecting from musical tradition altogether.[14]

With such frighteningly malleable resources it was perhaps inevitable that questions of aesthetics should turn into questions of dogma for some composers: the celebrated quarrel between the first studios of Paris and Cologne can be seen almost as a latter-day *guerre des bouffons*, the French concerned with the morphology of natural sound objects and the Germans with more formalised considerations of musical structure. On the other hand, composers like Varèse, Cage, and Berio in the 1950s and 60s, had a more liberal approach to the whole idea of using new technology for creative musical purposes, and were less concerned with the means by which new sounds and structures were obtained than by 'the approach itself in its purest conception'.[15]

In fact, the musical propaganda of the time obscured the more fundamental musical issues facing composers: the responsibility for creating a new aesthetic for their work, and the need or otherwise for them to redefine this with every new composition. Stockhausen, in the 50s and 60s, created a new palette of sounds according to the structural principles governing each new composition, and systematically deleted all the source material and preliminary sound manipulations for each piece after it was completed, so that there could be 'no catalogue of sounds which could be enriched by some hundreds or thousands of sounds "for general use" after realisation of a composition'.[16] His opinion at that time (before ideas about universality, and the integration and unification of musical influences from across the globe had taken hold of him in the mid-60s[17]) was that each sound should be carefully constructed from its constituent sine tones, or equivalent building blocks such as impulses, to suit the specific structural demands of that work alone.

By contrast, Denis Smalley is notable for having developed an idiosyncratic repertoire of sounds and sound gestures which He has been happy to use in several different compositions; there are even cases where he has transferred whole passages of his music from one piece to another, often with only superficial modifications. As Smalley maintains that his musical structures grow from the implications of the sounds used in a work, this would suggest that certain of his compositions have not only a timbral and gestural similarity to each other but also a structural or, at least, sub-structural uniformity.[18]

Although Stockhausen's aim might not have been entirely justifiable on perceptual grounds, as we shall see, the concern to explore the spectral and morphological characteristics of sound objects, both natural and synthetic, through the structure of a composition has been common amongst other composers of electroacoustic music. Jonathan Harvey, for example, has used the results of spectral analysis to inform the melodic, harmonic, and formal characteristics of several of his works, while Trevor Wishart's use of the phase vocoder[19] to analyse and re-synthesise the sound of the human voice had a direct effect on the composition of his piece 'Vox 5' (1979-86).

This is a good illustration of how new tools created by technological development have had an effect on musical language. Methods of sound analysis had to be invented before the internal structure of natural sounds could be harnessed in this way, and before thorough investigations into the workings of human perceptual processes (which have been of considerable significance for electroacoustic music) could be undertaken. The notion of language in the context of music is a complex issue, but a consideration of some typical definitions of language is interesting here:

1 The words, their pronunciation, and the methods of combining them...used and understood by a considerable community and established by...long usage.

2 A systematic means of communicating ideas or feelings by the use of...conventionalized sounds, gestures, or marks having understood meanings.

3 An artificially constructed primarily formal system of signs and symbols (as symbolic logic) including rules for the formation of admissible expressions and for their transformation.

4 The means by which animals communicate, or are thought to

communicate...with each other.

5 The vocabulary and phraseology belonging to an art or department of...knowledge.

(Websters 3rd New International Dictionary)

6 Applied to methods of expressing the thoughts, feelings, wants, etc otherwise than by words.

(Oxford English Dictionary, 2nd edition)

Notions of communication, specialized vocabulary and understood rules of formal construction are clearly of importance to any definition of 'language', and may be applied to music. There is no universal language of music, even though music is universal; rather there are many different musics all with their own specialized vocabularies and formal rules and conventions. If the vocabulary and rules of a language are specialized, then communication is limited to those who are conversant with them. Hence, if there is to be a language of electroacoustic music at all, there must be a common repertoire of musical assumptions on the part of the composer and the listener which becomes established over a period of time; a stream of 'unheard' ie. unfamiliar sounds in however elegant a structural scheme, will be simply meaningless.[20]

This is especially so in view of the fact that our perception of sound is a complicated psychological phenomenon. Philippe Manoury points out:

> The time necessary to recognise such 'forms' [traditional timbres].... is generally shorter than the phenomenon in question... The case of artificial sounds however is different. Electronic sounds are 'unheard' (in the etymological sense of the term), and the composer, who no longer has a fixed and finite instrumentarium, must operate with different criteria. The

very short time lapse which allows us to recognise a traditional timbre no longer applies here. The composer must work on the spectral envelope and on its evolution in time.....The novelty of sound itself...is not enough. Research purely on structure without a thought for sound or its impact on perception can hardly advance of its own account. There are times when the neutrality of sounds favours a complexity of structure, others when their richness imposes limits on structure, because they are too pregnant and will not integrate. There are finally ambiguous cases where one passes from timbre to polyphony, from sound to structure, where the frontiers of these categories become very fluid.[21]

Assuming that one of the chief delights of the electroacoustic composer is to explore the sonic continuum revealed to him, it follows that part of his task is to discover or create those sounds which can be incorporated into an existing musical language, or else to sacrifice some of his ease of expression in order to give his new musical language comprehensibility in a composition. As previously mentioned, the work done by Schaeffer in learning to understand the nature of acoustic sound and our perception of it was extremely important in this respect. Many of the problems since encountered by composers of electroacoustic music, in integrating diverse sound sources, or transcending our perceptual categorisation of sound types through transformation of sound, or even using new sounds, whether natural or synthetic, were illustrated in several of Schaeffer's pieces (for example 'Etude aux chemins de fer' 1948, and 'Etude pour piano et orchestre' 1948). However, concrete sounds are at least coherent auditory images which bear some relation to the everyday experience of the listener; for the exponents of *elektronische Musik* in the early 1950s, as Peter Manning has pointed out, 'it proved extremely difficult to create culturally acceptable alternatives for these essential characteristics of traditional music'.[22]

Within a musical structure, new sounds must either relate to sounds with which the listener is already familiar, or create such a strong

impression that they become familiar by themselves within the context of that piece. (Little did Varèse know, when he appealed for new sounds and new instruments at the beginning of the century, how much of a demand he was making.) This explains why, of all the applications of new technology to music, the development of sound synthesis has been possibly the most contentious. One of the problems encountered has been an incomplete understanding of the acoustical behaviour of natural sound - hence the importance of the sound analysis which has led to such techniques as FOF synthesis and acoustic modelling mentioned above. Another problem has been that the mechanisms by which we perceive sounds are still not fully understood. This means that learning how to create new, coherent auditory images has often been an unsatisfactory case of trial-and-error.

Studies in psychoacoustics have suggested that ordinary listening is a *synthetic* rather than an *analytic* process.[23] This means that although a natural sound may consist of many spectral components, it is generally perceived as a 'whole'; in other words, the components 'fuse' together to make a single auditory image (many synthetic sounds fail because they do not 'fuse' in this way: certain sine tone aggregates constructed according to serial principles would fall into this category).

Various factors contribute to this perceptual 'fusion'. Stephen McAdams notes that the degree to which the internal structure of a sound relates to the harmonic series (the 'harmonicity' of its frequency content) is particularly significant. The human auditory system appears to be biased in favour of processing harmonic sounds (that is, sounds whose spectral makeup closely resembles the harmonic series), as opposed to inharmonic sounds. This would explain why it is possible to

deduce the fundamental frequency of a harmonic sound from its high partials alone, while bell sounds, which are inharmonic, are often perceived as having more than one pitch. Another factor mentioned by McAdams is the coordinated modulation of spectral components in a sound: for example, if the partials of a synthetic sound modelled on a vowel sound are subjected to a small degree of parallel modulation (eg. vibrato), the sound will bear a closer resemblance to its natural counterpart, and will thus be said to be more strongly 'fused', than if the modulation had not been imposed.[24] A further cue to the 'fusion' of a sound involves what McAdams calls its 'spectral envelope'. By this he means that the spectral makeup of a sound is characterised by certain clusters of high partials which remain relatively constant even though the fundamental frequency and frequency components of the sound may change. As already noted, vowel sounds are good examples of this phenomenon, each one being characterised by different high clusters (or formants); thus a single vowel may be recognised regardless of the pitch of the voice which utters it.

Such factors contribute to our ability to 'parse' or separate two or more sound sources. For example, if the partials of a sound have a synchronised attack, the sound will be more strongly 'fused' than if the partials have separate, or asynchronous attacks; similarly, if we can distinguish between the beginning of one complex sound from that of another, the separate identities of the two sounds are more likely to be preserved. The identity of a strongly 'fused' sound will nearly always be preserved even when it is heard against another, less strongly 'fused' sound. In the context of music, our ability to recognise and distinguish individual instruments within an instrumental group depends upon these psychoacoustic phenomena; it is not impaired even when we hear the

sounds of several instruments coming from an apparently single source such as a loudspeaker. How much of these abilities is innate and how much is learned is still not known: as McAdams and others have pointed out, the ability to separate acoustic sounds in the environment is of biological significance - we need to distinguish friendly sounds from unfriendly ones. On the other hand, the kinds of variations in spectral content that are characteristic of a particular 'class' of sounds are learned by experience:

> Pattern recognition processes may be conceived of as "templates" of classes of sources that are encountered in the environment. This kind of "template" does not represent a static "object" with which it can be directly compared. Rather, it represents a class of rules of dynamic relations among and coordinated transformations of elements of a source characterizing a family of particular instances of a type of "object". In this sense, what we deal with as a particular "object" in the environment really implies a process of relationship between the "object" and the perceiver of that "object"....a clarinet tone remains a clarinet tone regardless of the register or the intensity being played.[25]

Computer-assisted Composition

The genre of electroacoustic music is not solely concerned with new sounds, however. From the earliest days of computer technology, composers have been interested in using machines as calculating tools to facilitate their structural working as well as enriching their palette of sounds. Indeed, many composers use computers to assist them in writing music for conventional instruments.

> Such use of the computer as a compositional aid originated with a desire to generate data for translation into traditional musical notation for conventional performance. The earliest experiments used statistical analysis of simple melodies or principles derived from basic rules of tonal harmony as the basis for computational procedures governing the

choice of notes from randomly generated sequences represented as numbers, often in an attempt to simulate specific compositional styles. The aim of the research behind the 'Illiac Suite', written for string quartet in 1956 by Lejaren Hiller and Leonard Isaacson at the University of Illinois, was to show how the computer could be used not only to generate data approximating to the conventions of simple 2-part and 4-part writing and first species counterpoint, but also to produce random chromatic music, 12-tone music, and 'markoff chain' music, the latter involving new approaches to musical decision-making based on probability functions.

Xenakis, having become increasingly interested in mathematical theories concerning indeterminism and the laws of large numbers, as noted earlier, as a reaction against 'the strict, deterministic causality' preached by serial composers, also turned to probability theory as a means of controlling large scale structure in works such as 'Achirripsis' and 'Pithoprakta' in 1956. Stating that

> computers are not really responsible for the introduction of mathematics into music; rather it is mathematics that makes use of the computer in composition[26]

he developed a method of creating stochastic music using a computer which led to the composition of such works as 'ST 10 - 1, 080262', 'ST 48 - 1, 240162', and 'Atrées', in the early 60s. In handing over the task of data calculation to the computer Xenakis was able to save himself considerable time which could then be filled with more musical concerns of structure and articulation, while modifying the composition program to incorporate elements of personal style.

Similar principles were at work in Koenig's composition programs Projects 1 and 2.[27] The first is a system based on the principles of serial composition and was intended for personal use, allowing only a minimum of user control; Project 2 was designed for more general use involving more comprehensive parameters (instrument, harmony, register, entry delay, duration, rest, dynamics - as opposed to the original seven: timbre, rhythm, pitch, sequence, octave register, dynamics) and incorporating probability functions over which the user has control.

These programs and others uphold the same basic assumptions: that the process of musical composition consists of choosing elements from a theoretical infinity, combining them according to particular rules, and producing a result which observes certain rules of proportion. Hence Koenig's statement:

> More than any other art form, music tends to have rules for its composition. There are rules for rhyming and metre, perspective and colour mixtures, drama and so on. But poetry, painting, acting and sculpture have natural objects as their model, or their geometric abstractions. Literature uses a language which is also used to communicate in everyday life. But music does not portray nature; the world of musical sounds and expression is absolutely artificial - there is no corrective in the form of a natural model. Whereas the model can be recognised in illustrative art, music, if it does not produce psychological associations or imitate the gesture of spoken language, must establish its "non-natural" sound formations in such a way that they can be repeated, recognized, altered and further developed.[28]

All of these procedures in musical composition can be modelled on a computer. The theoretical infinity may be represented by random (or pseudo-random) number generation, where each number is a symbol of a particular musical concept - pitch, timbre, duration, interval, and so on. It is possible then for the computer to select or discard individual numbers from the random sequence by observing simple statements in

the program, as it were, filtering off those which fall outside a particular boundary set by the composer or the system designer. One choice might be to allow through only those numbers which correspond to a major scale; a 'modulation' could then be effected by allowing an increasing percentage of a given 'accidental' to be generated over a specified length of time within the sequence. Hiller and Isaacson did this in the 'Illiac Suite' by programming cadence routines. These altered the selection of melody and harmony notes at regular periods to permit a higher percentage of numbers representing the tonic note and governing the context and 'resolution' of the leading note. Another choice might be to accept a random sequence within set limits as long as no number is repeated until all numbers within those limits have been generated once: this is exactly one of the procedures, called SERIES, incorporated by Koenig into the Project 2 system.

The 'laws of proportion' referred to above may be observed by including more constraints at a higher level to determine the overall shape of a longer sequence of symbols. Barry Truax's 'tendency masks' in his method of granular synthesis allow the texture of a given mass of sound, determined by the density and distribution of the grains, to be changed over time according to a higher level structure imposed by the composer. In all cases the constraints imposed at any level may depend upon the composer's taste, the doctrines of tradition, the flexibility of the program, and a host of other variables. The more restrictive the rules, the more predictable the outcome, and vice-versa.

In the field of computer-assisted composition there are still many artistic dilemmas to be overcome. Whereas in tape or instrumental music the composer is involved at every stage, reacting constantly to

what he hears or to new ideas which may modify his thinking at any point, with computer-composed music the (human) composer relinquishes control of those parameters he has assigned to the machine. A conflict then arises as to whether the composer accepts without amendment the result of the computer calculation or whether he permits himself to 'interfere'. With computer-assisted composition, as with all composing systems, composers often feel the need to contradict decisions which are implied by the rules of the system in order to preserve the musical sense of their piece. Not surprisingly, interactive systems which enable the composer to hear and react to the results of the program he is using, and thus exercise artistic judgement during the compositional process, are becoming increasingly popular.

It will be clear from the earlier discussion of the use of stochastic processes that algorithms can be used either to generate sound or to control low- and high-level structural features of a piece, or both. The same algorithm may be used to determine everything from the internal nature of the sounds to their shaping and distribution in time. The technique also has wider applications - Brian Evans' composition Marie Sets, which was performed at the International Computer Music Conference in 1987 in Illinois, uses the same iterative algorithm to generate both sound and visual images simultaneously. In such a case, it does not follow that the result will be musically as well as conceptually satisfying, unless an element of human choice can be built into the program.

Methodology

All of the sound synthesis and computer-assisted compositional procedures mentioned so far raise the question of how a composer actually translates his musical ideas into terms appropriate to the equipment in use. Attempts have been made to create systems which will 'understand' natural language commands[29] but these inevitably come up against the problem of interpretation: for example, the spectral and dynamic envelope required to effect a *crescendo* in one context will be quite different from that in another. Few composers, apart from those who choose to specialise in this area of research, have advanced computer skills, so unless they are happy to enlist the help of computer specialists for technical advice, time must be spent in learning how to master whichever system they have chosen for a particular piece. In conventional composition, the composer can control how his piece will sound to some extent, by means of a standard notation which can be interpreted by a suitably trained performer. With electroacoustic music, where the composer is using machines as well as, or instead of, musicians, nothing can be taken for granted.

The MUSIC family of synthesis programs, pioneered by Max Mathews in the late 1950s at Bell Telephone Laboratories, New Jersey, has been one of the most successful to date, with different versions having been installed in music centres all over the world. Its principal advantage is that the construction of sounds and sequences of sounds may be specified minutely via a syntax resembling the familiar concepts of an 'orchestra' and a 'score'. At the simplest level, a configuration of statements representing the constituent waveforms for oscillators and the segments of envelope shapers define the overall components of the

sounds in the 'orchestra', while the 'score' may contain details of their duration, combination, pitch, amplitude, and evolution in time.

Since the attack times of individual sounds may be specified to a fraction of a second in the 'score', it is possible with this kind of program to produce enormously complex sequences or counterpoints of notes relatively easily. The system is sufficiently general to permit many different synthesis techniques, from straightforward additive synthesis to more complex methods; signal processing, that is modification of acoustic sounds which have been stored in the computer by means of analogue-to-digital conversion, is also available. One of the drawbacks of such a program, however, is that all the data needed for calculation of a sound, regardless of which technique is being employed, must be specified mathematically. In other words, the composer must supply the particular numerical values of each parameter of every component of a sound (and as we have seen, any one sound may be the result of a bewildering complexity of different phenomena), so the process is arduous even with the most high speed machines.

One computer system of interest in this respect is the UPIC (Unité Polyagogique Informatique du CEMAMu) system developed by Xenakis from the early 1970s onwards.[30] The primary aims behind this development were to find a more general alternative to conventional musical notation for the creation and depiction of new musical scores, and to provide the composer with an interactive environment in which to work. The system was built around a two-dimensional graphics tablet (or 'graphic digitizer') equipped with an electromagnetic pen, with which the composer draws everything from

the wave forms of the sounds to their distribution and combination in the final piece (the updated version of the system includes a mouse-controlled graphics interface - a menu command allows the user to switch between mouse and digitizer). 'Pages' of score are read by the computer from left to right, the duration of the page (in seconds or minutes) being specified by the composer. Sensors underneath the the graphics tablet send the information to the main computer for processing; it is then made audible by means of a digital-to-analogue converter.

One of the main advantages of a system such as this is its accessibility to composers having little or no computer experience. The basic functions of the system can be learned in a matter of hours. In particular, the fundamental ability to relate a visual gesture - drawing - to an audible one - sound - makes reference to traditional methods of music-making with which composers are generally more familiar. Thereafter, the composer must experiment to find the 'drawings' which correspond most closely to the sounds he wishes to create. This is by no means a simple task: all the pitfalls discussed so far in relation to composing with new sounds, in particular that of inventing sounds which are acceptable perceptually as well as artistically, are still open to the composer using the UPIC, although the possibilities of real-time drawing, performance and editing offered by the current system do speed up the inevitable process of trial-and-error.

Questions of Performance

So far the innovations brought by electroacoustic music have only been discussed in relation to the composer's quest for new materials and new ideas. Mention has been made of the challenge presented by the musical neutrality of electronic equipment; the composer cannot assume that the new sounds produced by these 'instruments' will automatically fit into a piece of music, any more than he has ever been able to assume that a given set of composing rules, rigidly applied, will produce an aesthetically satisfying result.

Perhaps the most consistently challenging piece of equipment has been the tape recorder. Some reasons for this have been noted already. What we have ignored up to this point are the implications that tape (analogue or digital) in particular and technological developments in general have had on performance, a traditionally vital element in the process of musical communication. From the earliest days of electroacoustic music the role of live performance has been brought into question, both by the desire of some composers to do without live instrumentalists altogether through the medium of tape composition, and also by the development of new, electronic 'instruments' which are a breed apart from the traditional musical instruments with which composers, performers and listeners are more familiar.

Magnetic tape combined the facility for sound manipulation with that of recording. It was thus better suited than the original 78 rpm discs for Schaeffer's experiments with *objets sonores*, preserving in isolation sounds which could then be chopped up, played backwards, played at different speeds, played without attack, and so on; it was equally useful for the precise realisation of Stockhausen's serial structures and sound

aggregates, or Ligeti's superimposed layers of sound. Until the arrival of digital recording, magnetic tape was the best medium through which to explore the niceties of timbral contrast between acoustic and synthetic sound.

Pieces for tape alone arguably demand more of the composer in terms of structural emphasis and more of the listener in aural concentration than any other musical medium because they bypass the performer, thus precluding the possibilities of interpretation and spectacle which usually assist the listener in his understanding of the work:

> Electronic sounds are certainly perceived more attentively, because through their very novelty in relation to what is the norm they invoke a more contemplative state, linked to a greater psychological alertness. What is not yet assimilated holds our attention fatally more than what already is.[31]

Tape provided a useful tool for realising the composer's desire to exercise complete control over his composition - performance and the act of composition became one and the same in the studio: in fact, tape appeared to remove the need for a performer altogether. Thus, the additional problem of finding or inventing instruments (in the conventional sense) on which this music might be played seemed to have been overcome. This raised fundamental questions about the nature and role of performance in musical communication, from both the listener's and the composer's points of view.

In particular, the question of interpretation raised its head, in the sense that all elements of unpredictability had to be written into the music. Apart from the influence of external factors, such as the acoustics of different auditoria, the number and distribution of speakers, or the

effect of using different equipment, a 'performance' of a piece of electroacoustic music on tape could be guaranteed to be the same each time. The explosion of ideas fuelled by the use of chance procedures in performance and composition doubtless contributed to some degree to the disillusionment felt by some composers working with tape, especially at that stage of technological development when so many hours of labour were rewarded by so few seconds of sound. For Pierre Boulez in the 60s, the idea of a definitive performance of a work became artistically unsatisfying; the 'closed cycle' aesthetic associated with traditional Western music ceased to have relevance and gave way in his mind to the concept of 'labyrinth' structures with more than one path. Significantly, increased contact with performers during his conducting career, and especially the 'Domaine musical' series gave him an insight into those parameters of music which had particular communicative power:

> It is not possible to introduce phenomena of tempo into music that has been calculated only electronically, in terms of segments of time - lengths expressed in seconds or microseconds, and so on. Here one cannot speak of tempo because the modifications are imperceptible; there is always a calculation of duration which introduces a completely different relationship with musical time.....If, for instance, we were to analyse a pianist's rubato, even in familiar music...it would be interesting to calculate the exact durations in terms of some scale or other - perhaps a series of rubato semiquavers - and to see how this rubato is related to harmonic or melodic functions. We should find that the nuances were so delicate and so fleeting that it would be impossible to play them twice in exactly the same way; it is a category that eludes measurement....The concept of tempo is a concept of 'error'. You deliberately make a mistake in the numerical data, and that is what introduces the idea of psychological tempo. If you try to introduce the idea of error artificially into a machine it will produce fixed errors, which will be uninteresting for that very reason. In the psychophysiological phenomenon that we call performance, 'error' is an interesting factor because it always takes a different form.[32]

Boulez's early electronic works, 'Etude sur un son', 'Etude sur sept sons', (1951-2: both studies in rhythm) and 'Poésie pour pouvoir'

(1958), have all been withdrawn largely for this reason; in '...explosante-fixe...' (1972) the electronic component was deployed for completely different purposes:

> ...In this work [...explosante-fixe...] I have tried to entrust to acoustical transformation the very principle of communication in chamber music where it does not exist either on the geographical or the natural level. Transformation then becomes an element in composition and its appearance is central to organisation and composition, rather than to preoccupations with sonority.[33]

The concept of interpretation in live performance, and the importance of the correspondence between physical gesture and sound are constantly being re-evaluated. The combination of live instrumentalist or ensemble and tape has enjoyed prolonged popularity presumably for this reason, although the medium presents numerous musical and technical problems to composers and performers alike.

Instrumental gesture, together with vocal utterance are universal attributes of music, and by their very nature imply human interaction with sounding objects. Furthermore, until the invention of recording, they accounted for the total sounding repertoire of music. Any other sounds, such as the sounds of nature, could be incorporated into music only through instrumental or vocal imitation. Hence the position of the performer has always been of great importance in communicating musical information to a listener. By contrast, the tape medium need not rely upon instrumental gesture, nor vocal utterance, but can make use of any sound, whether of human origin or not. Thus the combined resources of performer and tape present the composer with various choices: for example, the tape material can be made to mirror the gestural characteristics of the instrument or instruments, or the instrument(s) can be made to depart from their gestural repertoire to

imitate the tape material. Jonathan Harvey's 'Bhakti' (1982) is an example of the first choice; Denis Smalley's 'Clarinet Threads' (1985) is an example of the second.

In music of this sort, it is assumed that the two parts (tape/instrument) must relate to each other to some extent. A typical technical difficulty encountered in works for performer and tape is that of coordination. Against the strict speed of a tape recorder, the performer misses the opportunity for minute variations and fluctuations (not to mention unintentional errors) which are afforded him by a suitably sensitive human partner. (Research into computer accompaniment is being carried out, notably by Roger Dannenberg[34], Barry Vercoe[35] and others, using techniques drawn from artificial intelligence, but so far only in the realm of realising conventional scores. For electroacoustic music, the advent of real time digital signal processing and interactive software has improved matters, so that specific gestures in the live performer's part provide 'cues' for stored material in the computer to be played, or for transformation processes to be initiated. The performer is thus at liberty to play the same music in many different ways without jeopardising his coordination with the electroacoustic part).

Balance between tape and instrument(s) is notoriously tricky and depends largely on factors which are often beyond the control of either the performer or the 'diffuser' - for example, the equipment at their disposal. Pieces which use the tape recorder's record and playback facilities simultaneously in performance (of which there are numerous examples - Roger Smalley's 'Echo III' and Jonathan Harvey's 'Ricercare una melodia' are just two) are perhaps the worst of all, as

any performer who has had to contend with a missing channel, or obstinate feedback noises re-iterating through the cycle will testify.

As already suggested, works for tape alone tread a different path from the conventional route of musical communication (composer - performer - audience). However, there have been many attempts to provide new instruments which do bear some functional resemblance to the traditional orchestral ones. These have either been quasi-orchestral instruments with typical pitch and dynamic capabilities controlled by electronic tone generation, or else devices by which to control and manipulate a different kind of sound material. Leaving aside commercial synthesizers for the moment, few of these in either category have enjoyed prolonged success, the celebrated exception being the ondes Martenot whose longevity has only been assured by the greatness of pieces like Messiaen's 'Turangalîla Symphony', not by its intrinsic value as a musical instrument. Recent experiments have involved creating instruments with which to 'perform' music stored in a computer, but as the sounds are not peculiar to the instruments, pieces of music can only be said to have been written for them in the sense that they have been conceived to take advantage of a particular kind of gestural control. The instruments do not characterise the sounds, but merely define their articulation.

Examples of this kind of instrument include Michel Waisvisz' 'Hands', aluminium frames provided with sensors which detect movements of the soloist's hands and send information via MIDI[36], the Musical Instrument Digital Interface, to trigger sounds stored in digital synthesizers[37]; and Max Mathews' 'Daton', a flat square surface, struck with the hand or a mallet, which is interfaced with a personal

computer: the location and intensity at which the surface is touched sends information to the computer which affects the output of the score stored in it.[38]

A musical instrument, however, is more than a means of imposing gestures onto sounds. Traditionally, the sounds themselves are a product of the physical properties of the instrument, and are uniformly recognisable across a wide range of pitches and despite subjection to a variety of articulations. Listeners to music played on traditional instruments can assume that a given instrument will produce sounds which not only relate timbrally to each other, but also relate to the means of their production (plucking a string, blowing down a tube, hitting a skin, etc): as Denis Smalley has noted[39], this is how a performance practice evolves. It is partly for this reason that composers of electroacoustic music need to create 'families' of new sounds which the listener can learn to identify. Unfortunately, the combination of specific physical and technical characteristics with an identifiable and uniform sound world in a new instrument seems very difficult to achieve. The 'Hands' and the 'Daton', as well as commercial synthesizers which can produce many different kinds of sounds at the touch of a button or key, are therefore only 'instruments' in the sense of being tools which the composer can use to flesh out his ideas. Devices like MIDI wind or guitar controllers give the performer access to a whole range of sounds which do not necessarily have any links with the gestural characteristics of the performance: for example, a plucked string could trigger a clarinet sound. This phenomenon has already become commonplace in pop music, and its implications for the role of performance in musical communication are fascinating.

The development of MIDI has had a profound effect on many composers of electroacoustic music, especially those who have an interest in live performance (both Trevor Wishart and Jonathan Harvey are examples, though arguably with different motivations). The main aim behind the development of MIDI was to allow commercial synthesizers to be connected together so that the same control and performance information might be sent to more than one instrument. Sound samples may also be sent via MIDI. All digital synthesizers are now equipped with MIDI, (and nearly all analogue synthesizers can be converted to handle MIDI information), many computers are MIDI-compatible, and mixing and sound processing may also now be controlled by MIDI protocol, so the possibilities of setting up quite complex networks of instruments are quite challenging.

However, MIDI does have disadvantages. For example, it is a serial interface, which means that only one bit of information may be transferred at a time: thus, the extent to which it can handle the increasing demands placed upon it by composers seeking to extend its uses in a given context is limited by its relatively slow speed and method of communication. Furthermore, the fact that MIDI protocol was originally designed with commercial music (which tends to be note-orientated) in mind means that most MIDI software packages and hardware do not lend themselves to development and adaptation within the broader field of electroacoustic music. While some composers are happy to use MIDI and MIDI-based equipment as a flexible alternative to composing with tape, others, like Denis Smalley, are not impressed by the relatively poor sound quality and limited gestural potential of many commercial machines (the majority of which are still designed

with the piano-type keyboard interface), and prefer to sacrifice immediacy in favour of systems offering more refined control.

* * *

As has been suggested, the relationship between the composer and the technology he uses is a complex issue. The choice a composer makes of one system over another may be influenced not only by the facilities offered by the machine or program, but also by the ease with which he learns how to communicate his musical ideas through it, the opportunities presented to him of experimenting with alternative technologies, the constraints of limited working time, the requirements of his performers (if there are to be any), the difficulty of obtaining performances, budget, and many other considerations. Some find themselves obliged to favour one particular kind of technology if none other is available to them; others choose to confine themselves to one machine in order to make creative use of its limitations. Few are in the position of Jonathan Harvey, who has profited from numerous commissions and invitations to the different computer music institutions of the world, and who has had access, therefore, to a wide variety of systems (and technical advice).

All three composers under discussion have written works for tape alone, and for tape and live performer(s). The tape medium is of prime importance for Denis Smalley, who has written almost exclusively electroacoustic music since his early participation in the composition course run by the Groupe de Recherches Musicales in

Paris. Smalley's overriding musical preoccupation is with the morphology of sounds, that is, the dynamic shaping of sounds in time (he has devised a complete musical syntax based on this, outlined in chapter two). Such pieces as he has composed for tape and instruments (for example, 'Clarinet Threads' (1985) and 'Piano Nets' (1990)) are concerned primarily with exploring particular aspects of the sonorities of the live instrument and their dynamic articulation, in relation to those of the tape part, rather than with the concepts of communication through live performance described above, or with any aspect of instrumental tradition. He is more inclined to use instrumental sounds as source material only, often transforming them beyond recognisability in a work while retaining enough of their gestural characteristics or timbral richness to avoid distancing the listener. These morphologies, isolated and categorised in his syntax, then become Smalley's compositional building blocks: sounds are transferred from one work to another, just as notes and rhythms would be between conventional pieces of music. This technique, and its implications for Smalley's musical structure and style, are discussed in chapter three.

By contrast with Smalley, both Jonathan Harvey and Trevor Wishart have retained a strong interest in instrumental and vocal writing. While this has not precluded the use of tape in their compositions (both have made significant contributions to the genre), they have each been drawn to live electronics and commercial technology as well. In Wishart's case, this is due partly to expediency. As a 'freelance' composer, not attached to a university music department or other teaching establishment as so many composers are, his access to institutionalised computer music facilities has been limited (his piece

'Vox 5' is an exception, having been commissioned by, and realised at IRCAM). Whilst commercial music technology has been a necessity for Wishart, on the other hand, it has also proved appropriate for some aspects of his style. His desire to illustrate levels of social interaction through music has led him to make thorough investigations of the concepts of gesture and utterance, particularly through the medium of extended vocal techniques, and he has written at length on this, and related subjects (see chapter two). Live performance, especially of a dramatic or theatrical nature, is a powerful way of reflecting social phenomena for Wishart, and commercial equipment has provided appropriate resources in the form of readily available real-time signal processing, and so on. On another level, he recognises the links between this kind of technology and the popular music scene, and has used it in that context ('Vox 6' is a piece of rap, for example).

For Jonathan Harvey, the question of man-machine communication has not been of too great a significance, since he is happy to work with computer technicians to obtain the results he desires from any particular system. In any case, much of his compositional work is done away from the studio, reflecting perhaps his background in conventional composition and his preference for thematic working, so his use of technology tends to be in intense short periods rather than over a length of time. The accessibility of commercial equipment has nevertheless been a welcome development to him; live electronics feature frequently in his recent compositions as instruments (usually keyboards) in an ensemble, and as real-time signal processing in a manner similar to Wishart's. In these cases the electronics have been used to suggest an extra dimension to the traditional instrumental resources, as a means of conveying the existence of an extra spiritual

dimension over and above the human experience (an interpretation of Harvey's spiritual concerns is given in chapter two). Their participation in the instrumental discourse is an important starting point from which to develop this metaphor of expansion.

The idea of 'transformation' suggested by this use of commercial technology finds another medium in timbral transformation. Much of Harvey's music experiments with the inner structure of sounds and the boundaries of their perceived identities, though for this purpose he has made use of more sophisticated music technology than that available commercially. 'Mortuos Plango, Vivos Voco' (1980), 'Bhakti' (1982) and 'Ritual Melodies' (1990) were all composed at IRCAM (with the assistance of its technical experts in each case), and all resort to the tape medium wholly or partly, since the degree of sound manipulation desired, and the synthesis techniques and interpolation procedures used were not possible to achieve in real time.

* * *

The various uses to which Smalley, Harvey and Wishart have put the technology at their disposal will be discussed in further detail in chapters three to five. Having established some of the fundamental issues of the genre of electroacoustic music, we now turn to the individual concerns of these three composers, as expressed through their writings.

CHAPTER TWO

Theories and Ideas

New music and new ideas about music have always provoked controversy. With that controversy has come artistic and musical debate, often expressed in writing whether in the form of theoretical treatises or impassioned manifestos. Over the centuries composers have been moved to justify their artistic visions and rationalise their musical language, both to their fellow artists and, increasingly, to the general public, whose demand for explanations of the new music has grown in accordance with the proliferation of styles and techniques which have evolved.

In the twentieth century, the development of recording and broadcasting has presented a paradoxical situation for musicians and composers. While the audience for music has increased enormously through access to recordings or live transmissions of performances, which might suggest the possibility of more widespread dissemination and understanding of new music and musical ideas, the more ready availability of favourite works for the musical 'consumer' which has resulted has meant that the need for new music, at least to some listeners, has become less pressing. In addition, these technological developments have nurtured the evolution of today's pop and rock

music, the tonal language of which is usually far removed from that of contemporary 'classical' music. As a result of such factors the broad musical public has become increasingly removed from the language of contemporary music and, with the exception of devoted new music fans, arguably more hostile towards it.

In such circumstances, it is hardly surprising that the radical innovations of electroacoustic music should have attracted a relatively small audience. Nor is it surprising to find that composers of electroacoustic music have contributed significantly to the written literature, if only to explain how they became attracted to the medium in the first place. The huge variety of expressions to which the electroacoustic medium lends itself, ranging from the most familiar pop music to the most unfamiliar manipulations of concrete or artificially generated sounds, guarantees a similar diversity in the writings of electroacoustic composers. This chapter studies those of Denis Smalley, Jonathan Harvey and Trevor Wishart, whose contributions to the literature as well as to the repertoire of electroacoustic music are of interest not only for insights into their own musical preoccupations but also as reflections of the diversity of the electroacoustic medium itself.

* * *

Denis Smalley is not a composer of instrumental music in the traditional sense. A student of the Groupe de Recherches Musicales in Paris, and influenced by the thinking of Schaeffer, his musical concerns have been with the structural implications of sounds, whether

instrumental, acoustic or electronic. Of the three composers under discussion, his sound world and compositional aesthetic are possibly the least accessible to the 'uninitiated' listener, so it is with his concept of 'spectro-morphology'[1] that this chapter begins.

Spectro-morphology

Smalley has devised a complex and exhaustive new syntax of electroacoustic music, giving it the title 'spectro-morphology'. He is by no means the first composer to have attempted to classify the sound material of electroacoustic music. Schaeffer, for example, aimed to find a way of categorising every sound type, and made an important distinction between 'the complex spectrum associated with a sharp attack or an abrupt change in content [and] the more ordered, slowly changing spectrum usually associated with the body and decay'.[2] Brian Fennelly, in his search for a descriptive language that would assist in the analysis of electroacoustic works, attempted to provide 'a systematic, straight-forward means for the concise identification and characterisation of sounds encountered in the tape literature'[3] by inventing a flexible formula to indicate details of a sound's timbre and envelope.

While Schaeffer's and Fennelly's classifications concentrated particularly on the body and decay sections of individual sounds, Smalley's taxonomy includes a catalogue of 'motion types' and 'structuring processes' which covers everything from the fundamental spectral characteristics of the smallest sound object to its compositional implications in a piece. An outline of Smalley's classification, as

elucidated in his chapter in 'The Language of Electroacoustic Music' (see note 1) is useful at this point. It comprises a discussion of the following:

a) spectral typology (ie basic sound types);
b) morphology (ie the dynamic outline or envelope of an individual sound event or string of events);
c) motion typology (ie the real/implied movement of sounds in a real/implied space);
d) motion style (ie internal details of motion typology);
e) structuring processes (ie levels of compositional focus); and
f) space

These are summarised in the following pages. Page numbers in brackets indicate the relevant section in Smalley's article from which this summary is drawn. (The terms which Smalley coins for this discussion may seem abstract and even unrelated to music, a fact which can be distracting for the listener wishing to discover more about the ideas behind Smalley's works. However, useful analogies can be found between these terms and concepts from traditional composition, and I have indicated these where possible.)

Spectral typology (pp. 65-68)

Smalley defines three basic spectral types (note, node, and noise) as central 'reference points':

1. a 'note' involves perception of discrete pitches;
2. a 'node' is a band of sound which resists specific pitch identification but is nonetheless perceived as a unified resonance - instrumental sounds such as cymbal clashes are good examples;

3. a 'noise' has no recognisable pitch content even though it may be 'coloured' - such sounds often have granular qualities, and Smalley cites wind and sea sounds as typical examples.

Smalley refers to the continuum between the extremes of note and noise as the 'pitch-effluvium continuum', where 'effluvium' signifies a state in which no discrete component sounds may be distinguished (compare the idea of pitch-noise continuum in granular synthesis described in chapter one). Effluvium in a musical work requires a shift in the listener's aural focus from low- to high- level, ie. from perception of structural units to considerations of their global shaping in the piece (see later).

Morphology.(pp. 68-73)

From three 'morphological archetypes' based on the dynamic shapes of traditional instrumental sounds ('attack-impulse', 'attack-decay', 'graduated continuant'), Smalley derives many variations. He makes a particular distinction between morphologies which are typically instrumental and those which are typically synthetic, citing linear onsets and decays as good examples of the latter (although it should be said that these are not always easy to distinguish aurally from the exponential patterns of natural sounds).

In discussing the linking together of different morphologies in a piece Smalley also notes that, depending on the spectral or dynamic movement in a sound during its continuant phase, the termination of that sound may imply or even act as a new attack, and thus have a dual function. The idea that there should be structural implications within

sounds is a common theme in Smalley's writings on electroacoustic music: the internal structure and spectral evolution of individual sounds are understood to have important implications for the use of those sounds within the larger framework of a composition. This is not too unfamiliar a notion if we compare it to the structural use made of motifs in conventional classical composition - the difference is that in electroacoustic music there are no commonly accepted low-level units from which motifs may be made; hence the emphasis on the interior makeup and gestural characteristics of individual sounds for this information. The interior qualities of sounds account to a large extent for the preoccupations of many composers of electroacoustic music including Wishart and Harvey, whose use of the resource is examined in more detail later.

An interesting observation made on this subject by Smalley refers to the complexity of our perception of morphologies in different contexts. He describes a possible musical passage in which accelerating attack-impulse sounds would be perceived firstly as isolated events, then, as the speed increases, as events within a larger unified sound, then as a 'grain' where individual sound events no longer have a separate identity, and finally, when the speed is too great for individual attacks to be heard at all, as a sound mass whose makeup is of less importance than the higher-level shaping which is imposed upon it in a broader stretch of time. This phenomenon has parallels with the perception of individual pitches in a complex spectrum, as described above, and Smalley refers to it as the 'attack-effluvium continuum'.

The three phases of a morphology, as defined by Smalley - onset, continuant, and decay - have analogies in larger-scale structuring processes (see later).

Motion types (pp. 73-77)

When we listen to sounds or musical sequences in conventional Western music we tend to interpret them as having 'direction'. Any change in pitch, dynamic, harmony (in the tonal functional sense), tempo or rhythmic patterning may be interpreted in this way: thus melodies move 'upwards' or 'downwards', rhythms propel the music 'forwards', volume 'grows', leading notes 'lead' and so on.

We deduce similar kinds of information from the sounds in our natural environment: loud sounds are alarming because they suggest the proximity and size of the thing making the sound; short, sharp sounds suggest sudden physical gestures such as a downward blow or a scream; repetitive or continuous sounds may suggest a system at rest or at peace (a cat purring, people snoring), or a being or an object revolving around a central point (a lassoo being swung around the head, an egg rolling around in a pot). We have noted this point in the previous chapter, with reference to the growing understanding of the relationship between physical (instrumental) gesture and the quality of acoustic sounds.

In all these cases, there is a perceived change in the nature of the sounds, either individually and internally, or in relationship to other sounds. It may be the musical texture which alters (such as a melody becoming a contrapuntal web), or a single line which develops (such as

a drone becoming rhythmically articulated), or a gesture which surprises or interrupts an otherwise steady sound. Smalley accounts for these through his definition of 'motion types'. He writes:

> Spectro-morphological design on its own, in controlling the spectral and dynamic shaping, creates real and imagined motions without the need for actual movement in space.[4]

Smalley defines three motion types: 'linear', 'curvilinear' and 'eccentric/multi-directional'. Linear and curvilinear motion types are subdivided into two further groups: 'uni-directional/bi-directional' and 'reciprocal/centric' or 'cyclic', respectively.

These are subdivided again for greater clarity. For example, uni-directional linear motion types are the ascent, descent and plane - these can be interpreted in terms of pitch (eg glissando), intensity (eg crescendo/decrescendo) and so on, and form the basic motion types of Smalley's composition 'Pentes'. Bi-directional linear motion types include convergence and divergence of sounds or sound streams (otherwise known as contrary motion). General linear motion also allows for the phenomenon of 'refraction', by which Smalley means linear motion deflected off course or changing direction (usually effected by abrupt changes in the implied speed of motion, or interruptions at a peak/trough) - the most common example of this motion type would be the Doppler effect.

Curvilinear motion is essentially an extension of linear motion since it links three phases - ascent/peak/descent, or the reverse, descent/trough/ascent. Shapes may be wholly or partially symmetrical,

(Smalley's term is 'reciprocal'), or may focus on a central point, thus becoming 'centric' or 'cyclical'. Varieties of curvilinear motion include 'oscillation' (alternation between two points), 'undulation' and 'convolution' (forms of reciprocal motion).

Smalley's comments on centric reciprocal motion are particularly interesting, firstly because of their direct reference to his piece 'Vortex' (the title refers to a specific motion type distinguished by Smalley), and secondly because of their acknowledgement of a very direct way in which electroacoustic music can alter and develop the way we listen to music:

> Focus on a central reference point is implied in centric motions, either radiating from a centre, or converging on it. This does not mean that a central point has to be represented by an actual sound, just that we surmise the existence of a central focus from the surrounding motion tendencies. In visual terms, centric motion is commonplace. But music, thought of in terms of time, and conditioned by notational practice, moves through successive stages in time, from left to right, thus seeming to prohibit any analogy with our visual scanning, which can shift backwards and forwards across a moving object. The musical solution lies in the cyclic nature of centric motions related to short-term memory. The recycling of motion allows us to re-perceive and therefore inculcate its turning shape and continuity in a series of film-like frames and surmise centricity as a result.[5]

Smalley offers five interpretations of centric motion: 'centrifugal', 'centripetal', 'pericentral', 'vortical' and 'helical', which he uses to express different relationships of motion types to the central focus - revolving around, flying away from, moving towards, etc.

Eccentric motion, Smalley's third category, contains ambiguities. Both linear and centric motion types may be discerned within eccentric motion, hence Smalley's alternative definition 'multi-directional'. The

subcategories he defines, such as 'accumulation' and 'dissipation', are what he refers to as 'growth processes' which involve textural transformations. In such cases, it is not so much the outer, delineating shapes of the sounds which have significance, so much as the changing complexity of the sound mass itself: an example from the conventional repertoire might be Ravel's 'Bolero', which, despite the obvious motion type of the enormous crescendo, can be regarded as an 'accumulation' of sonorities within a basically unchanging harmonic and rhythmic structure. Such motion types therefore have structural as well as motional implications.

Motion Style (pp. 77-80)

This describes the internal characteristics of a motion type, that is, the way different morphologies combine within a motion type.

A texture made up of a single morphological type is described by Smalley as 'monomorphological'; if several types are present, the texture is 'polymorphological'. In the latter case, it would be possible for separate bands of sound to be perceived and followed within a musical passage, in a kind of electroacoustic polyphony: this is what Smalley calls 'streamed motion'. 'Flocked motion', on the other hand, describes a texture which is uniform, where the ear follows the movement of the whole rather than isolating component strands: flocked motion is therefore monomorphological (or homophonic).

Pitch perception undoubtedly plays a role in our ability to grasp these sound phenomena, especially where 'polymorphological' textures are concerned. In particular, a 'stable pitch-space setting', or an area of

consistent (not necessarily static) tessitura, may be an effective means of concentrating attention on that which contrasts with it (compare the function of traditional pedal notes below or above a changing harmonic sequence). Smalley mentions the use of drones, which have taken on these connotations in electroacoustic music: this technique is a strong feature of much of his own music, for example in 'Pentes' and 'Vortex'.

Structuring Processes (pp. 80-89)

Smalley prefaces his remarks on structuring processes with a comment on the traditionally accepted view that musical structures are built from commonly understood and consistent low-level units (see earlier discussion of morphology). He points out that electroacoustic music can not be composed or listened to in the same hierarchical way as traditional music, precisely because there is no universal low-level unit, but only frames of reference within each individual composition. However, Smalley maintains that the composer's task remains to provide different levels of focus within a work so that the musical experience may be fresh and new each time a piece is heard. This is possibly one of the most difficult lessons for the composer of electroacoustic music to learn, since, as he puts it,

> The composer has to surmount all the preoccupations and distractions of the fabrication process to become the subject of his or her own musical experimentation - the universal listener, the surrogate for all listeners.[6]

According to Smalley, the passage of time in (electroacoustic) music is marked out by means of gesture and texture, the one contrasting with or even making up the other (we have noted how a single sound may be

perceived as an event in its own right or as part of a larger sound mass, depending on its context). However, 'gesture' is not always easy to define outside the boundaries of instrumental or common notational practice - is the sound of a flock of birds suddenly taking to flight a gesture or a texture or both? Smalley provides a definition in terms of 'surrogacy', as follows.

When we hear an instrumental sound, we are able to deduce from its spectral characteristics that it relates directly to an output of physical energy: this is first-order surrogacy (the flock of birds would therefore be interpreted as first-order surrogacy also). When a sound is heard which is not recognisable as having come from an instrumental source, but which retains spectral characteristics typical of those imposed by an output of energy, this is second-order surrogacy. Remote surrogacy is encountered when a sound implies no physical cause, and thus has to be subject to 'psychological interpretation'.

While this explanation may seem highly theoretical, it allows Smalley to make an important point about what he sees as one of the failings of much electroacoustic music. In defining the concept of 'dislocated surrogacy', Smalley criticises electroacoustic music which ignores the necessity for artificial sounds to retain or copy the gestural qualities of natural or physically produced sounds. Research in pyschoacoustics has proved the significance of this phenomenon, as noted in the previous chapter (the subject provides a particularly interesting area of discussion in relation to the music of Jonathan Harvey, one of whose aims has been to use the electroacoustic medium precisely in order to escape from the 'physicality' of sounds - see later).

In contrast with gesture, which, by its very nature, suggests goals, beginnings, ends and directions, Smalley defines texture as being concerned more with stasis: attention is directed inward to the movement within a sound rather than outward towards the external shape of a sound (so it is possible to talk about the texture of a particular gesture). Music is very rarely without both of these phenomena, often at once, and their relationship to each other throughout a composition is, Smalley believes, the primary means of controlling the levels of focus mentioned earlier as the prerequisites of a satisfying musical structure.

Smalley projects the three phases of morphological design - onset, continuant, and termination (see earlier) - onto the level of structural function. An anacrusis, for example, is a kind of onset, and a transition is a kind of continuant. A statement is another kind of continuant, whereas a plane or a resolution are forms of termination. The ambiguities inherent in such definitions give rise to a richness of interpretation, and Smalley argues that without such correspondences between micro- and macro-level structures a work's coherence and ultimate success may be jeopardised:

> ...it has been argued...that any dissatisfaction with structural functioning can be traced back through the formative notions of gesture and texture to the spectro-morphological sources from which structural functions are projected. The triple-group concept of structural functions is not the invention of electro-acoustic [sic] music. It is inherent in our experience of time passing. Even if in the extreme bifurcation of modern musical language spectro-morphology seems to sweep aside traditional musical notions the foundations of structural functioning remain.[7]

This point is discussed further in chapter three.

Space (pp. 89-92)

Smalley concludes his chapter with a brief discussion of space, a subject which introduces the listener as an important part of the musical equation. He divides the concept of space into five categories, ranging from the physical environment in which a composition is performed to the spatial analogies suggested by spectral distribution within sounds. The first three categories are common to all music: 'spectral space' might be understood as 'tessitura' in conventional music, and refers to the spread of frequency components across the duration of a work; 'time as space' refers to the psychological perception of time which fluctuates according to the density and flow of events perceived; and 'resonance' derives from the physical resonating properties of vocal and instrumental resources, which imply what Smalley calls an 'inner space'. The 'resonance' of an acoustic sound suggests particular spectral qualities imposed by the means of production, and Smalley extends the concept to that of 'resonance structures' which a composer might create in the studio by harnessing the spectral characteristics of 'resonance' to form elongated textures.

Smalley's fourth and fifth categories - 'spatial articulation' and the 'transference of composed spatial articulation' - are closely linked and are peculiar to the electroacoustic medium. These describe the behaviour of sounds within an acoustic environment, which may be determined by the composer and/or by the 'diffuser' of a piece. 'Spatial articulation' refers to the way in which sounds are perceived to interact with each other in an implied spatial setting, this setting being subject to manipulation according to the composer's use of

reverberation to suggest different reflective surfaces, and so on. Thus, for example, a sound may be presented in a sequence of spatial settings which cause the sound to be interpreted in different ways. Smalley's final category accounts for the combined effect which different auditoria and different electroacoustic equipment may have on a given piece as it is heard by the listener. The characteristics of this 'listening space' offer room for creative interpretation on the part of the performer, or 'diffuser' of an electroacoustic piece, and, in the case of works for tape only, provide the only variables which are likely to distinguish one performance from another. Smalley even goes so far as to suggest that this fifth dimension of 'space' may be the final determinant of a work's success or failure:

> In a medium which relies on the observation and discrimination of qualitative differences, where spectral criteria are so much the product of sound quality, this final act [of diffusion] becomes the most crucial of all.[8]

* * *

Smalley's concept of spectro-morphology is a composer's analysis of the interrelationships between sounds. It indicates those aspects of sounds which lend themselves to manipulation by a composer within a musical work, rather than to offer an explanation of the effect of sounds on the listener's imagination. His comments on the subject of space only hint at the complex nature of the listener's response to sounds, and he has written elsewhere[9] on this subject, taking as his lead Schaeffer's concept of the 'acousmatic' and his definition of four listening 'modes'.[10]

The 'acousmatic' also features in Trevor Wishart's writings on music. Broadly defined, it is the phenomenon of listening to any sound without seeing its source (the term has its origin in the practice of the Pythagorean Acousmatics, who listened to lectures delivered from behind a screen in order to avoid visual distraction from the verbal communication). Wishart's theories are based on the significance attributed by the listener to the imagined source of any perceived sound. Distancing himself from what he sees as 'intellectual' music-making (particularly if clever notational devices appear to be an end in themselves), he is concerned almost exclusively with the aural response to music and sound. Of key importance to his compositions, therefore, is that most powerful of musical and emotional resources, the human voice. For Wishart, the communicative role of music is paramount; from this he derives his whole approach to composition, outlined in the following pages.

Utterance and Landscape

In his article 'Sound Symbols and Landscapes'[11] Wishart asks the question: 'is there a natural morphology of sounds?'. Referring to the generalised onset-continuant-decay pattern of a typical sound envelope, he claims that the way in which a sound behaves during the continuant phase of its evolution gives the listener important information about both the sounding system (eg. instrument + instrumentalist) and the energy input to it (action of the instrumentalist upon the instrument), which, in turn, has implications for the listener's response to the sound. This is similar to Smalley's idea of 'surrogacy', as outlined earlier.

Wishart makes a distinction in this article (p. 57) between *intrinsic* and *imposed* morphologies: intrinsic morphologies are those which result from the resonating properties of the instrument, like the long continuation of a bell sound once the bell has been struck; imposed morphologies are those, like a drum roll, which indicate that the system continues to sound only by means of a continuous input of energy. There are many levels on which an imposed morphology can operate: for example, the morphologies of an electroacoustic work on tape may be (and should be, according to Smalley) constructed in order to imply notions of energy; in live performance, the link between physical gesture and sound morphology is more obvious. Wishart writes:

> The directness of physiological-intellectual gestural behaviour carries with it 'unspoken knowledge' of morphological subtlety which a more distanced intellectual approach may not be aware of. This is not to say that theorizing cannot lead to interesting results, but implies that it can lead to a loss of contact with the realities of the acoustic landscape.[12]

This statement leads us to Wishart's concept of 'landscape' as a significant dimension of a musical experience. A brief explanation of this is included in 'Sound Symbols and Landscapes', and a more detailed account is in Wishart's book 'On Sonic Art' (from this point on, page numbers in brackets refer to the book).[13] As we have noted, listeners can usually detect with accuracy the instrumental sources of the sounds they hear in a piece of music. This is not simply a question of a visual stimulus supplementing an aural one, as is testified by people whose first experience of music was of recordings or radio broadcasts rather than live performance. Rather, it is the subconscious knowledge, imparted by the spectral content and morphology of the sounds themselves, that the sounds are of human origin which seems to

be of significance. Whether a person is listening to a performance in a concert hall or to a recording of a performance relayed over loudspeakers, he is still aware that the sounds are produced by people who are playing instruments. The fact that, in the latter case, the actual source of the sounds is the vibrating cone of the loudspeaker, makes no difference. Wishart's general hypothesis is that

> the landscape of a sound image [is] the imagined source of the perceived sounds.[14]

Thus, the 'landscapes' of the two situations above (instrumental music in a hall, and instrumental music over a loudspeaker) are the same. When we step into the realm of electroacoustic music, and especially music on tape, the implications of this statement become clearer. The composer may create and control the 'landscape' of his composition in a way hitherto impossible, having the ability to create and juxtapose any sounds and to set them in any imaginary acoustic environment. In fact, the very creation of that 'landscape' becomes a musical and artistic objective in itself. Wishart cites Luc Ferrari's 'Presque Rien no 1', which is a recording of several hours of activity on a beach compressed into about 20 minutes, as being a serious attempt to exploit 'landscape' as a musical tool.

In his book, Wishart defines three characterising aspects of 'landscape' (p. 76). These are:

i) the nature of the perceived acoustic space;
ii) the disposition of sound-objects within the space; and
iii) the recognition of individual sound-objects.

Wishart's definition of an acoustic space includes everything from an enclosure to an environment; it encompasses concert halls, cathedrals, forests and valleys: any space in which a sound may be heard is understood to be an acoustic space. All of these may be suggested by imposing different reverberation times onto sounds, by placing sounds in concrete relation to each other in the real space enclosed by loudspeakers, by controlling the spectral evolution of the sounds (for example, sounds heard in a 'dry' acoustic, with a lack of high partials, imply large, flat expanses), and many other techniques. Thus, the three aspects of 'landscape' are interrelated: the nature and disposition of the sound objects will tell us something about the acoustic space, and the perceived acoustic space will add a dimension of meaning to the sounds within it - the similarity to Smalley's concept of spatial articulation (see pages 63-64) is clear.

Wishart cites examples of imaginary 'landscapes' where, for instance, the sounds may be recognised as real but the acoustic space artificial, or vice versa (p.79). He also mentions the possibility of a 'surrealist landscape' where sounds and space are both real, but the relationship of the sound images is impossible - one of his suggestions is a 'duet' between a whale and a wolf (p. 79).

The third aspect of 'landscape', the recognition of sound objects, offers particularly interesting possibilities if, for instance, sounds are <u>not</u> recognised, or, conversely, are recognised despite extremes of distortion. Aural ambiguities and and acoustic tricks can be exploited to great emotional, metaphorical, or even political effect, as Wishart's piece <u>'Red Bird'</u> demonstrates (see chapter five). Partly for this

reason, one of the richest sound sources, not only for Wishart but for many other composers also, is the human voice. It is one of the hardest sounds to disguise to the human listener, and also possibly the most difficult sound of all to imitate artificially. Its presence in a musical composition, whether alone or in a massed choir, is always particularly powerful, and its modes of expression are almost infinitely varied. The final large section of 'On Sonic Art'[15] is devoted to the concept of 'Utterance', and human utterance in particular, and Wishart's ideas on the subject provide valuable insights into the use of the voice in musical composition generally.

An understanding of the physical mode of production of voice sounds necessitates a re-evaluation of Wishart's theories on morphology, as he acknowledges (p. 123). The human mechanisms for making sounds are so complex that it becomes difficult, if not impossible, to distinguish between imposed and intrinsic morphologies, since the vibrating membranes which would be responsible for the latter, and the musculature used to articulate them which would be responsible for the former, are not separate from each other. The difficult question of <u>intention</u> now comes into play, since the extent to which a sound is made voluntarily, if such a thing can be perceived at all, has a direct influence on the way in which we interpret the sounds.

In Wishart's discussion of types of utterances in 'On Sonic Art', the question of intention features prominently. He divides utterance types into the following categories:

Indicators (pp. 125-127)

These may be voluntary or involuntary, but are descriptive of a state. The sound of thunder indicates the state of the weather.

Signals (pp. 126-127)

These are indicators which are perceived to have meaning. An indicator to one listener may be a signal to another. The difference between a signal and an indicator is as much to do with the way the sound is interpreted by a listener, as with the intention of the person making the sound. For example, a cough could be interpreted as indicative of a person's state of health, or a signal of a person's desire for attention.

Totemics (p. 128)

These are sounds which distinguish one social group from another. In the natural world, these may be understood to be the 'repertoire' of one species as opposed to another, over and above any particular features of one particular creature's 'utterances'. For a human equivalent Wishart suggests musical styles, by which we differentiate between one social group and another (eg. blues, punk rock, soul music etc). Wishart's own piece, 'Vox 6', which is in the style of rap, makes particular use of totemics.

Repertoire (pp. 128-130)

In the case of the higher animals which can produce a range of sound-objects, or a 'repertoire' of sounds, questions of sequencing and ambiguity come into play. Whereas for a creature which can produce only one kind of sound, there will be a direct relationship between the

manner of production of the sound and the state of the creature producing it, for higher animals, different sound emissions may be interpreted on different levels and have a variety of implications regarding the complex internal state of the animal itself. Furthermore, information may be conveyed through the ordering, or sequencing of these different sounds. In such a case, the individual sounds, whilst retaining their own gestural information up to a point, become less important as individual 'utterances' and contribute to a more complex expression. These different levels do not amount to language, as Wishart is careful to point out, but they do suggest concepts of macro- and micro- structure which are familiar from both language and musical studies. In such a context, a signal (ie. perceived meaningful sound) may be used as a symbol.

Invention and convention (pp. 130-131)

Many kinds of utterance make use of what Wishart refers to as 'conventional syntax'. A sequence of sound events (such as a sentence) may convey a certain sense or expression by virtue of conventions, without the individual sound events (words) having to be associated with particular states. However, within such a sequence we may still respond to the individual, microstructural gesture in a direct way. In a harmonic sequence in a passage of music, for example, a particular chord may provoke a greater response in the listener than the other chords, quite apart from the effect of the whole passage. An individual's idiosyncratic use or abuse of conventions, musical or linguistic, can be highly meaningful, since it will call into play the expectations of the person interpreting the 'utterance'.

Virtuosity (pp.131-133)

According to Wishart, western musical tradition generally conspires to negate the concept of 'utterance'. Individual 'utterance' becomes subservient to group 'utterance' in performance, and musical gesture is conventionalized. Not only does the expression of the composer's idea become one stage removed from the listener by the level of interpretation, but even the individual interpretation may be shared out amongst many players and become even less direct again. However, Wishart argues that 'utterance' reappears in the guise of virtuosity, where the articulation of a conventionalised gesture may be refined and personalised to a high degree. In addition, highly rigid, often totemic structures (such as Blues) may also be a vehicle for personalised 'utterances' and open, despite the apparent restrictions of the style, to elaborate gestural articulation.

Wishart observes an interesting relationship between conventional and direct utterance in what he calls Ecstatic behaviour. In possessed dance or ecstatic music a loss of conscious control is experienced. Liberated from this control, the voice and body are able to be articulated to a much higher degree than is normally possible; however, the expressions which arise tend to be those of a conventional repertoire - as Wishart puts it:

> 'this articulation usually takes place over a field of conventionally-established possibilities - an intense and immediate utterance swirls upwards through the conventional structures.'[16]

Wishart's explanation is that speech, like walking, begins as a learned skill, but eventually becomes second-nature. Once this is the case we

require high level conscious control only on a general semantic level. Ecstatic expressions become possible when this high level control is not exercised. This comment gives interesting insights into Wishart's vocal experiments, especially in the 'Vox' series (discussed in chapter five).

Confidence tricksters and psychopaths (pp. 133-134)

Under this heading, Wishart examines the ability which artists and other performers have to distance themselves from the 'utterances' which they use in their art. A piece of music theatre, for example, may contain 'utterances' of a frightening, erotic, amusing or aggressive nature which are experienced in a direct way by the audience, but which have been carefully and coolly planned by the composer. The audience is aware of the composer's detachment but Wishart points out that there is a fine line between detachment from and involvement in the 'utterance', from both the composer's and the listener's points of view. While social distancing may be useful for artistic research, to enable materials and ideas to be viewed in new ways, social distancing in the work produced renders it 'intrinsically meaningless'.[17]

Towards language (pp. 134-135)

Wishart notes the many ways in which the repertoire of the human voice may be divided: phonemes (used to make meaningful linguistic utterances), different kinds of imposed morphologies (intentional, involuntary or conditioned), semantic sequencing, and so on. The composer is free to make whatever use he wishes of these parameters, contradicting their natural implications or exploiting them to the utmost. In the realm of tape music, there is the added dimension of aural illusion: a sound may be made to appear as an 'utterance' (ie

related to a being) even though in reality it is not. Just as the composer may experiment with landscape, so he may experiment with the 'utteranceness'[18] of a sound object.

Wishart's book contains a detailed catalogue of human vocal sounds, illustrated on cassettes. These provide an indispensable guide to Wishart's sound (and notational) world, and expose the fine line between conscious control over sounds and the idea of intent, and the unconscious use we make of sounds (see earlier discussion). Many of the sounds described by Wishart, and notated with painstaking precision (insofar as it is possible) in his scores, are sounds which all people make without necessarily realising. Unless this is understood by the listener, the complex 'utterances' explored by Wishart in many of his compositions fail to achieve their complete significance, and risk being perceived as ridiculous and over-theatrical. In conventional tonal music, we rely on our understanding of basic harmonic formulae and tonal functions to give us the necessary expectations which the music may fulfil or frustrate; similarly, the listener is helped in his appreciation of Wishart's music by an awareness of the human vocal repertoire and its gestural and emotional implications. Wishart is not the first composer to make music from an extended repertoire of vocal sounds, and his rationalisation of the resource is an aid not only to his compositions, but also to those of Berio and many others.

Many of these sounds are used in human languages, although any one language will omit a large proportion of them. It is generally assumed that the smallest unit of linguistic significance is the word, but even a superficial examination of the components of words themselves - ie.

phonemes - reveals interesting morphological analogies with natural sounds and adds another dimension to their meaning. For example, in even a small word of one syllable, complex transformations of formants and airflow take place on a microlevel between the constituent phonemes, so that, if the phonemes are pronounced and recorded separately and then put back together to re-form the word, the original sound is not reproduced (note the similarity between this phenomenon and the results of Schaeffer's early experiments with the attacks of concrete sounds (see chapter one), not to mention the work of Meyer-Eppler in phonetics prior to the development of *elektronische Musik* in the 1940s and 50s).

A word is formed from a continuum of sound of dynamic morphology, rather than a combination of discrete sonic units, and it is partly for this reason that the human voice is difficult to simulate. Until recently, even a highly sophisticated program such as CHANT[19] (see chapter one) could produce excellent artificial vowel sounds by reproducing characteristic stable formant structures, but were stretched to produce equally convincing consonants to articulate the artificial airflow.

Wishart goes further to discuss the mimetic qualities of certain words (or 'phonemic vocal objects'). While not pretending that every word in any particular language has directly metaphorical origins, Wishart explores some interesting parallels between the shapes of certain words and their phonemic components, and the ideas they express. One of his examples is as follows:

> The phonemic object 'sl-' consists of a stream (or store) of energy ('s') which is gently released ('l') into the stable motion of the vowel. The sense of gentle release into movement is of course caused by the sliding of the tongue. We may bring this motion to an abrupt end by the insertion of a stop consonant such as 'p', to produce the word 'slip'. This motion is so analogous to someone 'slipping' on ice, where the move into the continuous sliding motion is abruptly interrupted by a fall (!) [sic] that it seems unlikely to be coincidental.[20]

[Related words are: sleigh, slide, slime, slot, slither, slice, slough, and slit]

Word endings are also interesting, such as the resonant nasal 'ng' sound where higher formants are gradually filtered out, typical of imitations of bell-like sounds (dong, clang and ping).

In a broad comparison, Wishart states that

> the melodic stream [in standard repertoire music] is pitch-disjunct and may be articulated by timbral colouration (either in the choice of instrumentation or within the internal morphology of the sound-objects of instruments). The language-stream [in standard repertoire use of language] is timbre-disjunct...and may be articulated by pitch inflections.[21]

Noting the extreme sensitivity of the human brain to articulations of the timbre continuum, Wishart argues that a 'sonic art' based on such a continuum may be as powerful as the traditional one based on pitch. Since the range of human vocal sounds greatly exceeds the boundaries of any one language, the timbre continuum described by Wishart in no way pre-supposes a language-like sound world. On the other hand, it is possible so to use the typical formant, rhythm, or other structures typical of languages in the manipulation of sound material as to conjure up the 'landscape' of language, and by implication, the concept of 'utterance': this is perhaps the musical tool most fascinating for

Wishart. Depending on the degree to which we understand a language, our focus on the timbral qualities it possesses will vary, but, as Wishart demonstrates, we may recognise the semantic connotations even of ungrammatical language streams or constructions using nonsense words, a fact which has been exploited in poetry ('Jabberwocky' by Lewis Carroll is a good example), and which Wishart exploits in his compositions. Even artificially generated word streams, which are constructed from statistically viable groups of letters (according to the typical formations of any one particular language) may be recognised and understood as having linguistic qualities.

Aspects of paralanguage[22], such as pitch and pitch stress, rhythm and tempo, as well as the many varieties of group 'utterances', may also be subjected to manipulations which may extend or destroy their semantic or social connotations. States of mind, age, race, dialect, relationship, and so on, may be conveyed and understood purely through these kinds of inflections, whether voluntarily or involuntarily, and their control in the electronic studio opens up tremendous creative and expressive possibilities. Wishart writes:

> ...as the internal architecture of sounds becomes both analytically and conceptually accessible, and hence available for more or less precisely defined composition, and as our ability to monitor the subtleties of human intellectual-physiological gesture and transfer them onto sound-materials increases, our notion of what "music" is must become much more generalised. It must embrace and systematically investigate areas that have been traditionally regarded as the legitimate property of psycho-acousticians, phoneticians, poets and sound-poets, or nature recordists and audio-zoologists, of naturalistic and 'effects'-based film-sound engineering, and much more. Musicians will concern themselves with the affective and systematic ordering of timbre-structure, sonic gesture, sound landscape, the subtleties of psycho-linguistic and psycho-social cues and many other dimensions of the sound universe, alongside the more traditional parameters of pitch and duration. The era of a new and more universal Sonic Art is only just beginning.[23]

* * *

Wishart's theories are based on the meaning attributable to sounds by virtue of the listener's awareness of their real or implied relationship to physical gestures. Smalley's ideas also make reference to the perceptual importance of choosing or designing sounds which imply notions of physical energy through their spectral evolution. By contrast, Jonathan Harvey's writings on music are characterised by frequent references to the possibility of using electroacoustic means to create sounds which suggest a lack of physicality or 'externality', to be used in meaningful relationships with more traditional instrumental sounds within a composition. His writings are of a more overtly personal nature than those of either Smalley or Wishart, and concern themselves less with technical or theoretical considerations and more with matters of a conceptual nature. His preoccupation with the spiritual dimension of art (and life) manifests itself throughout his writings and has maintained a consistent influence over his compositional activities and interests, being reflected both in his choice of texts to set to music and increasingly in his developing compositional technique.

It is important to remember that Harvey has written more music for conventional instrumental or vocal ensembles than he has for the electroacoustic medium. While this study concentrates on his substantial electroacoustic output, Harvey's musical and artistic concerns in both areas are strongly related and have far more to do with the implications of this spiritual awareness than with specific

technological details, although these, too, have influenced him in different ways. For an understanding of the thinking behind Harvey's music, therefore, it is necessary first to examine some of the basic spiritual ideas for which he seeks to find expression in his music.

Ambiguity and Expansion

Various related mystical concepts occur repeatedly in Harvey's articles and programme notes, particularly that of the relationship between the worlds of the Relative and the Absolute. All earthly (including human) phenomena are understood to belong to the world of the Relative: concepts such as personality (we are only individuals in so far as we differ from others), direction (we can only go somewhere if we leave somewhere else), thinking and feeling (we think <u>about</u> something or feel <u>towards</u> something - subjects cannot exist without objects) and perception (the world only exists according to our senses - to the blind there is no such thing as colour) are all indicative of this. The world of the Absolute, on the other hand, is infinite, immeasurable; there is no concept of time, individuality, direction, or conscious thought. It is the realm of pure consciousness:

> When thy mind dwells upon anything,
> Thou art ceasing to cast thyself upon the All.[24]

Harvey's writings contain numerous references to this duality - examples include being/becoming, stasis/dynamism, continuum/individuality - and his music is almost always concerned to some degree with this theme.

It has perhaps the most profound manifestation in the personal relationship which exists between the ('Relative') individual spirit and 'the All'. This is of particular importance to Harvey and is given a powerful depiction in his work 'Nachtlied', amongst others. In 'Mysticism', a book which had a profound effect on Harvey in his student days, Evelyn Underhill describes 'the innate tendency of the human spirit towards complete harmony with the transcendental order'.[25] The human soul is believed to contain within it an image of the Divine, which wishes to be reconciled with its originator by bursting through the boundaries of the limited human ego. A process of spiritual development is understood to take place when the human spirit consciously seeks this communion with the Divine. The ultimate mystical union involves a long and arduous process of self-transmutation, illustrated in the lives of the great Mystics (of all religions). Acknowledgement of the divide between the Relative and the Absolute is the first step; then follows the journey (often called the 'Mystic Way') across the divide so that the individual can become one with the All.

The journey itself, or process of self-transmutation, involves a rejection of, or liberation from sense perception: when the mind is closed to external stimuli, all mental energy is free to focus upon the Absolute. What this means in practical terms is meditation, an activity practised more commonly in Eastern cultures than in our own (where it is usually represented as prayer). This is very important for Harvey, both as a means to mental and spiritual refreshment and also as a way of becoming more receptive to art. The stillness of meditation, blotting out mundane everyday distractions, also liberates the spirit from the

confines of the kinds of social and cultural structures in which it finds itself. Once this mental emptiness has been achieved, other forms of consciousness become possible, the mind becoming receptive to a different kind of stimulus.

Thus Harvey says:

> Silence is the calming of the energies of the mind and body. There can be terrific distortions of the receiving apparatus; I think the receiving apparatus is best when it's completely quiet. Then it can receive very lively things, very peaceful things, or whatever, and can receive them purely without modulation from the system.[26]

For Harvey, the act of composition is always bound up with these three things: the relationship between the Relative and the Absolute, the spirit's journey to union with the Absolute, and the mental stillness which gives birth to new transcendental perception. His conception of musical history, especially that of the twentieth century, is coloured by what he recognises as a new artistic ideology involving a greater awareness of higher levels of consciousness: without implying an overtly religious influence in contemporary art, he points to the increasing familiarity with Eastern philosophies and the rejection of the notion of Romantic self-expression, which had its origin in Renaissance art, as being representative of this new ideology.[27]

In music, this is clearly signified in Harvey's mind by serialism, for reasons which will be explored more fully in chapter four. He has been influenced particularly by the techniques of Webern, Babbitt and Stockhausen, and finds parallels between the principles of serialism and his own spiritual ideas. For example, serial techniques offer freedom

from bassline-dominated directional harmonic structures; in their place, Harvey has often explored the concept of symmetry in his motivic, melodic and harmonic working, finding it a useful vehicle for expressing ideas of endlessness, perfection and stasis. In certain works, he has followed Babbitt in creating 'derived sets' from the basic twelve-note set as a means of generating musical material; here, too, we can see a metaphor for the idea of different spiritual dimensions, since each derived set is both a self-contained entity and a part of something larger and all-encompassing.

Of more significance at this point is Harvey's attraction, in the music of Stockhausen, to the 'famous exploitation of the static sound...this love of sound for its spiritual nature, for its paradoxical ability both to speak of something beyond and be itself more intensely.'[28] Interest in timbre for its own sake has been one of the overriding characteristics of 20th-century musical development. Progressing from the harmonic and orchestral colours of Wagner's music, to the *Klangfarbenmelodien* of Schoenberg and Webern, and the Futurists' liberation of noise in the new age of the machine, and prophesied perhaps most eloquently by Varèse, composers have looked to timbre as a new vehicle of musical expression. Some have been content to experiment with different combinations of instruments to create new sonorities; others, notably composers who have also tried their hand with electronic music at some point, have been more interested in exploding the concept of timbre as an individual *gestalt* altogether by probing the internal acoustic structure of sounds and discovering, as Harvey puts it, that

> vertically it's a matter of formant spectra, a subcategory of harmony, and horizontally it's a matter of both the evolution of spectra and the evolution

> of the fundamental pitch as melody. And culturally it's a matter of mental picture, of associating a sound semantically with an instrumental type. Everything really belongs to a more basic category, and you can't find timbre any more.[29]

From this comes the notion of the 'inner life of sounds', which features prominently in Harvey's musical philosophy and variously in his compositions. For Harvey, the discovery not only that every sound is made up of many other sounds, but also that these inner constituent sounds can be harnessed and used in their own right as musical parameters, has had fundamental musical and compositional implications. Thus, for example, an 'exploded' instrumental timbre may be used as the model for a harmonic structure, as in 'Mortuos Plango Vivos Voco', where the lower partials of a pre-recorded bell sound are analysed and used as the pitch centres of different sections of the piece. In 'Inner Light (1)', analysis of the timbres of the instruments in the ensemble gives rise to the different harmonic 'fields' of the piece and, in 'Inner Light (2)', the same process yields passing harmonies - a single timbre suddenly blossoms into a chord - so that the acoustic structure of the instruments in a given ensemble has a direct effect on the music written. The idea is similar to Stockhausen's desire in the 60s and 70s to create new sounds for particular compositions so that 'form and material become completely one'[30]; the difference is that for Harvey, the piece becomes a kind of realisation of the potential of an already existing sound rather than of something entirely of his own construction. To that extent, there are parallels with Stockhausen's 'Mikrophonie I', a piece of indeterminate length which concentrates exclusively on extracting the 'inner life' of the tam-tam: in Harvey's words,

> if one can submerge oneself into this giant mixing machine with all its complex reverberations (actions may reverberate and effect other actions for sometime afterwards), it cannot be denied that a totally new experience of sound is offered, as well as an exhaustive knowledge of the complex nature of one simple object.[31]

Probing the inner life of sounds becomes a metaphor for probing the inner life of the human soul. Just as the individual soul needs to escape from the outside world in which he exists only in relation to something else, by 'sinking into himself', so the individual sound needs to be isolated, removed from the context of its role as a unit in a musical argument in order to release the music within it.

Ironically, this music-within-timbre is nearly always hierarchically based - we have noted in the previous chapter that a sound's identity is governed to a large extent by the relationship of groups of upper partials to a fundamental note, a pattern clearly corresponding to that of traditional functional harmony. This would seem at first to be at variance with Harvey's musical (and spiritual) predelictions for symmetrical structures; however, his use of the spectral characteristics of acoustic sounds to inform his harmonic or structural working depends for its success on the fact that they are coherent sonic identities, and this is a matter of psychology and perception rather than artifice as we saw in chapter one. For Harvey, the perceptual phenomenon provides the starting point for musical and spiritual exploration:

> All the harmonic series we hear colouring every instrumental sound at every point are becoming functional in themselves. They are not merely colouristic designators of thematic argument, but are also assuming the mantle of thematic argument themselves - as when, notably, the harmonic series is meaningfully manipulated in electronic music, or totally re-invented.[32]

It is at this point that Harvey's choice of electronic music as one of the most significant developments in Western music this century becomes obvious, even inevitable. For such a composer, to whom the exploration of timbre is not only a musical but also a spiritual revolution, conventional acoustic instruments provide only a limited resource: the possibility offered by electronic technology of manipulating the components of a sound's structure in such a way as to disturb its unified identity and render it ambiguous, is one of the most exciting and inspiring attributes of electronic music for Harvey, creating what he calls a 'fertile borderland' of new sounds which are clearly related to, though nevertheless distinct from conventional acoustic sounds. Together with this goes the idea of 'the paradox of [the] interchangeability' of the identity of sounds[33] - in other words, the extraordinary aural phenomenon of hearing one sound transform into another, a significant feature of several of Harvey's works (and also Wishart's, though for different reasons). For this kind of transformation to achieve Harvey's desired effect, the sounds must be divorced perceptually from their source so that the evolution of one into another may be contemplated without the distraction of visual correspondence with a sounding body (in 'Inner Light (3)' all transformations of the instrumental sounds take place away from the orchestra by being diffused around the acoustic space). This is important perceptually but also has an extra significance, the implication being that the sounds have to be 'liberated' from the restrictions of the resonating physical source in order for their 'inner life' to be released - back to the idea of the flight of the soul away from the body and towards the Divine again. Electronic sounds lack what

Harvey calls 'externality': the lack of recognisable physical source imbues them with a disembodied quality which can thus be exploited for its associations of weightlessness and timelessness. The transformation process involves the setting up of a smooth continuum between the sounds, so that the sounds become the extremes in between which lie an infinite number of possibilities - two Relative worlds connected to each other through their relationship with the Absolute.

* * *

It will be seen that the ideas presented throughout this chapter overlap to some extent, even though they are products of three very different musical personalities. Common preoccupations range from considerations of the perceived properties of individual sound objects to questions of musical structuring and the relationship between material and form.

There are clear analogies between several of the terms coined. Smalley's concepts of 'surrogacy' and 'spatial articulation', and Wishart's concept of 'landscape' all refer to the listener's tendency to infer gestural (ie. relating to physical energy) and contextual information from the morphologies of sounds, and describe ways in which the composer can harnesss this phenomenon to expressive musical effect. They confirm the necessity of providing a valid context for sounds, whether new or old, which relates in some way to human experience - 'surrogacy' and 'landscape' are both defined in relation to the degree to which the instrumental (ie. by implication, human) origins of sounds can be detected through their spectral evolution. The

natural morphologies which result from the acoustic properties of physical instruments (and voices) and their modes of excitation are further recognised in Smalley's concept of 'resonance' and Wishart's definition of 'imposed' and 'intrinsic morphologies'. All of these terms make broader reference to the nature of our perception of our acoustic environment, itself open to new kinds of manipulation and transformation in the studio.

All three composers find ways to translate the acoustic phenomena of gesture and morphology into musical terms. For Harvey, analysis of the acoustic structure of instrumental and vocal sounds informs his melodic and harmonic working, influences his structuring processes, and provides the starting point for timbral transformations which explore the potential ambiguity of instrumental identity. Wishart uses the results of comprehensive research into the production of vocal (and some animal) 'utterances', and computer analysis of voice sounds, to expand the compositional possibilities of the voice both on a metaphorical level ('utteranceness'), and on a purely timbral level particularly with regard to transformations between vocal and other sounds. Smalley bases his whole compositional theory on the sonic 'archetypes' found in instrumental models, taking them as the starting point for his examination of high- and low-level structuring processes in a composition. For him, the details of a sound's dynamic shaping can project themselves on to the broader structural design of a work, so that the whole piece is an elaboration of a particular manifestation of energy.

This interest in the internal make-up of sounds has a further manifestation in the transformation of sounds. As suggested in the first chapter, manipulation of the spectra of sounds is much used in electroacoustic music (including pop and rock music), both from the point of view of creating new 'families' of sounds derived from a common source, and from the point of view of effecting a transformation from one sound to another - a common feature of Harvey's and Wishart's music in particular. Smalley makes little reference to such techniques in his writings, although several of his pieces derive their material from specific instrumental origins (see chapter three). Wishart and Harvey, on the other hand, write at length about the specific relevance of transformation techniques to their compositional aesthetics, and reveal that, in several instances, the desire for a particular kind of transformational control over their sound sources has dictated their use of certain technologies - Wishart's use of the Phase Vocoder for 'Vox 5' and Harvey's use of MUSIC V for 'Mortuos Plango, Vivos Voco' are good examples.

Each composer's writings include reference to a 'continuum' of sonic possibilities. Certain aspects of this continuum, such as pitch and intensity, are already familiar from instrumental music through glissando, portamento, crescendo and so on. The possibility of exploring a wider concept, such as the continuum of timbre, has only come about with the development of the electroacoustic medium, so it is not surprising to find all three composers discussing the idea at some length. Wishart suggests that a musical discourse based on an articulated timbre continuum could take the place of the traditional Western one based on pitch, such is the sensitivity of the ear to timbral

inflections. Harvey's understanding of continuum reflects his spiritual convictions, and is based on the notion that the boundaries between individual sounds are not fixed and immutable but flexible and able to be dissolved to reveal exciting areas of timbral ambiguity. He even goes so far as to dispute the existence of timbre at all, postulating that a sound's spectrum is really harmony, its dynamic evolution a kind of melody, and its identity a question of cultural association. Smalley's terms 'attack-effluvium continuum' and 'pitch-effluvium continuum' extend traditional parameters to show their place within a wider range of morphological possibilities and a new concept of structural articulation.

Whilst these analogies are of interest in themselves, they underline a more fundamental link between the three composers - that of a common attempt to find a meaningful relationship between the new materials and the new forms of the electroacoustic medium, which may or may not have implications for the sphere of traditional instrumental composition as well. In the absence of a common low-level unit of electroacoustic composition corresponding to the hierarchy of tonal harmony, or to conventional phrase structure, this involves a re-appraisal of what constitute the low-level units of a musical structure and how they combine to make larger forms.

For Harvey, the two areas of conventional and electroacoustic composition are closely linked, and his particular musical concerns find expression in both (though perhaps not to the same extent). His compositional building blocks are still provided in many instances by instrumental sounds, and where he delves inside a sound, the terms of

reference are usually still traditional concepts - hence the 'harmony' of a sound's spectrum and the 'melody' of the dynamic evolution of its partials. For Smalley and Wishart, on the other hand, alternative sound material has suggested alternative criteria for musical composition, and it is arguable that, for them, the new possibilities brought about by the electroacoustic medium have facilitated or even demanded a new conception of musical language altogether.

CHAPTER THREE

Denis Smalley

> One is confronted by two opposite extremes: some researchers, due to lack of imagination, have no hold over sound phenomena, whence they can only extract unusable trivialities. Others, overly talented in carving the material, fashion it at the drop of a hat to produce idiosyncratic objects, recognizably stamped with a particular manner or personality. Being endowed with too much meaning, revealing too much of an intention, do these objects still belong in the sol-fa?[1]

Denis Smalley is a composer specifically of electroacoustic music. He has written relatively little conventional instrumental or vocal music[2], examples of it being confined almost exclusively to his early compositions, and has concentrated instead on writing pieces for tape, tape and instrument(s), or amplified instruments. His willingness to be categorised as an electroacoustic composer facilitates understanding of his music in some ways. Narrowing the frame of reference permits a much finer perceptual tuning to develop in the listener: the intricacies and subtleties of a fine composition reveal themselves in proportion to the amount of time spent listening to that piece and to others in the genre, and the depth and richness of much of Denis Smalley's music can best be appreciated only after many hours of concentrated listening. While limiting the scope of discussion to electroacoustic music has its advantages however, some disadvantages are apparent. Two related difficulties, those of analysis and notation, are immediately presented.

Traditionally analysis is thought of in terms of a notated score, the aim of the analysis being to supplement the aural experience by investigating the levels of complexity which the ears fail to grasp. Before proceeding, it is worth attempting to establish what is understood by the terms 'notation' and 'score'. Jonty Harrison, in defining the use of notation from the composer's point of view, makes the following statement:

> ...it is arguably true that much instrumental composition takes surprisingly little account of specifics of sonic detail, being more concerned with relationships at the conceptual level, expressed through the intermediary medium of notation. Historically, musique concrète is not concerned with notation; moreover the recording and subsequent manipulation of 'real' ('concrete') sounds almost by definition exceeds the limitations of notation - imagine the notational convolutions involved, for example in something as aurally clear as filtering even a relatively simple instrumental note. Notation presupposes a parametric conception of sound which is relatively well suited to the kinds of compositional operations with which integral serialism or even tonality are concerned, but which may be inappropriate and unnecessary for complex concrete 'sound objects'; because they have already been captured on tape they are immediately available for compositional manipulation without the intervention of notation.[3]

Harrison is misleading in his assertion that *musique concrète* was not concerned with notation - this very problem was of crucial significance to Schaeffer, for example (as the opening and later quotations in this chapter will reveal). The statement also omits one of the functions of written music - that of communicating performance instructions to a player - and fails to take account of the complex traditions associated with notation and the production of scores. Harrison implies that notation is simply a composing tool, enabling the composer to manipulate and transform his musical ideas through symbols; as such, he suggests, notation has been made redundant by tape. A composer may indeed use notation to work out his musical ideas and plan large-scale structures which would be too complicated to refine in his mind;

however, the principal function of the resulting score, that is, the single document which contains all the composer's ideas for the work and indicates their relationships to each other, is to enable the music to be performed (or realised). A conventional score is therefore a set of performance instructions which happens, by virtue of the notation used, to give an insight into the composer's working methods. The fact that we are able to retain in our mind's 'ear' an accurate image of different instrumental sounds (see chapter one) means that looking at a score can also give us a clear idea of how the music sounds.

Not every performance detail is present in a conventional score. There are factors which common music notation and scores take for granted in order to function - for example, that the player of a particular instrument knows how to produce and articulate the sounds of that instrument, that timbres can be defined according to established instrumental standards, and so on. Thus a particular sound, which computer analysis might reveal to be a complex mixture of closely related notes joined together by vibrato or fluctuations of breath and coloured by a continuously changing blend of harmonics, can be represented by a single notehead on a stave, the simplicity of the code allowing the performer to decide the finer details of the sound in the context of the musical passage.

In a similar way, apparently rigid metrical structures implied by the mathematical division of notated time values (two (equal) crotchets = one minim, four (equal) semiquavers = one crotchet, etc) may be extremely flexible in practice. The metrical convention exists in order to divide time into rhythmical units and thus allow musicians in a group to coordinate their playing, but any meter may be subjected to

distortion (or 'rubato') by sufficiently skilled performers without destroying the rhythmical coherence of the music.

The traditions of composition, notation and performance practice are closely linked in Western music. Common music notation evolved before the inner structure of sounds became available for analysis and manipulation, and represents what were the lowest structural levels of music at the time, that is, commonly understood formalised pitch relationships and rhythms, and fixed timbres. Musical forms and performance practice became standardised during the last couple of centuries arguably through the very use of common music notation, since Western musical training has traditionally involved mastering the established techniques of an accepted instrument and learning how to interpret the codes of written music according to their musical and historical contexts. A composer uses this notation in the knowledge that the performer will understand the codes - the musical message is conveyed by means of commonly held assumptions (hence one interpretation of the concept of music as a language). While on one level common music notation may seem an imprecise method of communication, 'the performer's training grants accuracy'.[4]

None of these assumptions can be made with electroacoustic music. In many cases, neither the sounds, nor the methods of producing and performing the sounds, nor the systems of combining sounds to form compositions bear much resemblance to the traditions of Western music (see chapter one), which has meant, in turn, that no system of notation which provides the link between 'the musical thought and its materialisation'[5] has been developed. For the analyst or student of electroacoustic music, the fact that there is no common approach to the

notation of electroacoustic scores presents problems if comparisons are to be made between one composer and others, for the simple reason that the amount of objective information that can be gathered from the scores will depend largely on what individual composers decide to, or are able to notate. Where comparisons are to be made between the works of a single composer, there is not such a problem if, like Smalley, he uses the same format for all his scores (assuming that there is enough information within that format) - the resulting analyses should have at least a uniformity which may enable wider considerations of style, development, and so on to be raised. However, the scores themselves (whether intentionally or otherwise) are often little more than visual props for performance, or aids to the diffusion of the music, and give very few clues about the construction of the pieces they represent. To study electroacoustic music deeply, with a view to gaining a more profound understanding of a composer's style and methodology means to confront these issues in a context where they are arguably out of place.

In the repertoire of electroacoustic music there are few, if any, scores which combine all the functions of traditional scores mentioned above. In works for tape alone, the idea of a set of performance instructions applies only in cases where the composer gives directions for the diffusion of the sounds around the performance space. To a limited extent, these may be open to musical interpretation as in conventional performance, depending on the acoustics of the room, the layout and quality of the equipment (eg. loudspeakers) and so on. However, 'live' diffusion of a completed tape piece (as distinct from the spatial placing of sound events during the composition process in the studio) usually affects only superficial aspects of dynamic and direction, and diffusion

instructions in the score will say little about the actual construction of the piece.

Electroacoustic scores which do approach the traditional criteria tend to be of pieces which incorporate acoustic instruments. Such scores usually include aspects of common music notation, or a version of it which allows for extended performance techniques. For example, the performance score of Stockhausen's 'Kontakte' (the version for tape, piano and percussion) gives precise cues for the coordination of the instruments with each other and with the tape part, as well as clear indications to the analyst as to the relationships of the events. A separate score exists for this work, which gives precise details of the technical construction of the tape part - a set of performance instructions in its own right if we interpret 'performance' as the production of sounds, although this would have little meaning to the average performing musician.

By contrast, the score of Stockhausen's 'Studie II' (for tape) presents both the precise details of the piece's construction and a clear diagrammatic representation of the sounds. The sounds here are simple sine tone aggregates so there is no need for any kind of timbral or gestural symbology, the two aspects of electroacoustic music which have grown increasingly important as the genre has developed. Since the sounds are unfamiliar in terms of conventional Western music, traditional notation would have been irrelevant. The notation used in its place, however, does not enable the listener or student to 'hear' the music - that is, to imagine how it would sound - by looking at the score: it is only through hearing the music *with* the score that the diagrams become meaningful representations of the sounds.

Attempts at notating electroacoustic music which do not use common music notation usually fall into one of two categories: some kind of diagrammatic depiction of the aural experience, or else a list of operational data. Generally, diagrams are crude by comparison with conventional notation. Few, if any, of the structural characteristics of the music are evident other than obvious points of contrast precisely because the relevant structural parameters differ from piece to piece and there is no unanimously accepted method of dividing the new concept of the sound continuum. Operational data, or computer printouts, on the other hand, give a clear account of the use made of specific devices (and are therefore only valid during the lifetime of that device - commercial synthesizers, for example, evolve at a disconcertingly rapid rate) but are of too technical a nature to be of any value to most musicians. Even in a relatively straightforward score such as 'Studie II', which is both diagrammatic and technically detailed, the traditional concepts of pitch, dynamic level and rhythm, which have musical implications, are represented in dB, frequency and seconds, which do not. Marco Stroppa sums the problem up as follows:

> ..which analytical wizard would succeed in inferring from these complex parameters a unity as simple as a crescendo? And who would not be tempted to try to understand the significance of each change, to trace its evolution, serialize it, examine it under a microscope, compare it with the rest etc, completely betraying the musical sense of the idea? The relationship between the complexity of the effect and the simplicity of the result is also a function of context: the behaviour of the same parameters in another situation would be quite different, even if the idea remained the same.[6]

To understand a technical, or operational score usually requires considerable re-training on the part of the musician. Even then, its only use is as a guide to the precise reconstruction of the sounds - equivalent, perhaps, to the instruction the player would have received

from a teacher or a manual in learning how to play his own instrument. As Stroppa suggests, the musical implications within a technical score are usually beyond the grasp of any analyst.

Perceptual Analysis

Until such time as a new repertoire of sounds becomes established in the common musical vocabulary, and a new, standard notation is developed to symbolise it, the student of electroacoustic music must rely to a large extent on aural, or perceptual analysis to determine the important parameters of a piece of music. There are many who have advocated this on the grounds that music (especially electroacoustic music) only exists as it is heard, and that any analysis which does not take the listening experience into account is incomplete. Denis Smalley, for example, has said:

> Today we continually need to reassert the primacy of aural experience in music. The heritage of 20th century formalism and the continuing propensity of composers to seek support in non musical models have produced the undesirable side-effect of stressing concept at the expense of percept....Aural perception is fragile, fickle, empirical, and thus presents a threat to those musicians and researchers who have difficulty in coming to terms with the insecurity of their subjectivity. The primacy of perception is unassailable since without it musical experience does not exist.[7]

Two approaches to perceptual analysis of electroacoustic music.

Several commentators have outlined the difficulties of analysing electroacoustic music, but few have proposed methods of tackling these difficulties in a structured way. Michael Bridger and Andrew Lewis have given accounts of listening-based approaches which merit some discussion in the light of the above observations.

Michael Bridger's approach centres on two criteria: 'how to identify and classify salient features, and how to define ways in which they relate and interact in expressive and structural terms'.[8] His method, designed in the context of teaching students, resulted from group discussion of different listening experiences and took as its fundamental principle the notion that a work of art contains within it signals of the most appropriate analytical method for that work. He defends the necessarily subjective approach (or 'informal objectivity') by comparing it with

> the customary exclusion of any consensus of reported listening experience from most musical analysis.[9]

He rejected the use of a 'systematic classification of specific sound parameters' (a reference to the taxonomies of Schaeffer (1952), Brian Fennelly (1967) and Denis Smalley (1981)) for this task, since the body of works chosen for discussion presented such a complexity and diversity of material that any attempt at detailed categorisation would have been quite overwhelming. Instead, Bridger restricted himself to a study of the 'salient features' observed by the students, rather than 'minutiae'. To this end, he established six 'codes of signification' by which to interpret the structure and fabric of the music. These were: voice, music quotation, concrete sound, dynamics, location and structural significance.[10]

The pieces chosen for analysis were:

Berio: Visage (1961)
Cage: Fontana Mix (1958)
Ligeti: Artikulation (1958)
Stockhausen: Gesang der Jünglinge (1956)
Stockhausen: Telemusik (1966)
Varèse: Poème Electronique (1957-8)

(These pieces were composed within a few years of each other, by composers with established reputations in musical genres other than electroacoustic music, and were all readily available on disc; therefore, according to Bridger, they could be considered to be relatively widely disseminated and accessible examples of the genre.)

Three of Bridger's six codes of signification - music quotation, the human voice, and concrete sounds - relate to the actual sound material, and reflect the hybrid nature of the compositions chosen for study. The appearance of recognisable material in a context of unfamiliar, electronic sounds always seemed to attract listeners' attention, and promoted discussion about the relationship of the different kinds of sound material and the proportions of each in the pieces. It was noted, for example, that the affinity between the boy's voice and the electronic sounds in 'Gesang der Jünglinge' was in strong contrast to the differentiation between the female voice and electronic sounds in 'Visage'.

Bridger's comments on the subject of 'dynamics', another code of signification, is particularly interesting with respect to Denis Smalley's concept of 'motion types' (outlined in chapter two):

> In the absence of almost all the syntactical devices of conventional music that together enable the construction of musical phrases from smaller germs of material, and progressively longer aggregations of those phrases until the level of a whole movement or complex of movements is achieved, it is at once apparent that reliance was all the more necessary on the rather more crude and less finely differentiated aspects of musical language grouped together here under the heading of dynamics...In tonal, or even non-tonal instrumental music, so many layers of musical syntax operate simultaneously that the sheer grain of the texture is seldom a predominant, primary feature, but in this music, with little possibility of reliance on most of the traditional procedures, it is not surprising to find that textural flow and density is elevated to the status of a major structural principle.[11]

Bridger's experiments found that long term dynamic profiles bore a strong similarity to those of conventional music, despite the innovatory material: climaxes tended to be loud and alternations between loud and soft passages had a familiar pattern. On the other hand, there was a much greater range between the stillest to the most active moments, and the rate of 'event-flow' was considerably removed from conventional practice. Unfortunately the general nature of Bridger's report precludes examples to illustrate this observation, but he does indicate the scope of the concept of 'dynamics': his list of features includes states and processes, regularity and asymmetry, alternation and transition between sections of different status, congruence and non-congruence with other parameters, and homogeneity and heterogeneity.[12]

By focusing only on the 'salient features' of the music, Bridger's method has a limited application: smaller details of the electronic components of the works were passed over because they were not found to be responsible for the primary impact of the music, and little thought appears to have been given to the possibility of there being different levels on which to appreciate or understand the pieces concerned. Nowhere in his account does Bridger refer to developments in the listeners' perception of the music over a longer period of time, implying either that the experiment was conducted in a limited time frame, or that consideration was not given to the potential relationships between 'minutiae' and 'salient features'. Although the electronic sounds themselves aroused little comment, listeners were found to comment on the electronic transformations of acoustic sounds, an area where the 'minutiae' of subtle relationships could have offered

much scope for analysis and comment. The stated objective of the study ('to define ways in which the salient features relate and interact in expressive and structural terms') could not be completely fulfilled without this consideration. Those structural observations which were made - for example, by comparing the use made of familiar and unfamiliar sound material - are akin to the limited kind of information which might be obtained from an aural analysis of a piece of conventional music. Almost all musical forms exploit relationships between established material (eg. exposition/recapitulation) and new ideas (eg. development).

Bridger does make the point that the largely unfamiliar sound world of electroacoustic music denies the listener the kinds of musical expectations which would be fulfilled or denied in more familiar repertoire. The expressive power of almost all innovatory music is diminished for many listeners, until such time as the innovations have become absorbed into the wider musical language, or at least until they have become familiar to a given individual (the author's own analysis method, described later, provided just such a familiarity). As previously noted, the innovations of electroacoustic music have not yet been so absorbed into the general musical consciousness. The electroacoustic composer cannot draw on a pool of conventions necessary to create what Bridger calls 'expressive ambiguity', so the relationships between the sounds in each work have to be carefully established from the beginning if they are to be perceived by the listener at all. The difficulty is confounded in an experiment such as Bridger's (which involves group discussion) by the fact that there is no adequate terminology for the sounds, so comparisons between different sounds can only be expressed in vague terms. The exception in this

case was the sound of the human voice which, being a meaningful and recognisable sound regardless of the use of language, provides infinite possibilities for ambiguity:

> the composers seem to have been intrigued by the possibilities inherent in a sophisticated and teasing game with the paradoxes of vocal and linguistic communication, in which both metaphorical and metonymic processes can function all the more powerfully because of the prevailing aura of ambiguity.[13]

(This point is discussed further in chapter five).

Andrew Lewis' analyses of electroacoustic music are worthy of mention here not only because of their listening-based approach, but also because of their specific reference to works by Denis Smalley. Where Bridger confines the concept of 'dynamics' to one of several aspects of a composition, Lewis' analysis of Smalley's composition 'Vortex'[14] attempts to understand 'motion types' - a similar concept - as the basic units of structural building in the work (the term is borrowed directly from Smalley, see pp. 56-59). Lewis selects three attributes of 'vortical motion' - cyclicity, fluidity and vertical motion - for particular attention. He notes that:

a) rotating objects create repeating patterns when observed from a fixed point (such as the regular flashing of a lighthouse, or the chopping effect of a helicopter's blades): therefore, cyclical patterns are well suited to musical representation;

b) vertical motion has a direct musical analogy in pitch which, for various reasons, conjures up images of high and low;

c) fluidity has been represented in musical terms in a variety of ways - examples in conventional music include Schubert's 'Gretchen am

Spinnerade', Beethoven's 'Pastoral' Symphony (scene at the brook), and numerous pieces by Debussy.[15]

Lewis goes on to describe all the different sound types of the piece, (or as many as may be defined objectively through aural analysis). He finds sixteen (listed (a) to (p) in the analysis), and groups them into six basic motion categories in order to clarify the analysis: these are - sustained and static, cyclical (rotational, vortical), undulating, pseudo-random, upward, and downward (the categories overlap to some extent).

Taking into account all the (perceived) sounds and their categories, Lewis deduces that the structure of 'Vortex' is one of alternating stasis and movement, where movement means *rate of change* of motion types. This presents a seeming paradox whereby a static passage, that is one in which motion types remain the same, may be either very sparse in texture or extremely complex. According to Lewis' analysis, the middle of 'Vortex' is marked by the most prolonged period of stasis, that is the music achieves a state of calm; however, the section is one of the most complex according to his description of sound types, with six different sounds variously piled on top of each other, in comparison to other sections in the piece where only one or two sound types are heard together; furthermore, some of these sounds are described as 'very bright, momentary 'electronic' sounds, sometimes very densely packed'.[16] Following Lewis' definitions, then, the section is one of stasis packed with activity (a concept which would be familiar to Jonathan Harvey - see chapter four).

In order to follow through the analytical aim of his study, Lewis deliberately 'filters out' all the parameters of the sounds used except the motion components, to produce 'families of motion typology'.[17] While this enables him to focus clearly on the parameters suggested by the work's title, it allows him to omit other aspects of the piece which are arguably as important from a structural point of view.

For example, despite the apparent rejection of traditional structural principles in the work, there are quite clearly defined pitch relationships which may be perceived just as clearly as those of a conventional composition. Chords, or aggregates, are built around notes which also feature as isolated sustained pitches or drones (for example, the G major texture at c. 9' and the general oscillation between G and E tonalities suggested by the drones throughout the piece - see the diagrammatic score in Appendix 1a), and many of the aggregate sounds are distinguished by their reference to the harmonic series. Movement up and down the harmonic series (in the manner of vocal harmonics) is a common feature of the continuous and static sounds, the various metallic resonances, and some of the energetic electronic sounds described in separate categories by Andrew Lewis. Not only does this allude to vortical and swinging motions, it also lends a kind of uniform harmonic feel to the sounds in question, relating them on an abstract level as well as the implied physical level.

In terms of timbre (defined by the ear) the sounds in 'Vortex' fall into fairly straightforward families. For example, three kinds of metallic sounds described by Lewis in separate categories are sufficiently similar in timbre to be heard as part of the same family (see DAT example no. 1 - all DAT examples for this chapter are detailed in

Appendix 1), and the same applies to the electronic sounds of his categories (e) ('highly energetic and mobile 'electronic' sounds') and (h) ('very bright, momentary 'electronic' sounds') - DAT example no. 2. Many of the sounds fall into what one might describe as machine-like, for example the 'low rasping rumbles' of category (b) (similar to the chopping of a helicopter - described as 'pulsing low frequency texture' in the tape reduction list in Appendix 1a), the 'long sustained pitches' of category (c) and many of the 'long glissando structures' of category (j). This does not invalidate Lewis' distinctions, but does suggest alternative interpretations of the structural use of the sounds throughout the piece.

Other sounds are related more by gesture or shape (what Smalley might call 'trajectory'), such as the glissandi and the 'vortical' events. For example, the tendency towards resolution of an upwards glissando or crescendo are the same regardless of spectral details.

Andrew Lewis' examination of 'Pentes'[18] also seeks to define motion types or profiles as the building blocks of the work's structure. He investigates the idea of the title of the piece ('slopes', 'gradients' or 'inclines') with regard to the characterisation of sound material and the definition of its structural implications. He identifies three types of 'sound contour': descending slope, ascending slope, and a combination of the two; these are applied to amplitude and frequency, giving a total of six categories of material which are further subdivided according to the duration of each profile. Instances of each are picked out methodically from the work, with the aid of Lewis' own diagrammatic score, and a brief explanation of the musical function of each is given: for example, he notes that the first short-span descending profile near

for example, he notes that the first short-span descending profile near the beginning of the work gives the impression of great energy by its corresponding decay of density and high frequency information (DAT example no. 3 - from c. 46" as shown in score in Appendix 1a).

Lewis explains his reason for adopting this approach as follows:

> Pentes, like much electroacoustic music, is a work whose complexity in terms of the more usual musical parameters, such as pitch, make it very hard to pin down from an analytical point of view. However, amplitude and frequency (or dynamic level and pitch) have been singled out for discussion because they are the musical parameters which are most easily thought of in terms of rising or falling contours such as those implied by the title.[19]

On the basis of this method, Lewis determines that the 'structural centre of gravity' of the work is the section of rising and falling noise contours about two-thirds of the way through the piece, precisely because it exhibits all six types of slope profile. He adds, interestingly, that the passage of Northumbrian pipes, if diffused with slope profiles in mind, also exhibits all six types and thus presents an alternative structural peak to the one already mentioned. He concludes:

> This is perhaps the best solution since it creates two contrasting climaxes, one savage and noise-based, the other more restrained and melodious, but which share a common structural denominator in the *pentes* (sic) of their frequency and amplitude envelopes.[20]

This method of analysis works quite well for 'Pentes', since the the 'motion types' suggested by the title may be seen on both micro- and macro-levels of the music, and are fertile areas for musical representation. Lewis suggests in this article that it is possible to consider slope profiles of duration, timbre, density and space in addition to frequency and amplitude, but does not consider any other

possible unifying factors (such as pitch centres) nor even any other kinds of 'motion type' exhibited in the piece (such as rhythmic articulation of texture - see Observations in Appendix 1a).

Analysis by tape

Neither Bridger's nor Lewis' methods of analysis makes any attempt to provide an account of the derivation of related musical material from an originating sound source or musical idea. In conventional music it is often possible to trace the relationship between germinal motifs and extended passages by studying the notated score; in electroacoustic music it is virtually impossible to identify the precise transformation or synthesis procedures used in the generation and manipulation of material by aural analysis and memory alone, and composers are often loathe to reveal the specific details. A single sound source, either concrete or synthetic, may be the starting point for a wide variety of material, and while knowledge of the technical procedures alone does not constitute an understanding of a final work, it can give valuable insight into a composer's conception of his sound material in the context of a particular composition.

In an attempt to find an alternative method of analysis, which took account of the importance of perceptual response but did away with the need for symbolic notation, the author devised a simple analysis-by-tape procedure and applied it to three pieces by Denis Smalley: 'Pentes' (1974), 'The Pulses of Time' (1979) and 'Vortex' (1982). The goal was to achieve the same as a conventional analysis, that is, to divide each piece into its constituent sections and sound objects, to discover relationships between them at various levels, to deduce characteristics of the composer's style or 'voice', *and to record the analysis in terms*

appropriate to the style of the music. Since conventional methods of analysis rely on notation, and since no adequate, universal notation exists for electroacoustic music, these analyses were presented on tape, to be heard after or before the compositions themselves. Although transformation processes in the works could not be 'undone' by this method, sections of music could at least be rearranged to show how passages or sounds related to each other without having to resort to words or symbols.

For ease of reference a basic diagrammatic score of each piece was made, divided up into units of chronological time and annotated with readings taken from the tape recorder's timer for major structural features (see Appendix 1a for scores). Sounds were identified and grouped in crude categories specific to each piece, and then cut out from a tape (a recording of the original) and spliced together for comparison in sections. Thus 'resonant attacks', 'brief electronic sounds', 'discrete blips', 'drones', 'metallic resonances' and other sounds from the length of a piece would be removed from their context and juxtaposed in a 'tape reduction' of the composition. Once the tape was marked up, the splicing sessions were carried out without further listening so that the completed section of the reduction would be as fresh an aural experience as possible.

Results, predictably, were mixed. Many sounds which had seemed similar or related in some way, even after several hearings of a piece, proved unexpectedly dissimilar when put close together, and much re-ordering of the spliced sections was consequently necessary in an attempt to find more accurate derivations of the sound material (for final versions, see separate cassette: lists of the sounds included in the

reductions are given in Appendix 1a, together with legends for the diagrammatic scores; timings on the lists refer to the scores). This was felt to be a particularly worthwhile exercise for two reasons: first, it clarified some of the techniques of transformation and manipulation used in creating 'families' of sounds; and second, it illuminated the function of context in guiding the perception of sounds in sequence. Listening to the pieces subsequently became a more informed and thus more satisfying experience in the light of this knowledge (Observations on the tape reductions are included in Appenidx 1a).

However, there were many sounds which resisted classification by this simple method: one could only say that they seemed to be related in some way, despite many hours of patient listening over several months. For those sounds which could be identified, it was necessary to question the nature of the relationship between them in order to avoid misinterpreting the composer's intention: a shared source sound did not always mean a shared musical function. Unlike Bridger's and Lewis' methods, this analysis procedure took individual sound objects as the starting point for further investigation; considerations of structure arose only as they were suggested through the process of juxtaposing sounds in the tape reduction.

The value of this method in the long term proved to be with respect to the whole of Smalley's output rather than to individual compositions. Increasing familiarity with the sound objects in 'Pentes', 'Vortex' and 'The Pulses of Time' led to the identification of certain sounds or types of sounds which reappeared in many of Smalley's works. Families of sounds proved to be common between different compositions as well as within individual works, not only through common gestural or

structural characteristics such as the use of glissando-shapes or drones, but also in spectral make-up.

Smalley concedes that his output falls roughly into chronological groups of pieces which explore similar resources, as follows:

Gradual	1974
Pentes	1974
Ouroboros	1975
Pneuma	1976
Darkness after Time's Colours	1976
Chanson de Geste	1978
The Pulses of Time	1979
(Berne Mobiles	1980)
Word Within	1981
Vortex	1982
Tides	1984
Clarinet Threads	1985
(O Vos Omnes	1986)
Wind Chimes	1987

(Works in brackets are non-electroacoustic). Of these groupings, the most interesting from the point of view of their shared sound material are: 1) Gradual/Pentes/Ouroboros; 2) Pulses of Times/Chanson de Geste; and 3) Tides/Wind Chimes/Clarinet Threads.

1) Gradual/Pentes/Ouroboros. Smalley's comments on the genesis of Pentes are illuminating:

> What I did was to take the last movement of the tape part of Gradual [a work for tape and amplified clarinets], with only one or two alterations, as the beginning of Pentes. I only had 4 weeks at the GRM. If you have

to compose a piece from beginning to end you can't start from nothing, and you can't necessarily start just from crude sound sources, particularly using analogue techniques which would take a long time. So I had always envisaged when I was composing Gradual that that would be the beginning of Pentes....I had certain fixed ideas about these sources which were developed in a very complex way and were totally remote from their origins. I was going to start by developing them at the same time as I was investigating the analogue synthesis possibilities to see whether I could possibly be in sufficient control of them. The Northumbrian pipes recording I took along with me because I thought they'd be a fruitful source of development from nothing. So I had a range of possible sources...[21]

(The fact that Smalley disguised his original sound sources intentionally does not invalidate the attempt made during the analysis-by-tape method to discover the timbral relationships between different sounds and sections of the piece. Where concrete sound sources are used, the original sounds may be seen in the same light as a conventional composer's initial creative idea: it is not necessary to trace everything in the piece back to the very source if the relationships established in the piece itself are rich and satisfying. Concrete sounds are rarely identifiable in Smalley's compositions (those few that do occur are mentioned below); it is the sound material which he derives from them which reappears from piece to piece.)

According to Smalley, there are three basic areas of source material in 'Pentes': 'Gradual' material, synthetic material, and pipes material. These are used to generate the following basic sound types:

a) Large attacks (Lewis' short span downward slope profiles). These have structural significance: usually the larger the 'upbeat' and subsequent attack, the greater the effect on the ensuing material. The sequence of attacks without 'upbeats' between 1' and 3' introduces no new material, but simply adds to the growing momentum (see score). At 3' through the piece, however, the largest attack of all announces a

section of overlapping rising and falling noise glissandi (selected by Lewis as one possible structural 'centre of gravity'); this attack has no immediate 'upbeat' gesture, but is preceded instead by a brief silence. The initial effect is to create a moment of suspense, but there is also a suggestion that the preceding 3' of music acts as one enormous anacrucis for which the attack and the remainder of the piece are the resolution. Both of these interpretations, along with Lewis, identify the noise passage after the attack as being structurally significant.

b) Energetic 'electronic' sound fragments ('brief electronic sounds' on the lists for the tape reductions). These may be isolated punctuations, as at the beginning, or during the extended envelope of the large attack at 3', or combined in the attack itself to create a richly textured sound mass.

c) Rhythmical or pulsating material i) high frequency; ii) low frequency. The regularity of internal movement of these sounds gives the impression of cyclical motion, as Lewis pointed out with respect to 'Vortex'; when passages are more protracted, this has the effect of building up tension or expectation, or propelling the structure along almost like an ostinato.

d) Glissandi (pitch/noise). The sound material used for these is derived from the drones of the Northumbrian pipes, but the glissandi are important as much for their speed and direction as for their spectral make-up. In the section of overlapping rising and falling glissandi (after the attack at 3'), changes in pitch direction are always precipitated by an explosive sound event (similar to those at the

beginning of the piece); each explosive event itself is necessitated by the build up of tension created by an initial glissando.

It is significant that pitched material of any sort enters only after the large attack at 3'. The gradual emergence of stable harmonies and drones from the pitched noise contours crystallises the more general relationship between slope profiles and static material throughout the piece. The drones play an important role, not just because of the tonal focus they provide, but also through their internal rhythmic patterns. Smalley says:

> A significant feature of Pentes is the slow evolution of a harmonic progression introducing the Northumbrian pipes' melody. If played on the piano this progression would seem mundane. However, in this context, its temporal elongation and the careful revelation and control of the internal, fluctuating harmonics extracted through transformations in the studio ensure that many more qualities contribute to its impact than merely the effect of the chord progression alone. Interest focuses on the subtle pulsed shifts in the harmonic spectrum.[22]

The steady pulsating quality mentioned by Smalley is the antithesis of a slope profile, since it has no direction but revolves, as it were, on its own axis and is stable. This would seem to enforce Lewis' other suggestion of the pipes melody as the structural 'centre of gravity' of the work: not only does the melody itself show all six slope profiles, but it anchors them over a bass, so the implications of all the motion types in the piece are fulfilled.

Smalley talks of the 'narrative' flow of 'Pentes'[23], and Andrew Lewis describes it as a piece where

> the tendency is toward the use of clearly defined structures in which different sound-types and structure-types are each dealt with in large distinct sections. So in 'Pentes', for example, there is a section built around energetic sound particles and loud explosive events, followed by a

> section built around long descending or ascending noise contours, followed by a section using near static pitched drones, and so on.[24]

The work follows a logical progression from beginning to end: the pipes melody is heard as a distillation of what has gone before and gives a sense of resolution after the colossal sound masses and elemental gestures of earlier sections of the piece. We know that the beginning of 'Pentes' is essentially a restatement of the end of 'Gradual': Smalley uses the same technique in 'Ouroboros' which begins with an unambiguous restatement of the Northumbrian pipes melody of 'Pentes', clearly recognisable despite transposition and treatment in the studio (DAT example no. 4). 'Ouroboros' (a tape work) makes interesting comparison with 'Pentes', since there are many other insistent references to the earlier work in addition to the pipes melody, both in terms of sound material and in terms of gesture and shape: the same slope profiles articulate the same sound masses, are punctuated by the same busy electronic flurries and explosive events, and the drones and harmonies are all derived from the Northumbrian pipes.

Although it shares the material of 'Pentes', however, 'Ouroboros' does not share its logical structure, nor are the sound events well enough characterised within the work to allow clear relationships to be perceived. Whilst the title of the piece might suggest a structure other than developmental or goal-orientated, the 'morphologies' of the music do imply a need for a feeling of resolution, as they do in 'Pentes'. When the pipes melody reappears at the end of 'Ouroboros', there is no such feeling of resolution, nor, at a lower level, do individual sections in the piece lead convincingly to what follows. The use, observed by Lewis in 'Pentes', of distinct sections to explore different sound- and structure-types is evident in 'Ouroboros', but without a sense of

direction or purpose, as though Smalley recognised the strength of the ideas in 'Pentes' and was unable to free them from that mould.

2) The Pulses of Time/Chanson de Geste. Smalley takes pains in 'Pentes' and 'Ouroboros' to disguise his concrete sound sources. By contrast, the main sound source for 'The Pulses of Time' and 'Chanson de Geste' - amplified clavichord - features clearly in both works in addition to the material created from it. The sounds derived from the clavichord are mostly percussive, and vary predominantly in degree of resonance: strings are struck, plucked, strummed and 'bent' (the latter producing curious, Oriental-sounding gradations of pitch), and the soundboard and frame of the instrument are also struck in various ways, exciting the sympathetic resonance of the strings in addition to the initial attack (see legend to score and lists for tape reduction). 'The Pulses of Time' also uses sounds of gongs and metal bars, subjected to transformations in the studio.

Smalley says of 'Chanson de Geste':

> In instrumental and vocal works points of correspondence must occur among the different musical sources if fruitful relationships are to be structured. In traditional music this common ground is provided primarily by a stable pitch system. But pitch in terms of keys and harmony is not the only correspondence system available, and in Chanson de Geste it is not the only system used. The attack-resonance type of sound is prevalent and can be created with great variety among the limited resources through careful orchestration. Noise-like attacks are provided by clavichord clusters and resonances struck on various parts of the instrument's body, by voiceless consonants, stones, a wooden ruler, and a tuning fork....Natural resonances come from the clavichord and tuning fork but can be extended or decorated by the voice, either using pitches or noise-like air contours. The voice's timbral spectrum is enlarged by the use of harmonics. Amplification increases the detail of sound qualities available to the composer, greatly expanding the potential musical language.[25]

The vocal material in 'Chanson de Geste' consists largely of breath noises, and the audible harmonic 'filtering' created by changes in position of palate and tongue (familiar from Stockhausen's 'Stimmung' and many other works demanding extended vocal techniques); there are a few consonant-type sounds also, which serve occasionally to articulate the flow of air.

Although the clavichord material gives these two pieces a common sound world (due (a) to its distinctive timbral qualities, (b) to Smalley's almost identical treatment of the sounds in both works, and (c) to the fact that recognisable instrumental sounds are rare in Smalley's output as a whole), 'The Pulses of Time' and 'Chanson de Geste' remain completely self-contained works. The sounds listed above (struck soundboard and frame, struck/strummed/plucked/damped strings) are basic to both pieces but their context and meaning are quite different.

In 'Chanson de Geste' the composer attempts to find correspondences between the diverse acoustic sources at his disposal: the resonant sounds of plucked or strummed strings are combined with the humming of the tuning fork or the sung notes, while the more noise-based knocking sounds of the frame correspond to the sound of stones or the tapping of the wooden ruler, and to consonant sounds from the voice. The whole piece is about unification and diversity: the human voice is recognisable but it uses no language (except for the word 'sound') and therefore sheds its normal communicative role and takes on the neutrality of other natural sounds: at the same time, the sounds of clavichord, stones, ruler and tuning fork, by correspondence with the articulative effects of consonants and changes of unvoiced vowel sounds, appear to take on some of the qualities of human speech.

The 'Pulses of Time' functions on a completely different level. Here, the timbral qualities of sounds are less important structurally than their envelopes: in other words, the attack-resonance shape ( ) is the all-important structural parameter of the work, and timbre only comes into focus during those passages which specifically explore the resonance part of that shape. It is partly for this reason that the instrumental sounds in this work combine so convincingly with the electronic 'bounced' sounds which are little more than sine tones: they become integrated through shared pitches, and gestural shapes.

3) Tides/Wind Chimes/Clarinet Threads. The material shared between 'Wind Chimes', 'Clarinet Threads' and 'Tides' is less immediately obvious than in the examples described above. There are no large sections transposed from one piece to another, nor are there any obvious sound sources common to all, although the sound worlds of the three works are unmistakeably linked. Smalley maintains that the composition of 'Wind Chimes' was triggered specifically by the discovery of a set of ceramic wind chimes in a New Zealand pottery, and that the transformations of its sounds which were possible to effect at the GRM (where he was due to work) provided most of the material for the piece. Similarly, the tape part of 'Clarinet Threads' is clearly derived to a large extent from clarinet sounds, although the live clarinet part was added later. In this case, it is not so much individual sounds which connect the works, as subsidiary textural material or gestures.

However, whilst specific links between the three pieces are hard to pin down, there are many resonances of Smalley's other compositions in

them which open up the question of his compositional methods in general. Example nos 5-8 on the DAT reveal some of the similarities between 'The Pulses of Time', 'Darkness after Time's Colours', 'Pentes', 'Clarinet Threads', 'Wind Chimes' and 'Vortex', to mention only some of the best known. 'Vortex' stands alone in Smalley's chronological list of works, but still shares much material with the other works. Increasing familiarity with the pieces reveals the same metallic/electronic resonances and drones, the same pulsating or 'rotating' morphologies and rhythmically articulated textures, the same noise-based gestures and the same (or very similar) explosive attacks. In some cases, he uses the same recognisable acoustic sounds: for example, a distinctive cymbal crash and piano chord appear almost identically in 'Darkness after Time's Colours' and 'The Pulses of Time' (DAT example no 9 - see also the score to 'The Pulses of Time' at c. 6'45" and 7'05"). This is especially disorienting because the ear singles out these clear, familiar sound gestures from the context of unfamiliar electroacoustic sounds and attributes a disproportionate importance to them in the piece.

Smalley willingly admits to having accumulated a tape library of sounds to which he returns repeatedly, often choosing the same original sound sources whose implications can be further explored as material for an entirely new piece. Or is it an entirely new piece? To what extent is a composer's sound material a question of personal style, and where is the boundary between personal style and compositional technique? Can parallels be drawn between personal style as manifested through distinctive use of harmonies, melodic shapes and orchestration in traditional composition, and personal style as

manifested through distinctive use of concrete and/or electronic sounds in electroacoustic composition?

The clear difference which exists in conventional music between a *distinctive use* of sounds and a use of *distinctive sounds* easily becomes blurred in electroacoustic music. As already noted, the sound world of electroacoustic music has not yet been absorbed into the collective musical mind.[26] The identities of the sounds in each new piece have to be established from the outset so that relationships may be explored between them in a meaningful way for the listener. As long as the majority of sounds remain unfamiliar to the listener, aural focus is likely to be firmly on the sound objects themselves rather than on the subtle details of their manipulation or function within a passage of music - this is borne out by Michael Bridger's experiments described above. The fact that composers of electroacoustic music tend not to share their sounds with other composers contributes to this difficulty.

By comparison, the sound world of conventional (Western) music is more or less constant. The same instruments are used by many different composers and in a wide variety of musical styles. As they are well established in Western musical tradition, individual instrumental sounds in a piece of music tend not to be heard as sound objects in their own right but are understood to articulate higher-level structures; the composer may choose to explore a particular instrumental sonority for colouristic purposes, but he is not forced to do so by the novelty of the sounds (it is to this fact that Jonty Harrison refers in his statement quoted earlier). The harmonic language of much pre-twentieth century Western music is also well established (and is being reinforced constantly by the basic diatonic language of pop

music) so the individual melodic shapes, rhythmic patterns and harmonic progressions in a given piece of music become the variables which distinguish it from another piece. In other words, it is not so much the sounds themselves as the use to which they are put which characterises a conventional composition in the listener's mind.

During the course of this analysis experiment, the sound world of Smalley's compositions became sufficiently familiar to the author to enable aural focus to shift from superficial recognition of a particular sound to an understanding of the implications of that sound in a musical passage - a 'finer perceptual tuning' developed (see p. 91). It became apparent that some of Smalley's sounds are neutral enough to be incorporated successfully into different compositions, while others are too distinctive to be transposed into a different context: metallic drones and resonances feature effectively in several of his works, but the pipes melody of 'Pentes' is out of place in the context of 'Ouroboros' and the cymbal clash and piano chord in 'Darkness after Time's Colours' and 'The Pulses of Time' do not fit comfortably into either piece. Works like 'Pentes', 'Vortex', 'The Pulses of Time' and 'Clarinet Threads' are completely self-contained, integrated pieces of music despite their shared material but 'Ouroboros', 'Darkness after Time's Colours' and 'Pneuma' lack cohesion and identity.

Many composers of electroacoustic music, Smalley included, maintain that sounds have structural implications within them. The structure of a work for tape is therefore intended as a kind of realisation of these implications over time. Smalley has said:

> I work from a sound out into a section; I don't necessarily know how long the section is going to be when I work on it...I don't necessarily

> have a fixed idea about where the section will be in the finished piece...the problem is to find the right context for the sounds...you have to find the right psychological spot for sounds and that gradually determines the dimensions of the piece.[27]

Such a statement raises important questions when the same sounds are used in different compositions. For example, do the structural implications of a sound remain the same regardless of its context? Is context the main determinant of musical meaning? To what extent does the listener's perception of a sound override the composer's intention in using it, given that the unfamiliar sound world of electroacoustic music often provokes a different aural response in the listener from that commonly aroused by more traditional music (Smalley himself advocates 'percept' rather than 'concept' in musical composition[28])?

As we have noted, the clavichord sounds in 'The Pulses of Time' and 'Chanson de Geste' work equally effectively in both pieces, fulfilling completely different musical functions in each, but the Northumbrian pipes of 'Pentes' do not translate effectively into the context of 'Ouroboros'. The sounds in question in both cases are recognisable instrumental sounds, so no generalisations can be made about the functions of such sounds in an electroacoustic context. In a work for live instrument and tape such as 'Clarinet Threads', where the sounds and sound gestures are more familiar still by virtue of the live instrumental part, the questions raised by Smalley's statement still apply.

The live clarinet part in 'Clarinet Threads' is one of the few instances of instrumental writing in the whole of Smalley's output.[29] His use of the instrument in this work is not particularly remarkable - the breath sounds, key clicks, tongue slaps, reed biting and so on are familiar and

well-used contemporary techniques: more interesting is the relationship between the clarinet and the tape. Smalley's instructions for the amplification and diffusion of the work include precise comments regarding the balance between live instrument and tape. The performer is required to stand at some distance from the audience in order that the direct acoustic sound of the clarinet should not be heard more prominently than the amplified sound which is mixed in with the tape and projected over the loudspeakers. This is not merely a question of ensuring that both parts may be heard equally; Smalley desires the work to be heard 'electro-acoustically [sic] rather than acoustically'.[30]

Each of the sections in the work focuses predominantly on one type of clarinet sound gesture, from slow glissandi and sustained high notes (which have an almost continuous presence through the piece), to breathy noise-like sweeps, rhythmically articulated sforzandi, and so on. The live clarinet does not initiate, nor dominate each section, but rather serves to draw out and highlight certain strands or 'threads' from the overall texture. The richness and variety of timbre of the instrument is used as a link between the two worlds of instrumental and electroacoustic music; Smalley makes no attempt to deny the clarinet its pitch and note-event characteristics, but incorporates them into the music as vehicles through which to reach the electroacoustic sounds in the tape part. As the clarinet sounds are an integral and distinctive part of the sound world of the tape, it is doubtful whether they could be incorporated effectively into another composition (although there would be nothing to stop the composer from writing another piece using different clarinet sounds); subsidiary sounds, on the other hand, have been taken from this work and used in others quite easily, as we have seen.

* * *

By way of conclusion it is interesting to return to Schaeffer, with whom the chapter opened:

> One is confronted by two opposite extremes: some researchers, due to lack of imagination, have no hold over sound phenomena, whence they can only extract unusable trivialities. Others, overly talented in carving the material, fashion it at the drop of a hat to produce idiosyncratic objects, recognizably stamped with a particular manner or personality. Being endowed with too much meaning, revealing too much of an intention, do these objects still belong in the the sol-fa? The question is all the more relevant since it also presents itself as regards the eventual musical content spontaneously attached to the object by the composer when he operates on (chosen or produced) energetic events according to possible meanings which he aims or glimpses at. This is why experimental musicians do not so easily swap sounds between themselves. Each sound unequivocally bears his author's mark. A particular facture or basic material often constitutes so recognisable a characteristic that it could not be employed more than a few times in the same work, or even in another, without the risk of redundancy. Thus we discover in this new music something analogous to the painter's line and colour, or to the sculptor's 'hand': there exists a fusion of material with composition, and the form of the element can become no less meaningful than the overall form. Between a piano note belonging to the public domain, and another sonic object of the same duration, yet as original as an idiosyncratic motif, the difference of level is no longer classical. Thus distinct musics evolve, whose meaning is attached to, or begins to reveal itself at one level or another.[31]

Viewed in retrospect, this passage seems prophetic. To borrow Schaeffer's terms, Smalley's music is full of 'idiosyncratic objects, recognisably stamped' with his particular musical personality. His whole output represents a 'distinct music', part of the electroacoustic repertoire by virtue of its medium but sharing little in terms of material with the work of other composers. And some of his 'basic materials' do risk 'redundancy', as we have seen. It appears that Smalley is not always aware of the pregnancy of his musical material: the sounds which, in some instances, serve to give his works a richness

and coherence rarely encountered in the genre, are the very ones which, in others, overwhelm the moulds into which they are forced.

CHAPTER FOUR

Jonathan Harvey

> To grasp the essential nature of things is to understand man's position in the cosmos. The future development of music will be toward spiritualization, and involve a recognition of the special character of the individual tone. Today we relate the individual tone to harmony or melody, in order that, together with other tones, it may reveal the mystery of music. In the future we will no longer recognize the individual tone solely in relation to other tones, which is to say according to its planal dimension, but apprehend it in depth; penetrate into it and discover therein its affinity for hidden neighbouring tones. And we will learn to feel the following: If we immerse ourselves in the tone it reveals three, five, or more tones; the single tone expands into a melody and harmony leading straight into the world of spirit. Some modern musicians have made beginnings in this experience of the individual tone in its dimension of depth; in modern musicianship there is a longing for comprehension of the tone in its spiritual profundity, and a wish - in this as in the other arts - to pass from the naturalistic to the spiritual element.[1]

In any encounter with Jonathan Harvey, whether in person or through his writings and music, one is reminded of his preoccupation with transcendental consciousness. This concern with the spiritual dimension of life and art originated in his childhood experiences as a chorister at St. Michael's College, Tenbury, and developed later in his discovery of the works of Evelyn Underhill and others during his years as a student at Cambridge (see chapter two). The titles of many of his works - 'Inner Light', 'Bhakti' (meaning 'devotions'), 'Smiling Immortal', 'Be(com)ing' - betray this interest, and his compositions include a significant number of vocal pieces which set

texts from scripture or other sacred works, philosophy such as that of Rudolf Steiner, or original writings on spiritual themes.

Recognition of this underlying thread in Harvey's compositions raises the subject of communication through music. The question of whether music is capable of expressing anything 'except itself' (Stravinsky) is a tortured one, and it is with some caution that we should examine Harvey's music to see how his spiritual awareness manifests itself in musical terms. While it is possible to recognise particular features of his technique as embodiments of certain metaphysical ideas (and these are discussed below), it is another matter altogether to consider how these ideas might communicate themselves to the listener, and yet another to decide how appropriate, or even attributable they might be to the electroacoustic medium.

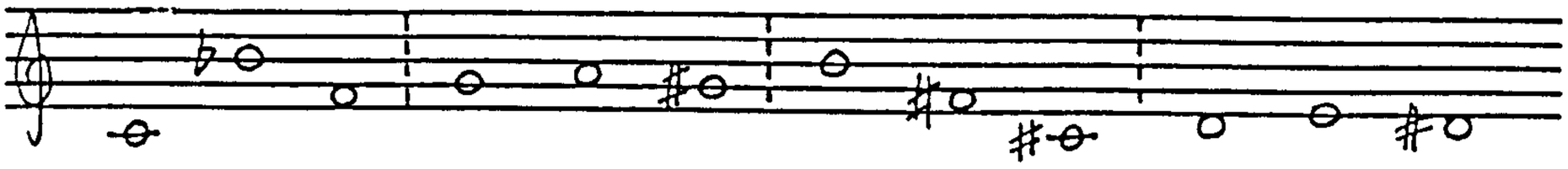
Of the three composers under discussion, Harvey is the one whose commitment to more conventional instrumental resources is the strongest, and his approach to electroacoustic composition is undoubtedly influenced by this background. Before attempting to answer more aesthetic or philosophical questions, therefore, we begin this chapter with an analysis of his use of a technique from conventional instrumental composition - that of serialism.

Serialism and the Spiritual

As suggested in chapter two, Harvey has been attracted to serialism for reasons both musical and spiritual. For him, a vital feature of serial technique is that which he calls the 'liberation' of the bass line. Tonality forces us to perceive structure and meaning in music in terms of harmonies built from the bass line upwards: the harmonic progressions which create tension and resolution are all governed from below, thus 'rooting' the listener to the ground. Although serialism may be used to this end as well (and Harvey notes that the common misunderstanding of much 12-note music is due to the listener (or composer) subconsciously relying on the very bass-line progressions which are no longer there[2]), it also releases the possibility of creating musical motifs, harmonies and structures which have different unifying principles.

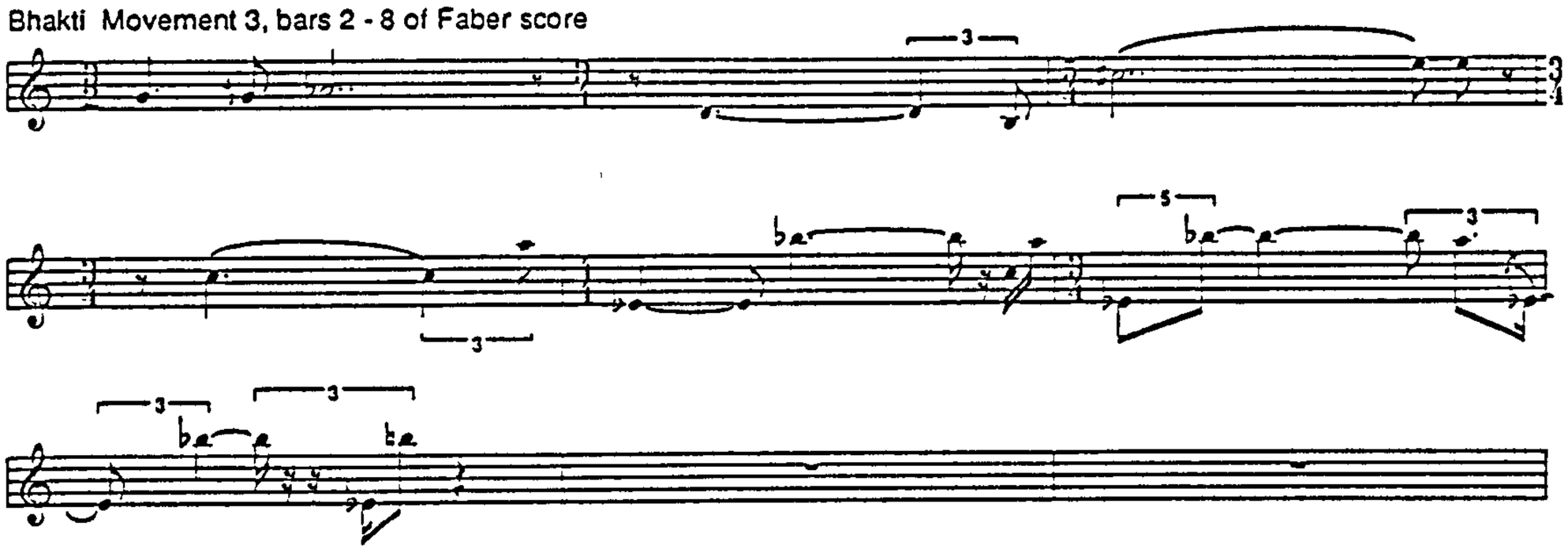
For Harvey, symmetrical constructions have provided an alternative to such bass-line-dominated models. Showing the influence of the music of Webern (another composer with profound spiritual awareness), his compositions have often featured rows, chords and musical cells which have been constructed around a central axis, thus ensuring that even in retrograde or inversion they remain mirrors (a favourite term of Harvey's) of the same essential musical idea. Instances of this include the basic twelve-note row of 'Inner Light (2)' (see example 1a), the macro-melody of 'Bhakti' (example 1b) and the harmonic fields of 'Madonna of Winter and Spring' (discussed later). In a sense, 'symmetrical' music revolves rather than proceeds.

Example 1 (a) 12-note row of 'Inner Light (2)'

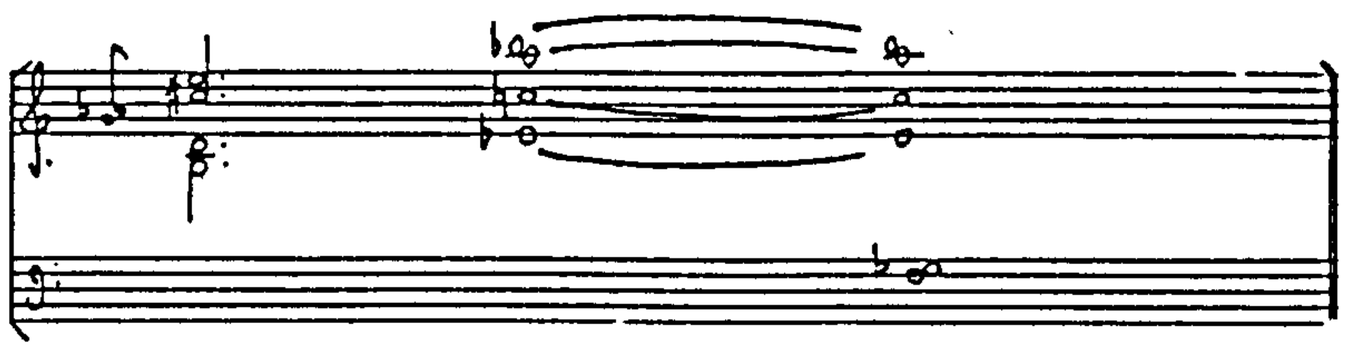


(The two hexachords are built from the same intervals: perfect 4th and major and minor 2nds; the first and third trichord are a semitone apart; the second and fourth trichord are a perfect fourth apart.)

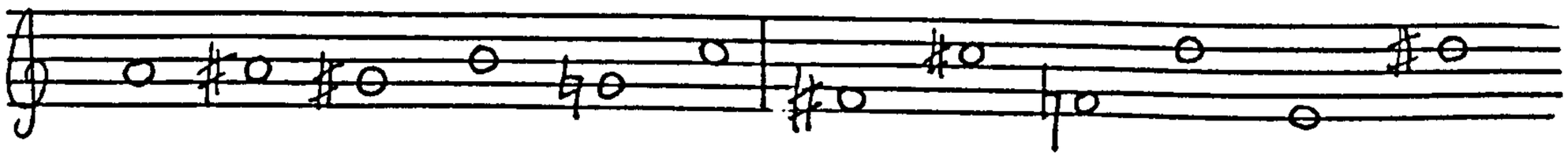
Example 1 (b) Macro-melody of 'Bhakti'



(The sequence of notes is taken from a symmetrical construction:



Example 2 (a) 12-note row of 'Inner Light (3)'



Since the manipulations of material yield only reflections of the same idea, it is music of stasis, in which motion and development take place within a much larger stillness. Freedom from the bass means freedom from direction, freedom from time (as expressed through harmonic rhythm), freedom from gravity; the movement of 'the bass into the middle' comes to symbolise for Harvey a liberation from the Relative and a sign of the Absolute.

The idea of a musical motif having a firm identity regardless of its treatment or manipulation in a work is reminiscent of Schoenberg:

> To the imaginative and creative faculty, relations in the material sphere are as independent from directions and planes as material objects are, in their sphere, to our perceptive faculties. Just as our mind always recognises, for instance, a knife, a bottle or a watch, regardless of its position and can reproduce it in the imagination in every possible position, even so, a musical creator's mind can operate subconsciously with a row of tones, regardless of their direction, regardless of the way in which a mirror might show the mutual relations, which remain a given quality.[3]

While the composer may be able subconsciously to manipulate his material in this way, however, the listener perceives music through time (with or without tonal harmonic rhythm), and is not always able to 'view' and recognise a musical idea from different angles except through its symbolic notation. Music played backwards tends not to make sense, and even that which does, such as backward canons in the music of Bach, usually deludes the listener into perceiving a continuously forward-moving form rather than a mirror image. Exact symmetries are rarely perceived in a musical passage, just as palindromic words are not necessarily recognised as such until they are written down. This is not in itself a fault - many compositional

techniques and devices are (and arguably should be) imperceptible to the listener. On the other hand, in Harvey's music the symmetries are there for more than intellectual amusement: it is his hope that symmetrical harmonic and thematic constructions will convey a sense of a new, spiritual dimension to the listener by virtue of their dissimilarity to traditional tonal hierarchies. Therefore, Harvey's symmetries must be perceived in some way if his message of a new consciousness is to be heard.

Harvey's use of serial techniques is a synthesis, or perhaps a distillation of various influences. If Webern was the inspiration for symmetrical structures and self-referential material, studies with Babbitt at Princeton in the late 60s gave Harvey a rigourous training in the usage of the techniques of serialism, particularly in the generation of derived and secondary sets from a basic row, while Stockhausen's music provided him with new insight into the interpretation of the very concept of the series. In his book, The Music of Stockhausen, Harvey distinguishes between the serialism of Schoenberg, Webern and Babbitt, on one hand, and that of Stockhausen on the other; in the latter's case, he says, one is aware of a scale of 'graded possibilities'[4] between two extremes, rather than a repertoire of repeated parameters. Much of Harvey's own serialism can be understood in these terms, particularly in his manipulation of pitch material. The basic row of 'Inner Light (3)' (written in 1976 for full orchestra and 4-track tape) is one of expanding intervals from a semitone to a tritone (see example 2a); derived sets are generated from the sequence of intervals in the basic set, one or two at a time, to provide the substance of the musical material. The idea

is to take each 'grade' between the two extremes of the row and 'expand' it, as a way of exploring the continuum which is represented by the 'grades' of the basic set. In theory, each derived set has a character of its own but also represents a small part of something larger (ie. the basic row). The pitch structure of the piece is therefore expressive of both expansion and unity, the relationship between the Derived and the Source.

Used in this way, serial techniques provide useful symbols for the transcendental concepts Harvey mentions: the unifying germ (basic row or cell), the symbol of the Absolute (symmetry, self-reference), and the link from the Relative to the Absolute (derived material is a reflection of the original set). Whether this is apparent to the listener or in any way valid musically is a different matter. Harvey himself has remarked how his early attempts to create musically meaningful structures through dense serial working often failed because the 'low-level intervallic working [was] too unmemorable'.[5] Without clear structural working, the spiritual metaphor is lost: Harvey's own analysis of 'Inner Light (3)' reveals it to be a piece of considerable complexity, both conceptually and musically, and yet it is arguably less satisfying a work than either of the two other 'Inner Light' pieces or, indeed, other equally complex works of Harvey's which are, significantly, built according to different principles.

His outline of the structural features of the piece is summarised as follows:

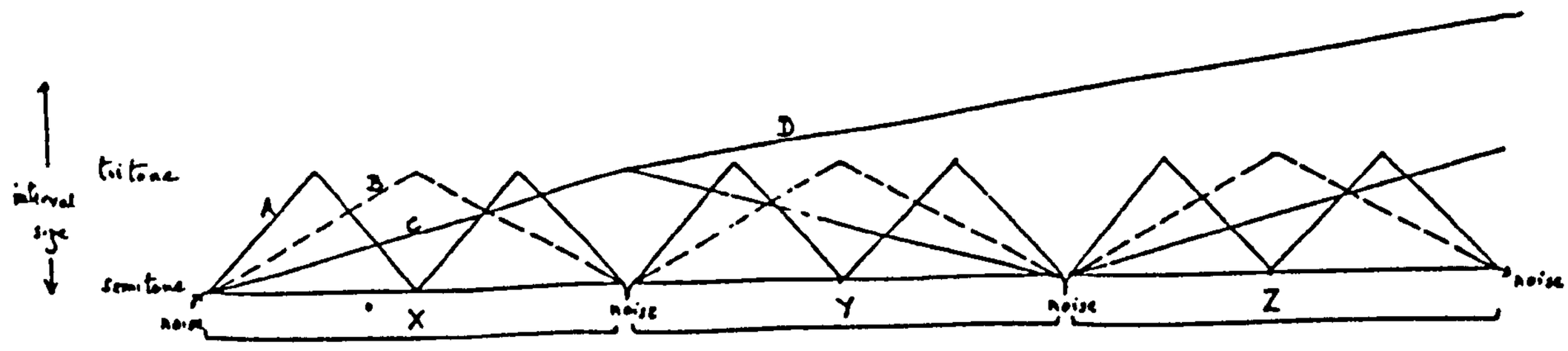
a) The basic set is one of expanding intervals (contracting in retrograde and also within the row as the second half retrogrades the first). Six forms of this set are used as a kind of cantus firmus underpinning the entire work almost without interruption.

b) Derived sets are generated from the intervals of the basic set, one or two at a time. Hence there are semitonal sets, sets of a semitone and a tone, etc. These form the substance of the musical material.

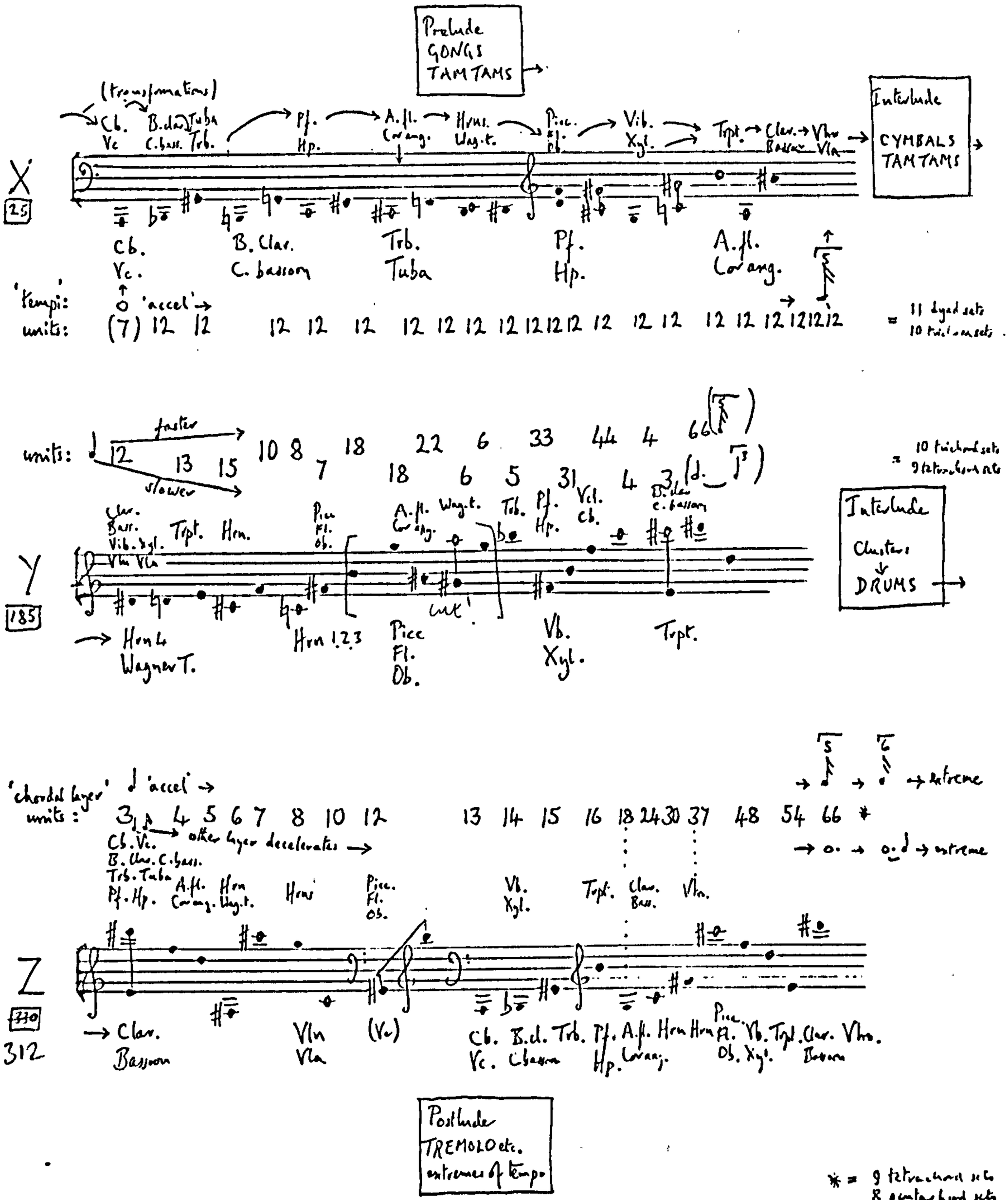
c) Harmonic fields, or 'spaces', expand and contract on another level from tritones to semitones and even further to noise at four significant points.

d) On the highest level is a background sequence of expanding intervals, whose constituent pitches slide off both ends of the audible scale one by one into silence (Harvey's diagrammatic representation and pitch sketch of the first four points are given in examples 2 (b) and 2 (c) below).

Example 2 (b)



Example 2 (c) Pitch sketch for 'Inner Light (3)'



e) Ideas of expansion and contraction may also be seen in the rhythmic organisation, which gets alternately faster and slower and eventually does both simultaneously, loud chords articulating a slow tempo while the instrumental figurations reach the speed of alpha brainwaves.

f) The concept of expansion is also manifested through transformations of instrumental timbre. First, each pitch of the basic set has an associated instrument or instruments; hence the orchestration at any point is governed by the number of pitches in the derived set. The instruments remain in the texture once they have entered accumulating as background material to accommodate new instruments as they are introduced. Second, the piece begins, as do the other Inner Light pieces, with indistinct, low sounds on the percussion and tape, from which clear, recognisable sounds emerge. Third, and more significant, instrumental identity is expanded through tape transformations, the wave form of one instrument 'metamorphosing' into that of another (see later): each instrument thus becomes part of a much greater, all-embracing sonic world.[6]

Much of the detail indicated in this analysis is difficult to detect in the score, let alone to hear in a performance. For example, the development of harmonic spaces related to the set of expanding intervals, the background series of expanding intervals, and the system behind the rhythmic organisation are not evident, nor does repeated listening to the work render them any more so. One does not expect necessarily to hear the serial structures unfolding through the piece, but even the sense of the organising principle is missing - the work lasts for 30 minutes, during which only the broad outlines of the structure, highlighted by the passages of tape transformation, the noise sections described in (c), and the gradual expansion of register towards the end of the work, are really clear. Certainly the

spiritual dimension of the piece is hard to perceive, either from the use of serialism or for any other reason.

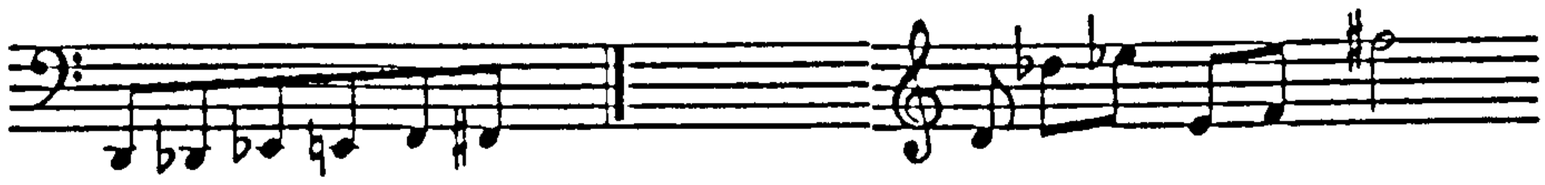
The possible exceptions are the transformation passages, where the suspension of orchestral activity and the diffusion of the electronic sounds around the auditorium as their spectra change might well imbue a sense of the other-worldly in the listener. It is not surprising, therefore, to find that an exploitation of the internal structure of sounds, and of the increasingly subtle transformations which can be effected with today's technology, have remained a feature of Harvey's writing in more recent compositions, while the use of serial structures has been supplanted by new ideas (discussed more fully later).

By contrast with 'Inner Light (3)', Harvey's use of serialism in 'Nachtlied' (1984) achieves its aims more successfully, both musically and metaphorically. The work is for soprano, piano and tape, and is a setting of two poems, 'Wanderer's Nachtlied' by Goethe and 'Abends/Morgens' by Rudolf Steiner.

Examples from 'Nachtlied'

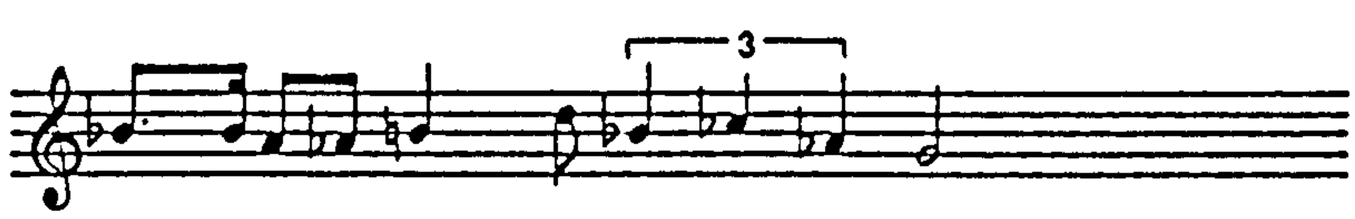
3 (a) Basic 12-note row (soprano melody)

3 (b) Ostinato

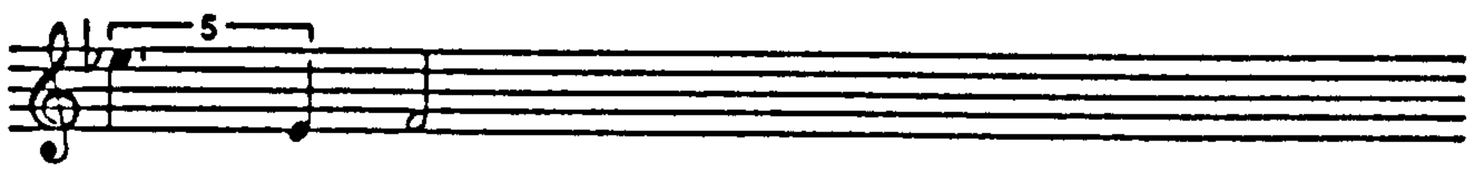


Soprano line from ostinato

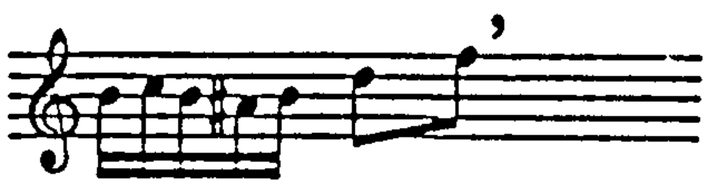
3 (c) Row fragment in opening vocal melody

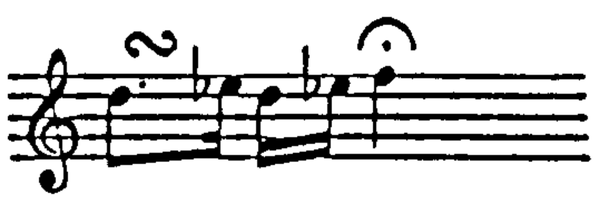


3 (d) Row fragment in opening vocal melody

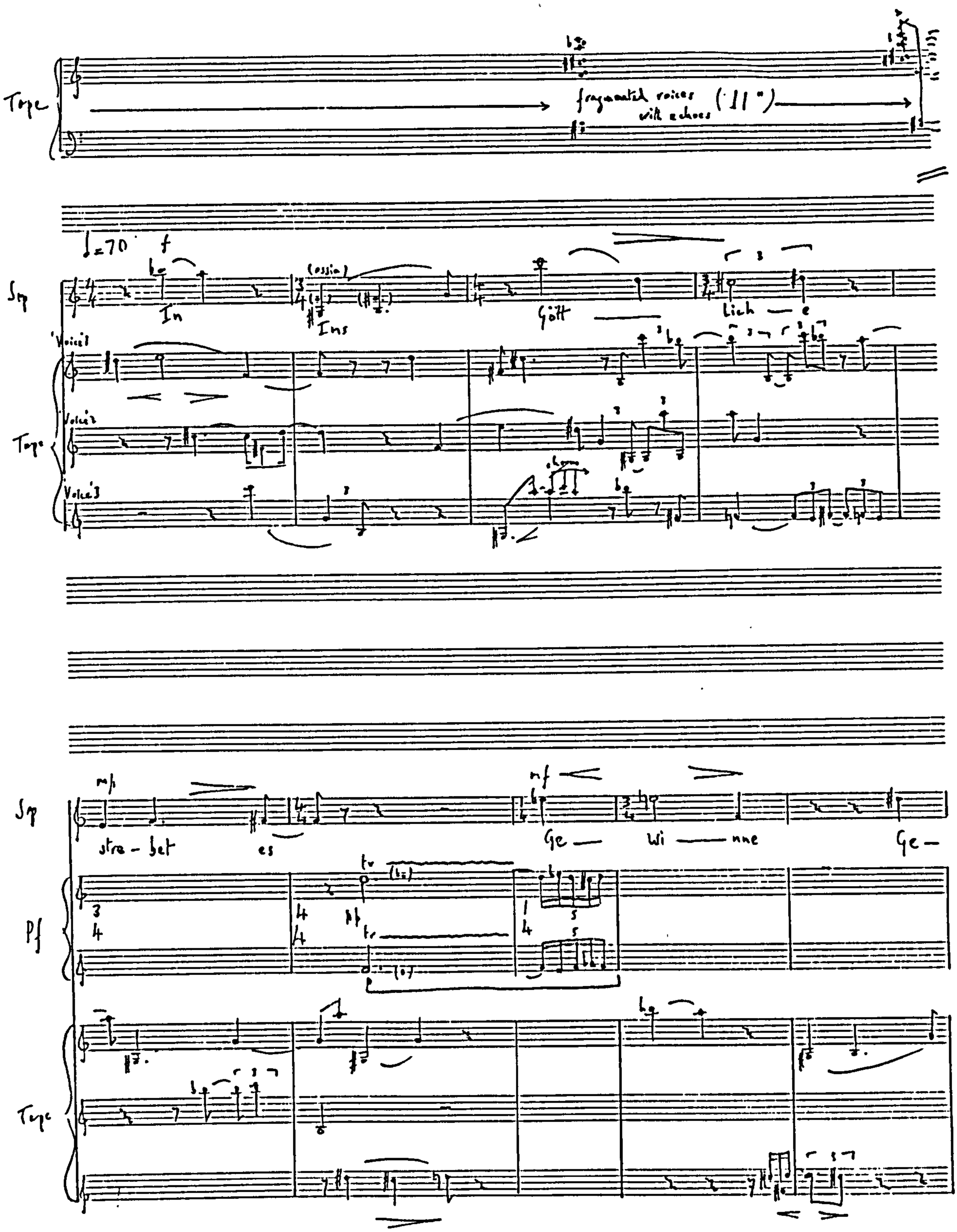


3 (e), (f), & (g) Turn figurations





Example 3 (h) Polyphonic interlude from 'Nachtlied'



The basic twelve-note row (example 3 (a)) is generated from semitonal cells which unify the whole work, providing the building blocks for construction of both harmony and melody. The row is not stated in its entirety until the beginning of the second poem, where it grows out of an ostinato introduction (example 3 (b)). However, two fragments of it are present in the melodic lines of the first poem (examples 3 (c) & (d)), and the latter of these is extended prior to the first appearance of the full row in the soprano's echo of the ostinato (3 (b)).

The work falls into two sections, corresponding to the two poems. The first section consists of four renderings, either full or fragmented, of Goethe's poem, initially by voice alone, then twice by voice and piano, and finally by voice, piano and tape. The Schubert setting of the same poem finds its way into Harvey's version: three ideas are taken from it more or less directly, all based on semitonal movement and/or a turn figuration which Harvey develops throughout the work (examples 3 (e), (f) & (g)), while the opening uses Schubert's rhythm, and the tape entry is almost an exact quotation of Schubert's melody, though greatly transposed.

The second section comprises an alternating series of accompanied vocal passages with three short interludes, preceded by an introduction and concluding with a coda. The section is roughly symmetrical around the second interlude, paralleling the mirroring of the linked Steiner poems which are almost exact inversions of each other (written out with translation in Appendix 2). Of particular interest are the polyphonic passages on either side of this

central interlude. The soprano is joined by three synthesized vocal lines on the tape in loose imitative counterpoint built entirely from (displaced) semitonal units from the basic row and fragments of the 'Nachtlied' melody (see example 3 (h)). Interjections from the piano in the first passage use the trills and turn figuration from the first section of the work; these are echoed in the tape interlude when chord clusters built from semitones are sung by 'fragmented voices', and 'perforated' in accelerating and decelerating sequences (the terms are taken from the score). These 'voice fragments' persist into the second polyphonic passage as an extra background layer and lead finally into the coda, where, after increasingly agitated and melismatic material in the voice and piano parts, the melodic lines and even the words of the poem break down and fall away to silence.

'Nachtlied' lasts almost as long as 'Inner Light (3)' (25 minutes), but is considerably less complicated in its serial working. There is not a profusion of themes or motifs in the work, nor is there much deviation from the basic row and the harmonies it engenders. The 'Nachtlied' melody, the ostinato, and the fragments from the polyphonic passages are all clearly linked with one-another through their relationship with the row and yet easily identified and memorable as individual themes. 'Background' material, such as the fragmented vocal textures and chord perforations in the tape/piano interludes and the figurations of the piano part, is often derived directly from the vocal line: harmonies are formed from notes picked out and highlighted from the melody; 'massed voices' echo the soprano's statements or initiate them; vocal inflections are developed into pianistic gestures or elaborate figurations.

The whole piece is rigourously integrated but also rich in ideas and deeply expressive; it is immediately accessible to the listener, but continues to be rewarding after many successive hearings. The clarity of thought in this work is not merely due to the small forces for which it is written, but more a result of Harvey's reappraisal of his compositional priorities: his statement to Paul Griffiths in 1985 gives an indication of the direction in which his thoughts were turning at the time of writing 'Nachtlied':

> I do increasingly feel melody as the bearer of feeling, whereas earlier it would have been harmony: it seems more and more powerful, the idea of a line as strong and expressive.[7]

Melody has assumed growing importance in Harvey's compositional technique in recent years. On one level, the lyricism of his music has become more pronounced and expansive, while on another, the dense contrapuntal argument which he continues to explore in his instrumental and electroacoustic music has become more carefully delineated and clearly thought out, more melodically constructed. 'Nachtlied' embodies both of these developments, but Harvey waited until 1986, and the composition of 'Madonna of Winter and Spring' to rationalise them completely. This work represents something of a turning point in Harvey's output, both looking back to 'Inner Light (3)' and forward to a new style of writing and a new spiritual metaphor.

Melody

In his article 'Madonna of Winter and Spring: some structural and aesthetic thoughts', Harvey writes:

> The first large section of the piece is concerned very much with thematic working. To say this immediately labels one as a reactionary, of course. Starting with Schoenberg's Erwartung or Farben or Webern's Symphony working with memorable themes has come under serious attack. The Darmstadt generation, John Cage, the minimalist school, the new maximalists - all have rejected it as sham rhetoric belonging to a world in which such a pretence at certainty is highly suspect.
>
> I agreed, until recently. I changed because I found structural depth was not perceptible without memorability. Having for years created an infra-structure of considerable (often serial) density, I noticed that works did not necessarily get 'deeper' the more I heard them - my attention was struck by other things about the sound, rather than the too unmemorable low-level intervallic working, which was intended to provide a rich labyrinth for extended exploring, but which failed.
>
> To achieve structural depth, I concluded, the building bricks must be remarkable and memorable, then you notice how deep they go, structurally speaking.
>
> Yet the method chosen differed significantly from the traditions stretching from Haydn to Britten. The themes are not prepared for like heroes, they do not make a grand entrance in full spotlight, they are not quitted on bended knee with bridge passages and cadential formulae. There are 20 of them, they are all equal, and in general they serve as texture-fodder as much as prominent melody. Sometimes all 20 sound together, weaving in a harmonic field, bits and pieces of them perceptible only.[8]

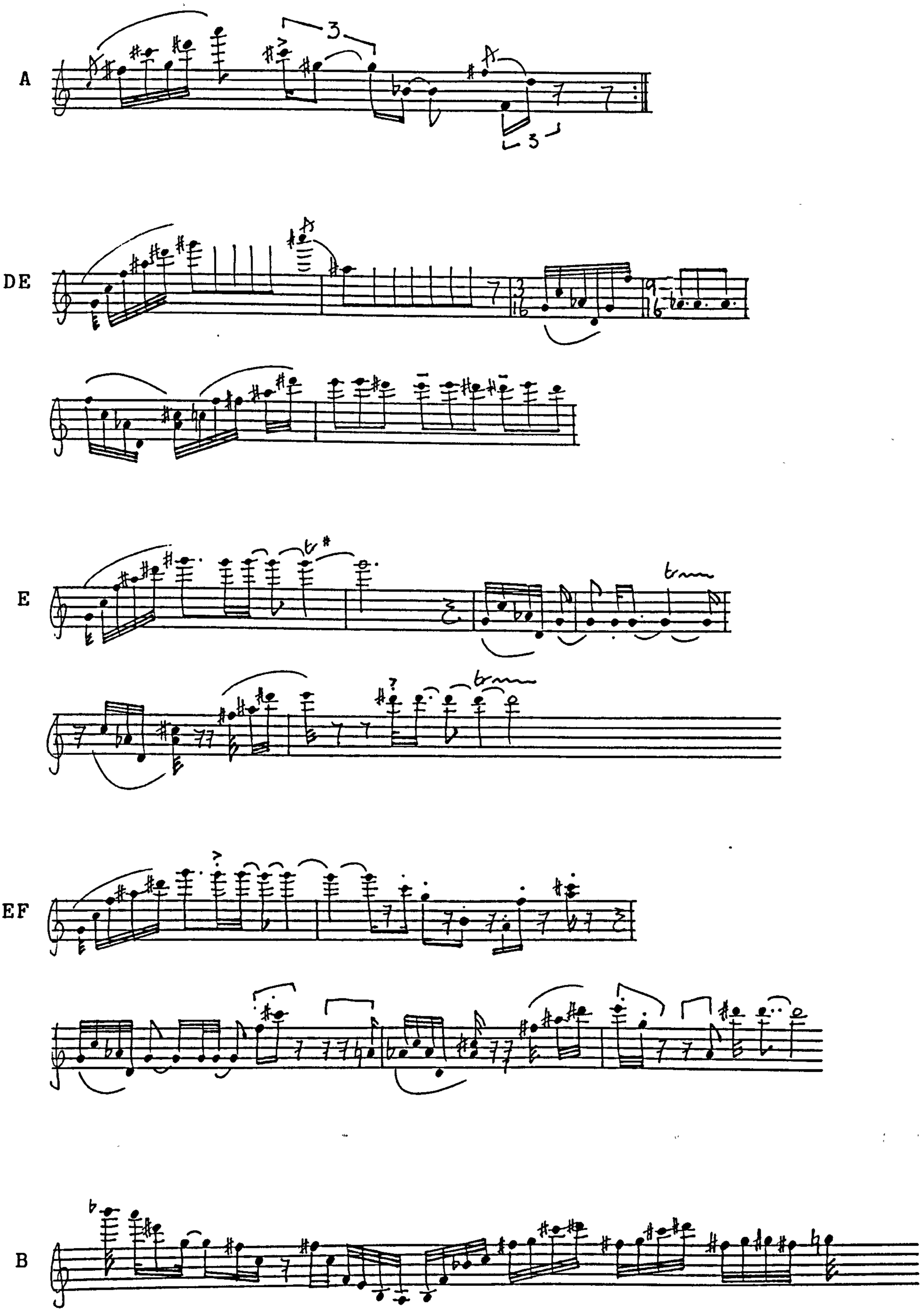
'Madonna of Winter and Spring', a large-scale work for orchestra and live electronics, was commissioned for the 1986 Henry Wood Proms. The 20 'melodies' mentioned in Harvey's article are both self-contained themes and also parts of a circular chain: a group of 'prime' melodies was created (A, B, C, D, E etc), from which compound melodies were constructed (A+B, B+C, E+A, etc); the chain was formed by a compound melody linking the first and last

prime melodies together. This chain was then used in a flexible way: sometimes the individual melodies are stated completely, sometimes they are stated together in dense polyphony, and sometimes gestures from various melodies are juxtaposed to create new ideas, so that the identities of the melodies at any given point in the work may be quite ambiguous.

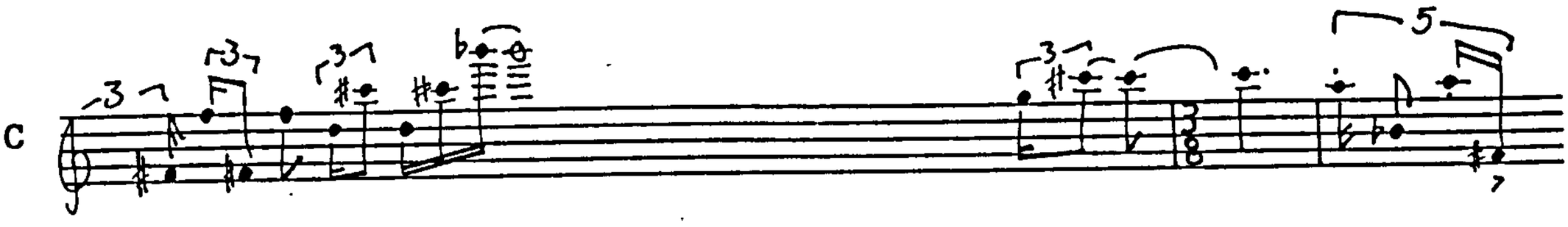
This kind of melodic 'addition' has only developed in Harvey's compositional technique in recent years, featuring in works as diverse as the tape piece 'Ritual Melodies', completed at IRCAM in April 1990, the chamber work 'Tendril' (no electronics) and the electroacoustic piece 'From Silence'. Harvey's structural claims aside, it is clear to see an extra-musical motive for this kind of writing. Each melody is at once individual and a small part of a greater whole. The permutations offer a chance for the individuality of each one to be incorporated and thus transformed into a larger entity. Dense 'intellectual' thematicism, such as that of the opening section of 'Madonna of Winter and Spring', may be presented in striking contrast with more static music to highlight the shift from discourse to what Harvey calls 'psychic music', as a metaphor for the kind of spiritual and social transformation which he wishes to portray.

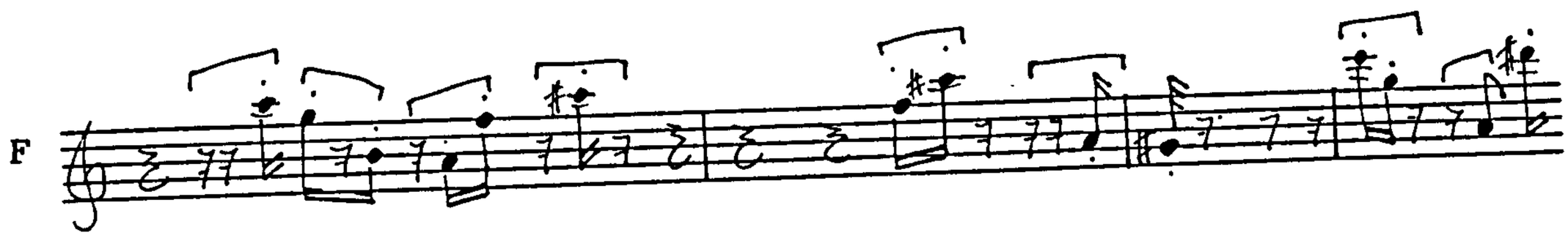
The melodies themselves are characterised by the harmonic spaces in which they are centred, and by rhythmic or decorative gestures peculiar to each one and its compounds.

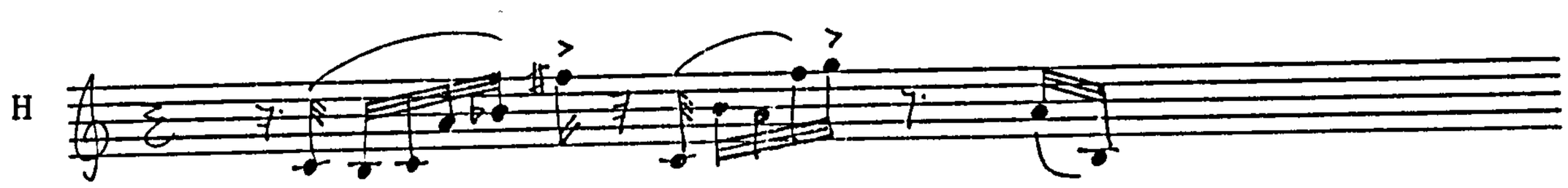
Example 4 Melodies from 'Madonna of Winter and Spring'

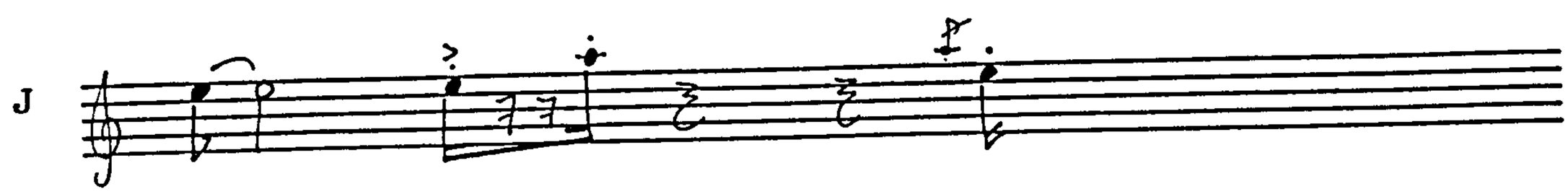


Example 4 (contd.) Melodies from 'Madonna of Winter and Spring'









For example, melody A begins with an upward flourish, answered by a series of downward leaps, and ending with a rising 6th; melodies DE, E and EF begin with a similar upward flourish, but in each case the top note of the flourish is sustained, and does not fall. Some, such as A, B, C, and G fall clearly into two complementary sections (not necessarily of the same length), while others, like F, H and J are more fragmentary. Compound melodies are more elaborate, and can be quite different in shape from their primes: melody AB, for example, is a continuously undulating semiquaver passage which does not suggest termination at any point, while both A and B are bipartite, balanced structures, each with a beginning, middle point and end (see example 4; all melodies are reproduced in Appendix 3).

'Madonna' opens with seven loud chords, presenting the seven harmonic 'spaces' of the work. These are symmetrical constructions, centred on an E/F semitonal axis which is fixed in register, and all the melodies are drawn from them. The spaces are transposed down a minor 9th for the third section of the work ('Depths'), when the axis becomes an inverted pedal, and up a minor 9th for the final section ('Mary'), when it becomes a bass for a new, 21st melody. Apart from these transpositions the harmonic spaces are fixed in register, Harvey's intention being to focus the ear as clearly as possible away from the bass-line and 'into the middle' (the harmonic spaces are reproduced in Appendix 3).

This kind of working has analogies with Harvey's technique in 'Inner Light (3)', at least in theory. In both cases, a basic reservoir of pitch

and rhythmic material, provided by a twelve-note row and its derivations in 'Inner Light (3)' and the cycle of melodies in 'Madonna', is intended to generate both 'foreground' thematic or motivic material and also 'background' textures (Harvey's terms), in an attempt to create a rich web of musical cross-references. In both pieces, a sense of tonal focus is implied by the harmonic 'spaces' in which the motifs are centred. Whilst Harvey is anxious to avoid traditional bass-line harmonic progressions, both pieces are, nevertheless, goal-orientated: in 'Inner Light (3)' and 'Madonna', Harvey strives to convey the notion of spiritual and musical development towards an expanded consciousness (not the state of expanded consciousness itself).

However, the economy of means and simplicity of structural design in 'Madonna' in comparison to 'Inner Light (3)' mean that the two works are quite contrasting in effectiveness, despite their apparent similarities. Where 'Inner Light (3)' is overburdened with the contrived structural detail illustrated earlier, the music of 'Madonna' travels an uncomplicated path through four sections ('Conflict', 'Descent', 'Depths', 'Mary') illustrating argument, calm, stasis, and new birth respectively. The spiritual transformation suggested by the titles of the sections is mirrored closely by the music, the complex thematic writing of the opening giving way entirely to static washes of sound in the central sections and, finally, to a lyrical, wordless song at the end.

If such a message is conveyed through the orchestral writing alone, what is the contribution of the live electronics? These consist of a

Yamaha DX1 (and TX816 voice bank extension), an Emulator II (both synthesizers have foot pedals and are controlled by one player), ring modulation (of harp, piano and vibraphone), extended reverberation and sampling facilities, and amplification (of cor anglais, clarinet 1, horn 1 and trumpet 1): the last three effects, as well as the overall balance, are controlled separately from a mixing desk in the auditorium. The front pages of the score give detailed instructions regarding the layout of the instruments, the configuration of the mixing desk, and specific information for the synthesizers: in addition to the normal Yamaha cartridges Harvey provides an extra cartridge of sounds of his own design for the DX1, and three disks for the Emulator II.

As this might suggest, the electronics play an important part in the work. One role is simply to augment the orchestra - the two synthesizers are used in the first section as orchestral 'instruments' (usually of percussive sound), and participate in the discourse effectively but unobtrusively. Ring modulation and amplification are also used for this purpose, expanding the timbral resources of the orchestra without detracting from its physical presence.

The second, more significant role is to illuminate the path from discourse to spirit. The sampling and reverberation facilities are able to 'freeze' any sound, prolonging it indefinitely or storing it for later output independently of the original instrumental gesture. Diffusion instructions are explicit in the score: particular sounds are sent on a journey across the acoustic space in a manner reminiscent of 'Inner Light (3)'. Both of these effects draw our attention away

from the abstract musical argument towards contemplation of the sounds themselves, and imply stasis. The transition ('Descent') between the first and third sections is effected almost exclusively in the electronics. After the climax of 'Conflict', the orchestral activity ceases and the synthesizers discard their 'instrumental' guise to become generators of continuous expanses of sound. The section consists of little more than a series of smoothly descending *pianissimo* chords, with reverberated high harmonics in divided strings panned slowly around the auditorium as the music descends in pitch. Tiny amounts of modulation to the synthesizers' sounds, controlled by foot pedals, create the effect of continuously shifting sonorities, so that the listener's attention is still held even while the momentum of the music is wound down.

In the final pages of the work the two functions of the electronics merge: in a passage in which the conductor is instructed to 'lose all sense of time', the sound of temple bells is sampled and looped by the Emulator to produce a continuous, breathing, pulsating sound which is reminiscent of the bell and yet something more.

Once again, there is a comparison to be made between 'Madonna' and 'Inner Light (3)'. In both works an electronic component is added to otherwise conventional orchestral forces for the purpose of enriching the timbral resources and expressive potential available. Harvey's development as an electroacoustic composer is manifested in 'Madonna' not by the more sophisticated technology but by the greater degree of integration between the electronics and the instrumental writing, and, paradoxically, by the greater simplicity of

his vision. In 'Inner Light (3)', the tape transformations are intended to suggest the whole continuum of sound; the new sounds of 'Madonna', by contrast, hover on the borderland of familiar instrumental timbre, extending the orchestral palette just enough to hint at a new world (timbral or spiritual) without attempting to reveal every possibility.

Timbre

In his article 'New directions: a manifesto', Harvey singles out the two most important attributes (to him) of electronic music. The first, as noted earlier, is the lack of 'externality' of synthetic sounds - the fact that they seem to issue from no known instrument or identifiable physical locality and can thus imply other-worldliness. The second is that, in electronic music, individual notes may take on a new dimension, no longer simply units of a musical argument, through explorations of their acoustic structure:

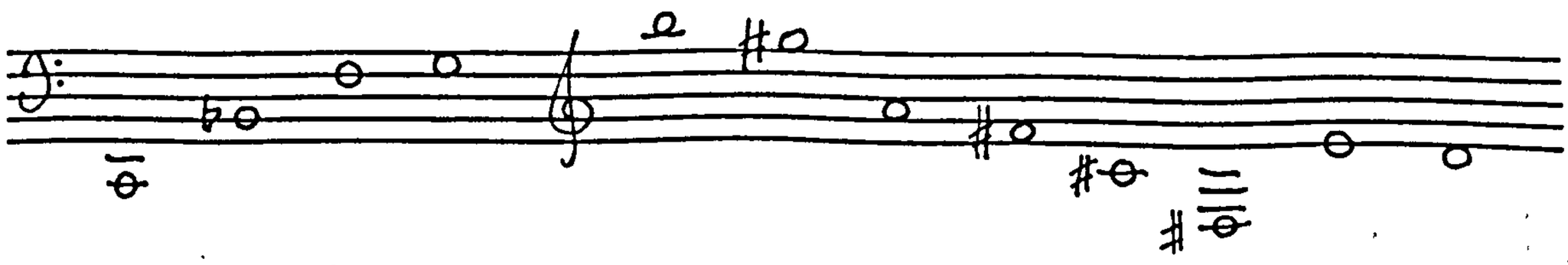
> Form there still is, of course. In a sense it is pure immanence (lack of identifiable source for sound), but also it is pure timbre (the exclusive construction of form from tinkering with timbre itself). 'Outer' colours are not used to colour an 'inner' abstract pattern, rather colours and pattern are one and the same. There is no more 'outer' and 'inner'. Everything has changed. We are getting closer to a more spiritual art in some sense.[9]

The term 'timbral composition' has been used to describe a wide variety of music but none perhaps so accurately as that which derives its very substance from the study of the internal acoustic structure of sounds.

Harvey's use of electronics to extend conventional instrumental resources and to open up the concept of a sonic continuum has been noted with reference to'Madonna of Winter and Spring' and 'Inner Light (3)'; it is to the 'Inner Light' trilogy that we return to see how his explorations of the inner structure of sounds has informed every aspect of his compositional working, from structural outlines and details of harmony and melody to more conceptual levels of thought.

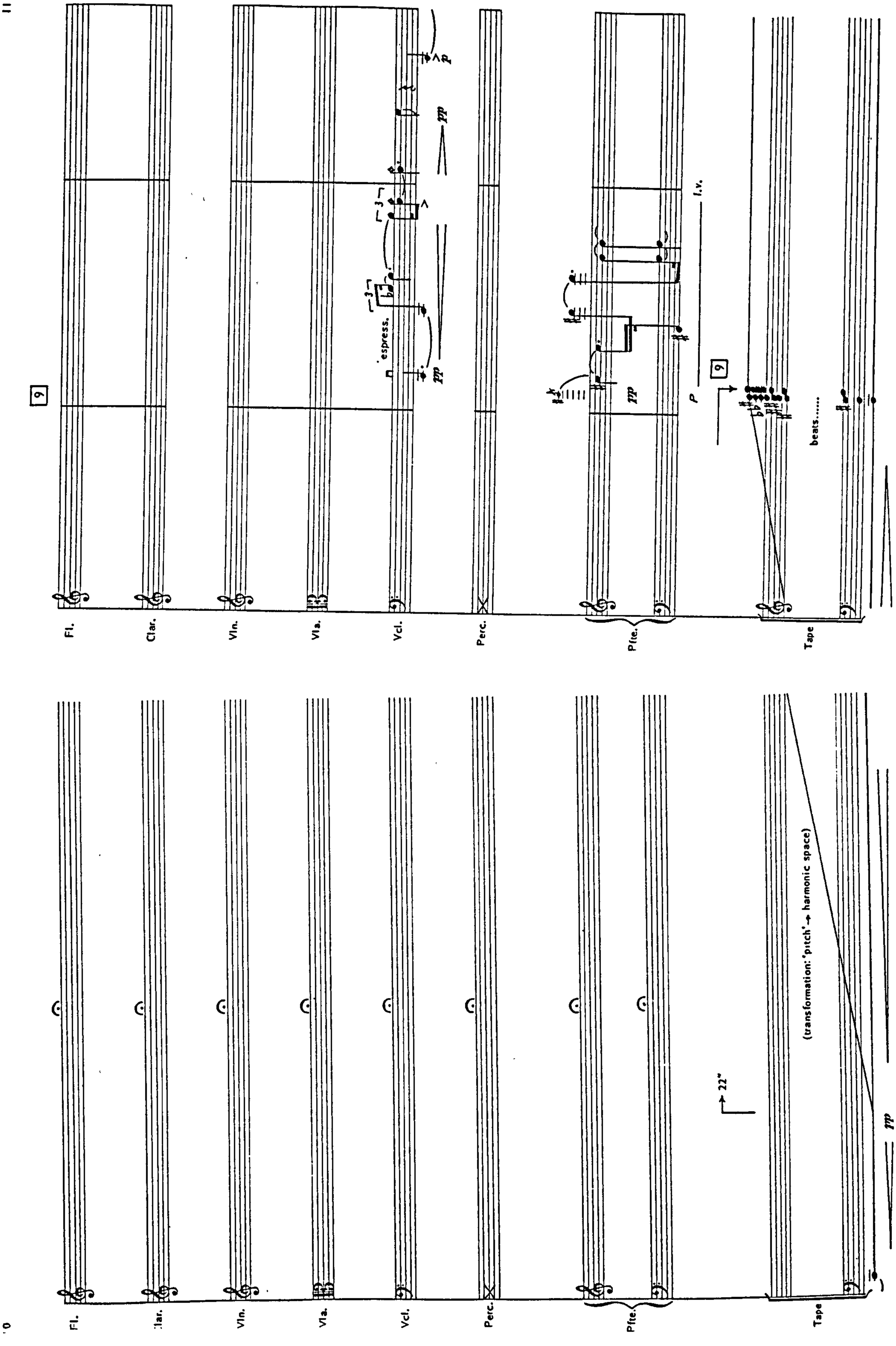
'Inner Light (1)', (1973), for seven instruments and tape, sets up a continuum between instrumental timbre and structural harmony. The harmonic 'spaces' of the work are created in approximation to the analysed spectra of the instruments in the group. The basic twelve-note row (example 5 (a) below) is established in the first section of the work: noise sounds gradually change into simulated cello sounds in the tape part on low C, the real cello's first note (see example 5 (b)), and all eleven remaining pitches are subsequently introduced in this way, the tape always giving the cue for the real instrument to enter on its associated note.

Example 5 (a) 12-note row of 'Inner Light (1)'



Example 5 (b) 'Inner Light (1)'

Example 5 (c) 'Inner Light (1)'



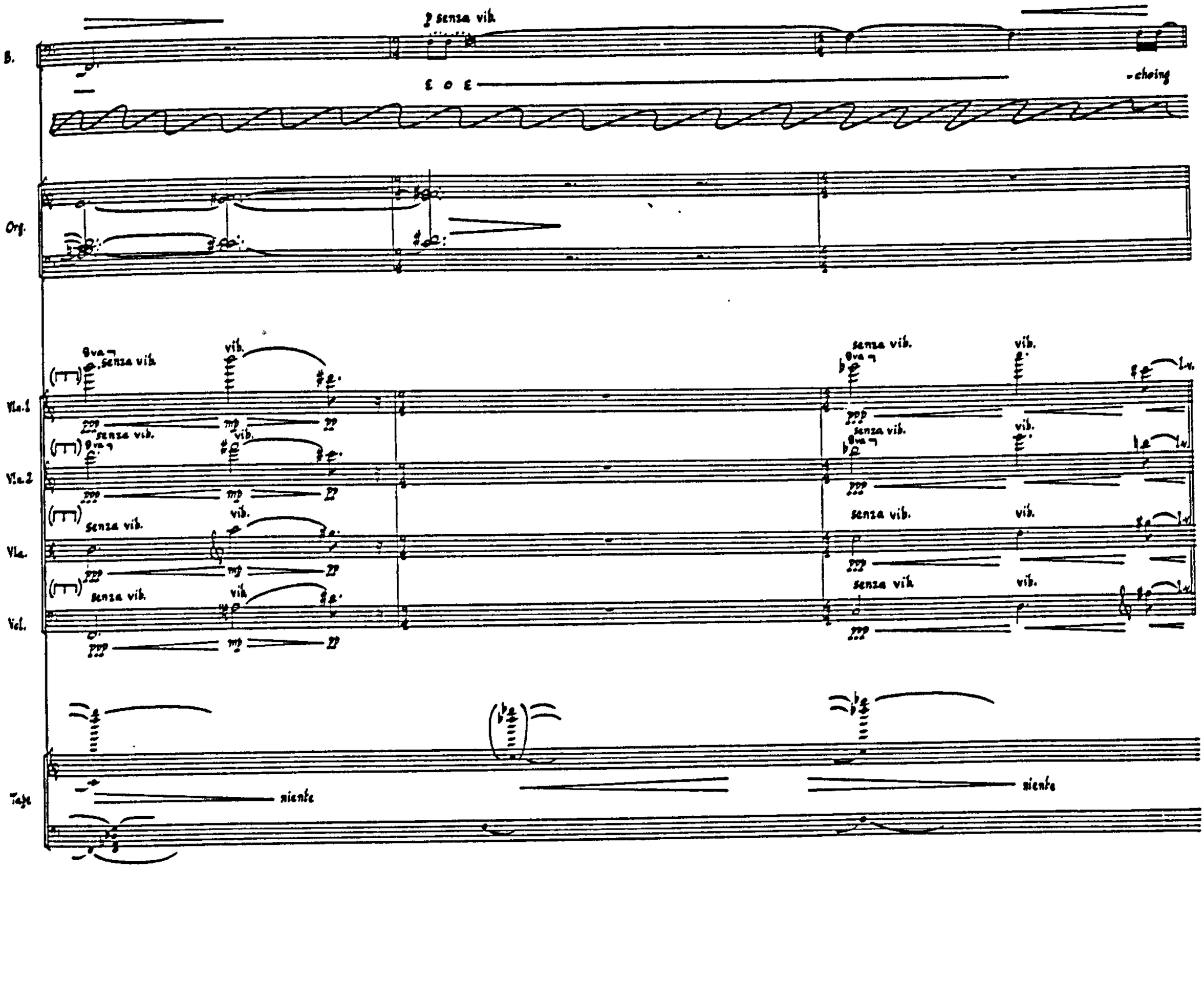
The upper partials of each simulated sound on the tape are then increased in volume until they are heard as a chord: it is this chord which is used as a harmonic framework for the music which follows (see example 5 (c)). Thus, timbre 'flowers' into harmony, and the harmonic 'spaces' from which new sets are drawn. Each note of the row is further linked to a rhythmic figure, so that the instruments finally become characterised on four related levels: timbre, harmony, derived pitch material and rhythm. Instrumental timbre is used as an integrating medium through which the interrelationships of different musical parameters can be explored.

Concepts of integration and expansion are also important features of 'Inner Light (2)' (1977). This piece, which was the last of the trilogy to be written, makes explicit the ideology underlying all three 'Inner Light' works. It is, nevertheless, the intermediary work in many respects, the most obvious being the forces employed: chamber orchestra, five solo voices and tape. It is the linking piece in terms of musical material also; its basic row is almost identical to that of 'Inner Light (1)' (except that the 5th and 7th, and 10th and 12th notes have been exchanged respectively to increase intervallic symmetry in the row of 'Inner Light (2)' - compare examples 1 (a) (p.128) and 5 (a) above). The piece begins on C, the last note of 'Inner Light (1)', and ends on A, the first note of 'Inner Light (3)'. Serial proportions are extended to the twelve different kinds of vocal material (though, as with 'Inner Light (3)', this is far from obvious); these range from vowels and consonants to jumbled texts, invented nonsense language, speech and narrative. 'Inner Light (2)' explores

the relationship between timbre, harmony, and structure in a similar way to 'Inner Light (1)', only taking the human voice as the starting point rather than instrumental sounds. At various points in the piece, the formant structures which characterise vowel sounds are translated into audible pitches in the tape, which are then taken up by the strings to form chord sequences (see example 6).

The tape part in 'Inner Light (2)' has the same vital bridging function in the transformation passages mentioned earlier as it has in the other two 'Inner Light' pieces, but it also performs several other roles. Harvey uses it quite deliberately as a dramatic device, almost like a film sound track, in accompaniment to the tenor's spoken narrative.

Example 6 Vowel transformations from 'Inner Light (2)'



This is an extract from 'They' by Rudyard Kipling, in which the protagonist attempts and finally succeeds in making contact with the spirit world, symbolised by children. Thus, for example, children's voices break through the texture in the tape, speaking, singing, laughing and breathing, but always through a distancing veil of other noises.

A large part of the text is spoken over a rising glissando in the tape part, during which formant chords and their fundamentals ascend repeatedly into inaudibility, the whole passage being punctuated by rising clusters in the organ (see pp. 23-37 in the Faber score). This both looks back to a similar passage in 'Inner Light (1)' and looks forward to the expanding spaces of 'Inner Light (3)', and is symbolic of the theme which unites the three pieces: that of reaching towards higher levels of consciousness. In describing 'Inner Light (3)' as the culminating work in this 'expanding' series, Harvey writes:

> The third is concerned with expansion itself, a reflection of the basic idea of the expansion of the consciousness towards God.[10]

This transcendental theme is encapsulated in the final text of 'Inner Light (2)', a Meditation by Rudolf Steiner, in homage to whom the whole trilogy was conceived:

> Ich schaue in die Finsternis. In ihr erstehet Licht, lebendes Licht. Wer ist dies Licht in der Finsternis? Ich bin es selbst in meiner Wirklichkeit. Diese Wirklichkeit des Ich tritt nicht ein in mein Erdensein, Ich bin nur Bild davon. Ich werde es aber wieder-finden wenn Ich guten willens fur den Geist durch des Todes Pforte geschritten.

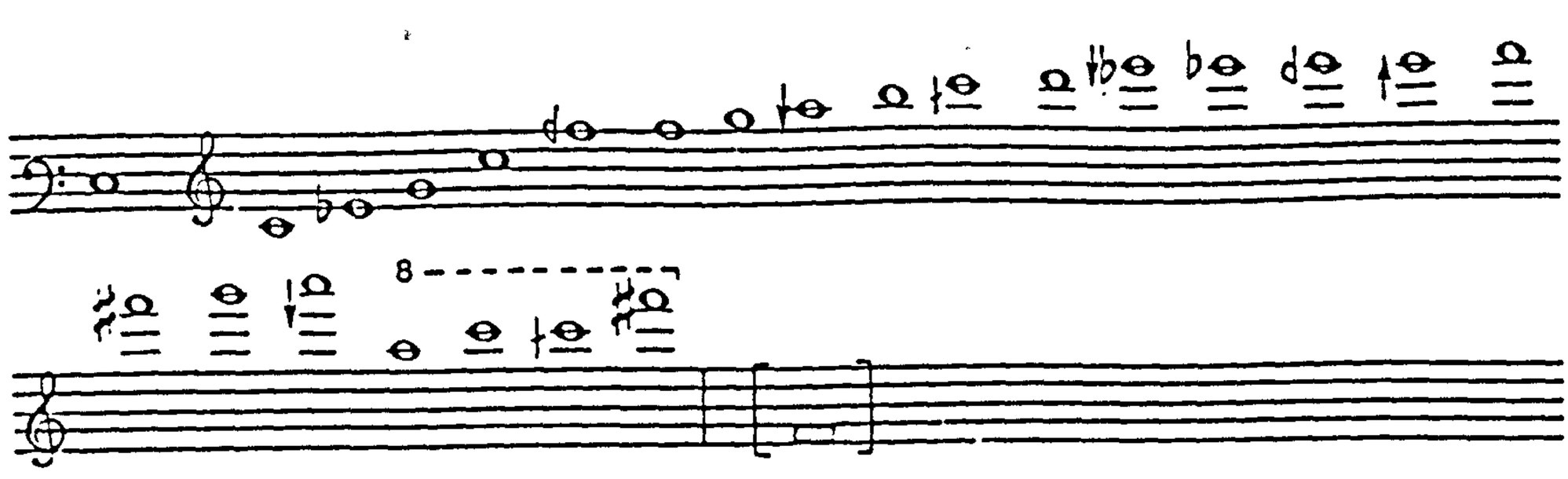
> (I gaze into the darkness. Light arises from within it, living light. Who is this light in the darkness? I am it myself in my reality. This reality of the 'I' does not step into my earthly existence, I am only an image of it. But I shall find it again when, with goodwill for the Spirit, I have stepped through the gates of death.)[11]

The possibilities of analysis of instrumental and vocal spectra which enabled Harvey to explore these concepts in the 'Inner Light' works were to inspire him further when he ventured into the digital domain to write 'Mortuos Plango, Vivos Voco' in 1980. This was not his first exposure to digital technology, but his experience with the MUSIC IV BF sound synthesis program at Princeton in the late 60s had not been favourable (he found working with it 'too protracted') and he was discouraged from experimenting further with digital computers (with the exception of 'Veils and Melodies', 1978, now withdrawn) until trying his hand at IRCAM with the assistance of Stanley Haynes to produce this now classic tape piece. The title of 'Mortuos Plango' is taken from an inscription on the great tenor C bell at Winchester Cathedral which reads HORAS AVOLANTES NUMERO MORTUOS PLANGO VIVOS AD PRECES VOCO, meaning 'I count the fleeing hours, I lament the dead, I call the living to prayer'. The sounds of this bell, and of Harvey's son (then a treble in the Cathedral choir) singing the words of the inscription, provided the models for generating all the sound material of the piece.

Fourier analysis of the spectrum of Harvey's pre-recorded bell sound gave the sequence of notes in example 7 below (the spectrum was analysed half a second after the beginning of the sound, to capture

the richness before too many upper partials had decayed without the distortion of the attack transients).

Example 7



This information governs both the macro- and microscopic details of the whole composition. The carillon with which the work opens is made up of individual bell sounds, each tolling a note from the analysed spectrum: the higher the note, the faster the repetition of strokes, mirroring the faster decay pattern of the higher partials. After this opening gesture, a series of single notes is heard: these form the first eight partials of the spectrum, and Harvey uses them as the pitch centres of the eight sections of the work, as well as presenting them one after another as a kind of theme.

Spectral analysis provided Harvey not only with pitch material but also with the information to resynthesize and manipulate the bell and the treble voice sounds. In the case of the bell, it was possible to

have complete control over each partial, opening up the possibilities of transposition and all manner of mutations. The digitized recording of the bell was stored as a file of sound samples which could be read backwards as well as forwards, or backwards and forwards in rapid alternation to create strange crescendos and decrescendos in the partial notes and to produce rhythmic effects of great complexity. More elaborate processing techniques were also available. For example, the normal decay patterns of the partials could be reversed, so that the lower partials decayed more quickly than the higher ones, thus turning the sound 'inside out'. Individual partials could be assigned to separate tracks on the tape and routed to different speakers, giving the listener the impression of being inside the bell - the bell 'explodes' before our ears and yet remains intact, recognisably whole. Transpositions of the bell sounds could be made easily by reading the file of samples at different speeds, or by mathematical interpolation: one particularly striking transposition effect in the piece was created by making the partials of one note glissando independently upwards or downwards on to the set of partials of a new note. The possibility of such control over the behaviour and distribution of individual partials meant that a rich area of hybrid sounds could be created from combinations of bell and voice sounds. A common one is a chord made up of bell partial notes sung by a 'chorus' of boys, hence a bell-cum-boy effect. (The same technique is used in 'Bhakti'. The bell chord reappears in movement 7 with the notes of the spectrum distributed across all instruments.) At the same time, this control enabled specific gestural characteristics of the voice or bell to be implied by the dynamic

shaping of the sounds individually, as when the bell envelopes are phased to simulate the effect of the bell swinging.

Ten years after its completion, 'Mortuos Plango' is still regarded by many as a benchmark for electroacoustic composition on tape. The reasons for this are manifold. On a technical level, the work achieves the difficult aim of exploring and integrating two totally different yet very familiar and meaningful sound sources (one metallic and inflexible, the other human and articulate), maximising the potential of the technology without compromising the ear's sensitivity to the qualities of the natural models. The piece is a study in transformation techniques, reaching a level of sophistication greater than anything Harvey achieved in previous works, and realising far more effectively his artistic goal of exposing the music-within-timbre. On another level, the jumbled text is loaded with implied meaning, a feature which Harvey exploits in a manner reminiscent of Berio and Stockhausen. The work attempts to challenge accepted modes of listening, at the same time giving the listener the footholds of familiar sounds and imbuing them with a sense of history (and even cultural heritage in a country famous for its cathedral choral tradition).

Harvey has described how the decay pattern of the bell sound - the rapid disappearance of the high partials leaving 'the prolonged calm of the deep hum note'[12] - suggested to him the progression from outwardness to inwardness, the central idea of the piece. Hence the relationship between the bell spectrum and the work's structure: the bell, in a sense, 'is' the piece. This idea is familiar from the 'Inner

Light' works, although in none of them is the influence of timbral structure so pervasive as in 'Mortuos Plango': the piece has a degree of unity and integration which sets it apart from Harvey's earlier 'timbral' works and confirms its position as a classic of the electroacoustic repertoire.

'Mortuos Plango' lasts about 15 minutes. In contrast, 'Bhakti', (1982), explores similar ideas over twelve movements lasting almost an hour. This is another product of IRCAM, though Harvey returns here to the instruments-and-tape format of the 'Inner Light' pieces. The intention in 'Bhakti', however, was to disguise the tape by making the synthetic sounds as close as possible to acoustic ones, thus releasing a fertile area of ambiguity. Furthermore, the tape part itself has a strong instrumental character - not only are the sounds similar, but also the gestures, so there is a real sense of dialogue between the orchestra and its mirror image. Timbral transformations play an important part in creating this ambiguity. In several instances instrumental sounds fan out into harmonies or melt into new sounds (especially at the end of movement 7), so that the attack, usually a clue-giving component of a sound's identity, becomes less dependable. However, transformation and instrumental ambiguity are not the essence of 'Bhakti' as they are of the 'Inner Light' pieces and 'Mortuos Plango'; rather it is the concept of timbre as the sole conveyor of musical meaning which is being explored:

> Once you strip away all complexities of relationship and simply listen to the single note as such, another new music begins to become possible. If the melody is slowed down to such an extent that all that normally charms the mind into constituting pretty intervallic patterns is absent, the mind explores the timbre itself.[13]

Examples of this are the first movement and the ninth, both of which are dominated by the axial pitch G to the exclusion of almost all others in the desire to liberate that 'new music'; it is for this reason also that the symmetrical macro-melody (see example 1 (b)) is heard throughout the work in unison.

Both 'Bhakti' and 'Mortuos Plango' embody Harvey's conception of the potential of electronic music, as suggested by his statement to Paul Griffiths quoted earlier.[14] In 'Mortuos Plango', the tape medium guarantees that the sounds, though natural, cannot be seen to issue from physical instruments and thus lack 'externality', while the exploration of the inner nature of the sounds of bell and voice is the raison d'etre of the whole work. In 'Bhakti', there is deliberate ambiguity between 'external' sounds, and those lacking 'externality' on the tape; here, the very concept of timbre is explored through the medium of pitch/melody (rather than the other way around, as in traditional instrumental music). Some of Harvey's more recent electroacoustic compositions seem to challenge these predilections in a puzzling way. This has much to do with his fascination with, and sporadic use of commercial technology: for example, a Fairlight CMI in 'Nachtlied', and various synthesizers and samplers in 'Madonna of Winter and Spring' and 'From Silence'.

'Nachtlied' is one of the best examples of Harvey's instrumental approach to the use of tape. By far the largest part of the material used in preparing the tape involves piano or vocal simulation, with clearly defined melodic lines and polyphonic writing in places (eg. the interludes mentioned earlier). Very rarely does the range of pitches in the tape part extend beyond the natural compass of the piano or voice, and the timbral or technical extensions which do take place serve to integrate the two sound worlds of voice and piano rather than adding a new dimension to each individually. Not surprisingly, the tape part is crucial to the structural unfolding of the piece. This is especially so of the second section, which is introduced by the tape part with the ostinato from which the basic set emerges; the section is subdivided by interludes for tape or tape and piano, and much of the material here consists of the four-part polyphonic vocal texture mentioned previously, for which the tape provides three simulated 'voices'.

What is perplexing about this piece particularly is the combination of some convincing electronic sounds with other very crude ones. The vocal simulation varies in effectiveness according to context: where words are clearly defined (eg. 'tritt', 'ich', p.6; 'mein ich' p.23), our recognition of the word makes up for deficiencies of timbre; the same applies to the 'massed voices', but the single vocal lines of the polyphonic sections are unsatisfying and rely on reverberation for added depth. The 'bells' at the beginning of the ostinato sound cracked and tinny, as do the 'perforations' of piano chords, and the pitch shifting which is used liberally at several points (pp. 9, 15, 18 of the score) verges on the banal. Such timbral transformation as

takes place in the tape part (for example, in the interludes) is more akin in quality to that of the analogue 'Inner Light (3)' than the subtle effects of 'Mortuos Plango' or 'Bhakti'. The criticisms are harsh only because the quality of the electronic part is incommensurate with the beauty of the work, which is tightly constructed, lyrically expressive, and emotionally rich.

To compound the dissatisfaction, the tape part has a deeply symbolic function. The Steiner poem 'Abends/Morgens' reflects on the nature of being, and speaks of the movement of the soul between the realms of the Worldly and the Divine through sleep, placing great emphasis on the 'radiant light' which illuminates the world of the Spirit. With reference to these images, the tape part seems to represent the Divine, by virtue of its lack of physical source (while the piano and voice represent the Worldly, their sounds issuing from visible and limited reverberating bodies). The tape also represents the human soul since it is able to move easily between the sounds associated with both states of being. By extension, therefore, the tape part is symbolic of the Spirit's affinity with the 'higher worlds' while maintaining its links with material reality. To quote from Steiner again,

> ..all higher spiritual realities must be related to the physical world,and man himself must act as a channel for them to flow into it.[15]

To a certain extent however, Harvey's intentions were thwarted by the limitations of the Fairlight's 8-bit technology. It cannot be claimed, for instance, that the electronic sounds have no identifiable source: in Harvey's sense, of course, they do not, since there are no

physical instruments seen to produce them; on the other hand, the sounds and gestures (such as pitch shift and 'perforations') are quite clearly recognisable as coming from a commercial machine, if not directly traceable to the Fairlight. Moreover, the concept of expansion of identity implied by the tape transformations is restricted by the resolution of the instrument: sounds can only be permuted and transposed up to a point before becoming horribly distorted. No wonder, on reflection, that the range of pitches in the tape part is kept within the natural registers of the piano and voice. Although Harvey is well able to tailor this particular shortcoming to his needs and even make it appropriate to the piece, it is indicative of the instrument's inferiority, which in other respects is too intrusive for the work to be entirely successful.

The two years between 'Nachtlied' and 'Madonna of Winter and Spring' are, as Harvey acknowledges, a long time in electronics. It is partly for this reason that the electronics in 'Madonna' (described earlier) are more successful than in the earlier work, the sounds improved. It should also be said that Harvey's use of the instruments in 'Madonna' is more appropriate, in that he asks from them only such effects as they are capable of producing convincingly - the percussive sounds used in 'Conflict' complement the orchestral percussion well, and the transitional effects of 'Descent' are simple and effective, for example. The only reservation one might have is that, while the reverberation and diffusion techniques will not be greatly altered by the progress of technological evolution, the keyboards will date the work prematurely when they become

obsolete, unless their parts are redesigned for succeeding generations of synthesizers.

The same reservation might apply to 'From Silence' (1988), although in other respects this work consolidates the progress made by Harvey in 'Madonna' in integrating live electronics with traditional instruments. It is a setting of four transcendental texts scored for soprano, violin, viola, percussion, tape and live electronics: the latter comprises two SPX 90 audio processors, an AKAI S-900 sampler played from a Yamaha KX88 keyboard, a Yamaha DX7 II FD synthesizer (and TX816) - a typical array of MIDI-controlled devices - and a Macintosh Plus computer. The tape part is small but significant, lasting less than five minutes in total out of about twenty, and consisting mostly of pitched noise ('wind') and vocal effects which mark the beginning of each section (the music of each grows 'from silence'). The live electronics, conversely, are used extensively. The SPX 90s perform pitch transposition, delay, panning, and reverberation, much as they would in a jazz or rock ensemble. The keyboards use both pre-set and programmed sounds as well as standard pitch bend and 'vibrato' (ie. amplitude modulation) effects. In addition, there are several automated sequences programmed into the Mac computer which initiates the TX816. These include two 'cadenzas' which sweep up and down the register of the instrument at moments of climax in the piece, changing setting (and therefore timbre) as they do so.

Due partly to the sparse instrumentation, the presence of the electronics is far more pronounced here than in 'Madonna of Winter

and Spring' or even 'Nachtlied'. However, Harvey never allows them to become overpowering. Certain techniques are familiar from the earlier works: individual notes from the soprano's line are occasionally 'frozen' as in 'Madonna' and diffused around the acoustic space as a halo of sound; electronic 'harmonisation' (simultaneous pitch transposition) is imposed at different points, most effectively on the soprano's spoken words; and the acoustic instruments are amplified to allow control over the total balance.

Apart from these 'effects', the electronics part is closely integrated with the instrumental writing. Timbres are carefully matched, with the soprano's whispering and the violin and viola's harmonics and *sul ponticello* sounds reflecting the noise-based sweeps of the tape and keyboards. The melismatic, ornamental vocal line exploits microtonal pitch inflections which are mirrored both by the strings and by the electronic sequences. The percussion comprises vibraphone, marimba, crotales, cowbells, cymbals, tambourine, temple blocks, wood block and Chinese drum, all of which find resonances in the Yamaha pre-set sounds.

* * *

Harvey has described the electronics in 'From Silence' as 'still, philosophically speaking, "showing" the relation of the relative world or manifest world to that of the absolute. There are both types of sound and a borderland in which "absolute" warms up and analyses itself to differentiate into form, the "Word"'.[16] It is evident that Harvey's attraction to the electroacoustic medium is not confined

to particular kinds of technology. He seems equally at home with a variety of equipment, choosing whichever resource satisfies the requirements of each work individually. A comparison between two similar works which use dissimilar technologies, therefore, gives further insight into the differences, if any, which these impose on Harvey's compositional style.

Ritual Melodies and Madonna of Winter and Spring: a comparison

The tape piece 'Ritual Melodies' (1990) was Harvey's third IRCAM commission, composed between 1985 and 1990 with technical assistance from Jan Vandenheede. Of all Harvey's works to explore the relationship between timbre and instrumental identity this is arguably the most complex, both in its conception and in its realisation. Harvey chose an unconventional group of sound models - Vietnamese koto, Indian oboe, Japanese shakuhachi, Tibetan temple bell, and Tibetan monks and Western plainchant - and strove to create not only realistic simulations of the timbres but also the gestures and ornamentation characteristic of the music associated with each instrument (or type of singing) in its own culture. For this to be successful, it was necessary to use different synthesis techniques for each model: Harvey recalls, for example,[17] that the koto model used formant synthesis, with additive synthesis for the attack, while the shakuhachi model required one level of formants to make the partials, one for the spectral envelope of the partials, and an independent method of noise filtering to produce the characteristic 'breathy' sound of the lower notes. The difficulty on the technical level was not only to produce the models, but also to find a way of

accommodating the different synthesis procedures in a single program so that subtle transformations of these carefully constructed sound models could be effected (a process known as interpolation). The result, Harvey argues, is quite different from a 'fade-in and fade-out mix' since, during a transformation, the structure of the sounds actually mutates, rather than simply being replaced by another, stimulating a 'mental evolution' rather than a 'mental switch' in the listener.

'Ritual Melodies' was composed using the cyclic technique of melodic addition familiar from 'Madonna of Winter and Spring'. In certain respects, Harvey's treatment of the melodies in both works is similar: the melodies are sometimes heard in their entirety, sometimes fragmented to expose particular motifs, juxtaposed with each other, and so on. In other aspects the two pieces are quite different from each other, and a comparison of them reveals both the flexibility of this particular compositional technique and the scope of Harvey's imagination.

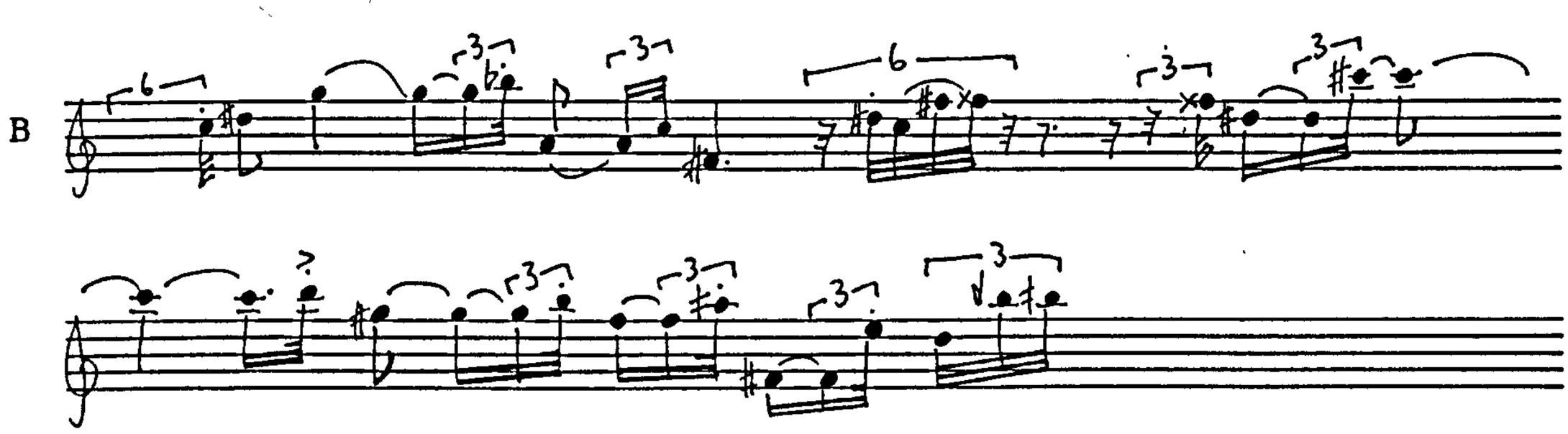
All of Harvey's sound models in 'Ritual Melodies' are melodic instruments, associated with monodic musical traditions rather than the familiar Western harmonic tradition. His cycle-of-melodies technique is therefore quite appropriate to the sound material of the work, although he extends its use to parallelism, polyphony and heterophony as well. As noted, Harvey was at pains to capture the typical figurations and gestures of the instruments, and constructed his melodies to incorporate these elements: thus, they are characterised by the use of fast figures contrasted with long sustained

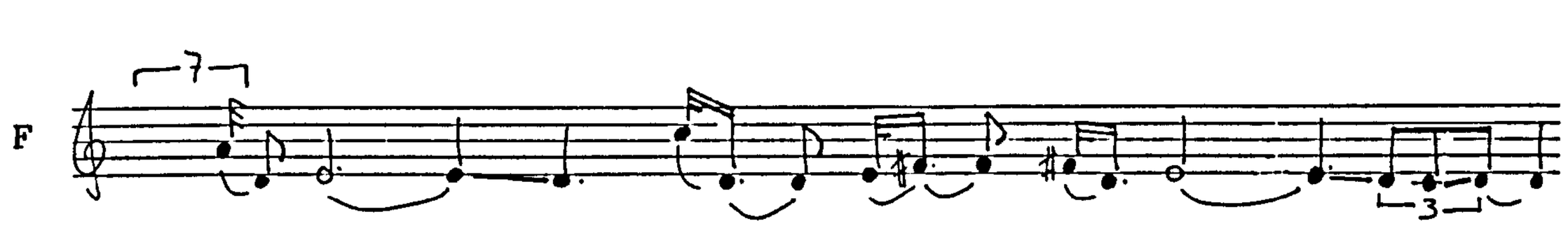
sounds, the different combinations ensuring that each melody has a separate and recognisable identity.

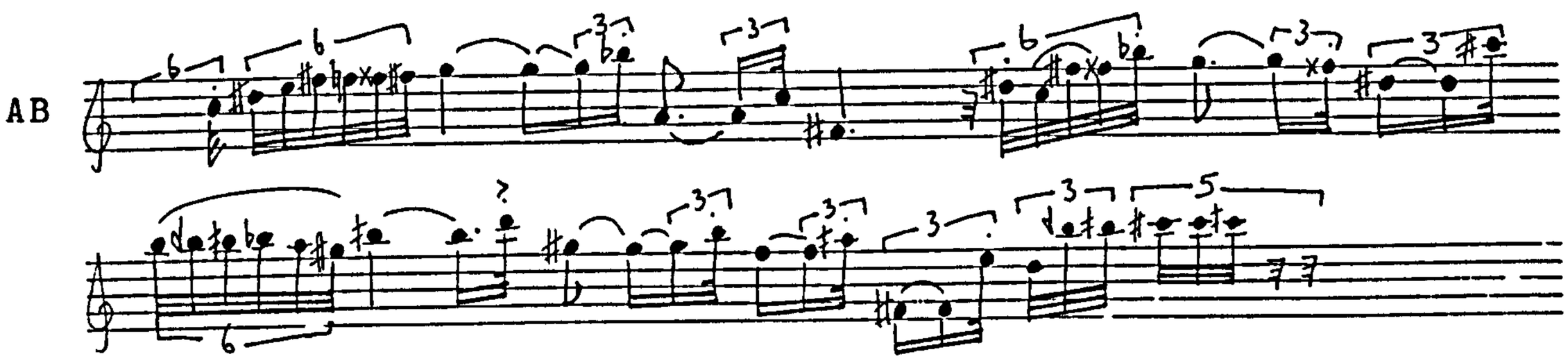
In addition, each prime and compound melody is played by a fixed pair of instruments - a departure from 'Madonna'. Transformations from one instrument to another during the course of a melody are peculiar to that melody, so when a fragment of melody X is heard in melody X+Y, the change in instrument (or different transformation) indicates the identity of the compound melody, though without destroying the reference to the prime melody. On the other hand, there are instances where canons are made from a single melody; here, the unambiguous structure of the canon is obscured by giving each entry to a different pair of instruments. Another device used is topological transposition: where a single instrument is 'chorused' to play a line in parallel harmony, the transpositions take place within the spectrum of the instrument so that melodic intervals become diminished in higher transpositions and augmented in lower transpositions: the harmonic effect produced is strange to Western ears, but curiously coherent.

Other factors such as tessitura and interval content also contribute to the identity of each melody: melody A (oboe and shakuhachi) has a high tessitura, small range and predominantly stepwise ornamental figurations, while melody B (temple bell and oboe) has displaced gracenotes and a wide tessitura, and melody F (plainsong and shakuhachi) has a low tessitura, sustained tones with appogiaturas and slow glissandi between neighbouring notes (see example 8).

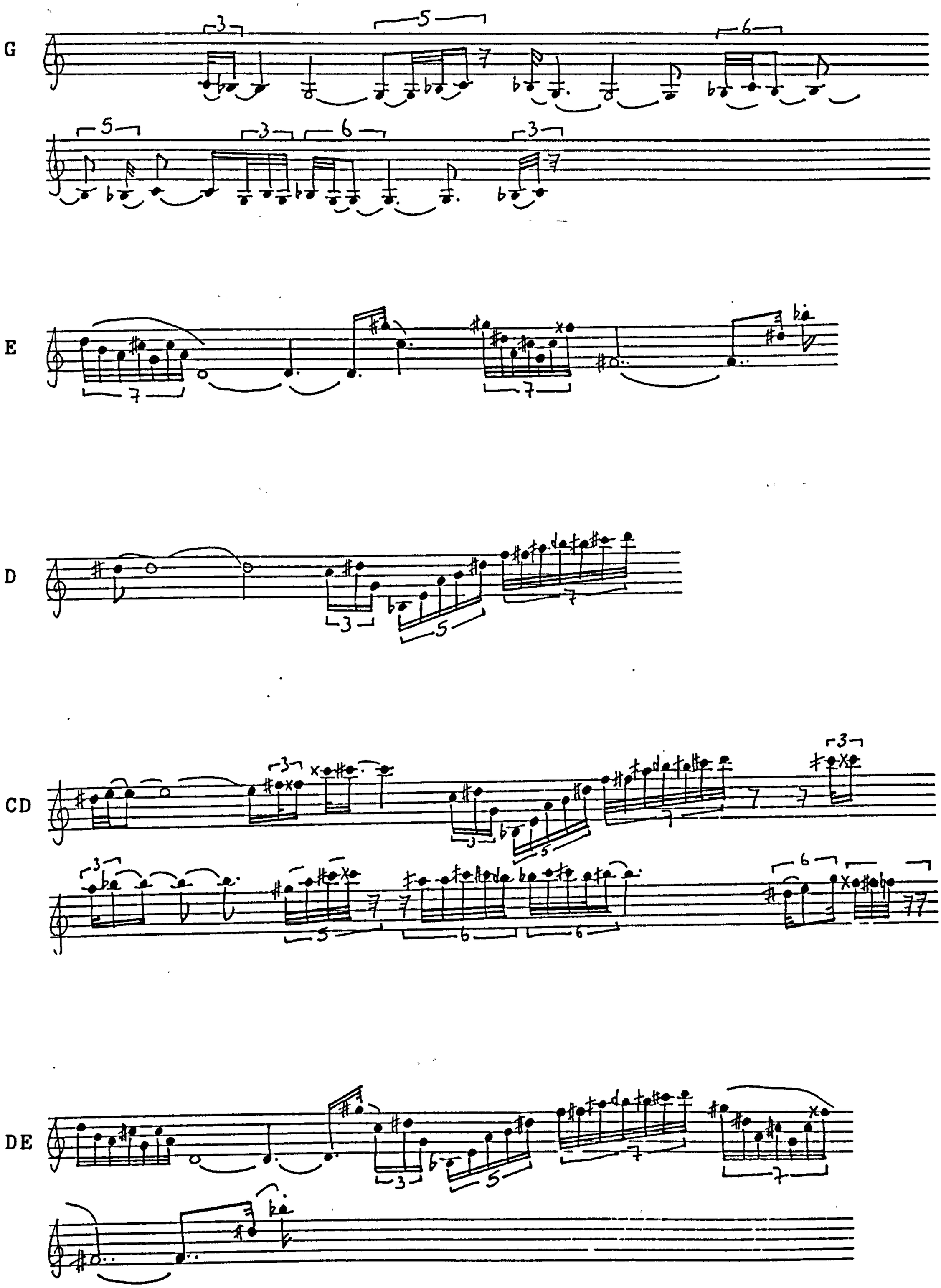
Example 8 Melodies from 'Ritual Melodies'







Example 8 (contd.) Melodies from 'Ritual Melodies'



The compound melodies are more active, the faster gestures of one tending to take up the space of sustained sounds in the other: thus, melody A+B has a wide pitch range and widely displaced grace notes as well as rapid stepwise figurations (see example 8; all melodies are reproduced in Appendix 3).

Most of the melodies are bipartite, the second part often developing features of the first. For example, melody G begins with a silence followed by three grace note figures, which are extended after a second silence into a kind of trill; melodies A and E are similar in that the two halves of each are triggered by fast figures; melody D is a question-and-answer type, with a sustained note followed by a rapid rising arpeggio figure. These balanced structures are crucial to Harvey's intention of playing with identity and ambiguity: compound melodies do not always have the same shape as the prime melodies which constitute them, so there is a distinction to be made between melody X+Y, and melodies X and Y played at the same time.

Relationships between all the different melodies are complex and varied. Each melody shares one instrument with the adjacent melody: since there are sixteen melodies in total and only five instruments, there are melodies which are some distance apart in the chain which share an instrument, and consequently have figurative features in common (for example, melodies B and E both use the temple bell, both having sustained notes preceded by leaping grace notes; melodies A and D share the oboe and the turn-like ornament of A is hinted in the arpeggio of D which, in turn, is reflected in

similar gestures in melodies C+D and D+E - see example 8). The figurative elements of the melodies are of particular importance with regard to their memorability. It is the ornamental gestures and groups of fast notes, and their alternation with sustained tones, rather than the pitch content or instrumentation of the melodies which arguably remain in the mind, and Harvey is able to switch from one melody to another using these figurations as stepping stones.

Vandenheede, in his detailed account of 'Ritual Melodies',[18] notes the following relationships between the prime and compound melodies:

a) 'heterophonic ornament' - basic structure of melodies preserved, but with greater use of small figures;

b) 'structural variant' - similar motivic material but with noticeable variation such as different pitch centre;

c) 'polyphonic combination' - alternation between two melodies;

d) 'new gestalt' - a new melody is created from the combination of two prime melodies.

(The melodies are reproduced, with associated instrumental pair, in Appendix 3, and can be heard on the cassette provided along with Harvey's sketches for the interpolations.)

For an exhaustive descriptive analysis of 'Ritual Melodies' the author is indebted to Jan Vandenheede, whose close association with Harvey during the composition of the piece rendered him an authority on the pre-compositional work and break-down of the sections as well as on the technical details of the sound modelling and interpolation procedures. Harvey approached the composition of the piece in

sections, having experimented beforehand with the imitative treatment of the melodies. Vandenheede's analysis divides the work into eleven corresponding sections as follows.

Section 1

The first motif of A is played by a choir of oboes at different topological transpositions and a chord of bells. The bell chord transforms into the oboe chorus again to play the last motif of A (also accompanied by a bell chord, which is quickly damped).

After a two-second silence a new arpeggiated chord is heard, played by kotos. The upper partials of this transform into shakuhachis, which lead into a contrapuntal section.

The contrapuntal section begins with a canon at the unison of the first half of A. This is in two phases: in the first, the phrase repeats at a distance of a fraction of a second, producing a kind of macro-rhythm; the second phase makes a canon of the first phase, resulting in a dense pulsating texture.

The contrapuntal section develops to include canons on fragments of melodies C, BC, B, AB and finally HA, reinforcing the A gestalt at the end.

Section 2

The two bell chords from the opening announce section 2, overlapping with the end of section 1, and are quickly damped. The koto-arpeggio appears again, beginning to transform to shakuhachis as before, but moving to voices instead.

A bell and koto trigger the new melody G (oboe and plainchant), thus introducing a new tessitura (low) and new timbre (voice) as well.

A dense canon follows on the few notes of G, with incantation-like effect.

A bell stroke brings back the shakuhachi with H; more bells trigger a canon on H. HA appears, with a reminder of the first motif of A from the opening, followed by GH to tie in with the beginning of this section.

A new passage, heralded by a note on koto/shakuhachi, introduces elements of B with HA (both of these melodies use the oboe/temple bell pair, with oboe leading). Further free canonic working uses motifs from B, C and D and their compounds.

Section 3

A short silence precedes an outburst of temple bells and kotos. This acts as a kind of development of the single note which triggered G in section 2, and a reminder of the bell chords of the opening. Some of these bells/kotos evolve to shakuhachis as before.

A new antiphonal section begins (front/rear diffusion), with complex multiple canons using a) prime melodies, and b) compound melodies, interspersed with bell strokes. The density of the texture produces a kind of macro-rhythm, which gradually accelerates.

The section ends with motifs from the end of the C-group (C, BC, CD) and the A-group, echoing the end of section 1.

Section 4

Two new elements are introduced by a low koto/bell stroke: Tibetan chant, and melody C, 'frozen' (a complicated reverberation effect captures the notes of a melody and creates a veil-like harmony from them).

The Tibetans sing G, unaccompanied, and two octaves lower than the plainchant rendition in section 2 (which was also introduced by a low koto/bell stroke), thus extending the tessitura even further). The grainy texture of the low vocal sound, and the vowel transitions are especially prominent.

A canon on D follows, leading into a series of 'frozen' melody/chords which are filtered dynamically (an effect not unlike the chord 'perforations' in Nachtlied). Motifs from E and A appear. The 'frozen' harmonies act as a link between the short motifs and long inharmonic sounds which make up the melodies.

Section 5

A mixture of 'frozen' harmonies follows another silence, and leads into a new melody: F. This is characterised by a slow glissando (foreshadowed in section 2). It is treated canonically, with a fragment of Tibetan chant on G, before 'frozen' F reappears.

Another silence, before 'frozen' F again, this time dynamically panned and with a hint of the glissando. It continues in the background, over which there is a canon of G (complete) sung by the Tibetans.

Section 6

The section begins with more 'frozen' harmonies, and is distinguished by a subsection of dynamic panning. This uses B, C, D, E, F and G (all 'frozen'), the harmonies becoming shorter until they coincide on a bell stroke which triggers E in parallel (topological) harmony. The section is a kind of transition between the previous timbral textures and the melodic element which returns in the next section.

Section 7

Reappearance of the first motif of A, again played by oboes but in canon rather than in chords.

A new chordal section on E follows, as a development of the end of the previous section; chordal treatments of D and F are included. Note that the first motifs of E and A are rhythmically very similar.

A new canon of the first motif of A appears in oboes, overlapping with the chordal material. Then more chordal material using E, F, G and H, followed by more oboes on A and HA.

Throughout these alternating passages, there are rhythmic interjections from the koto/bells. The whole section forms a symmetrical pattern of chordal, contrapuntal and rhythmic passages, using material from all the melodies except B and C (which feature prominently in the next section).

Section 8

A rhythmical imitative section, beginning in a way similar to section 2 with HA leading into the second half of B.

Fragments of B and C begin to glissando, as does a 'frozen' harmony of B. The last motif of C is used towards the end of the section.

Section 9

This overlaps with the previous section, beginning with melody C over a background of 'frozen' C harmony. C is then treated canonically before B enters, and the two melodies are heard complete.

The entire section continues to glissando upwards, resulting in an increase in speed of the melodies.

Section 10

This is heralded by an outburst of koto/bells. There is antiphony between the koto/bells and the more sustained sounds of voices, oboe and shakuhachi, all in a downwards glissando.

Melody G is sung by Tibetans, then is heard in the oboe and plainchant.

After some more interjections from the koto/bells, melody F is heard in oboe, shakuhachi, Tibetan chant and plainchant.

A new subsection enters, with a repetition of section 9 transposed down two octaves. The musical material is correspondingly slower, sounding other-worldly. FG, the compound of the two melodies heard earlier in the section, is heard in parallel motion. Melody A is also heard, sung in parallel harmony by the Tibetans.

Section 11

The section consists of fragments of various melodies (DE, HA, A, B, BC and C), both in transposition and at normal pitch, and with much use made of glissando - the tessitura of the music is at its broadest here. Melody C, one of the first to appear, and the first 'frozen' harmony to be heard, is the basis of this section, the last four notes of the melody finishing the piece.

Unlike 'Madonna of Winter and Spring', 'Ritual Melodies' is entirely composed from the melodies and their manipulations: there is no contrasting 'static' music (except insofar as the individual melodies impose their own characters on the separate sections), and no obvious sense of progression away from musical 'discourse' to a different kind of writing. However, the work may be divided into broader sections which do outline a development from the highly imitative opening music towards the more 'crystallised' melodic and harmonic writing at the end. The first three sections described above present dense counterpoint in contrast with long, sustained sounds; the counterpoint becomes increasingly complex and rhythmic towards the end of section 3. The following three sections introduce 'frozen' harmonies and spatial movement. The final sections bring back the melodic writing, but maintain the harmonic textures of the middle part; Vandenheede notes that the use of the melodies towards the end of the work becomes less imitative and more 'developmental'[19], thus allowing the identities of the melodies to become more clearly established.

While 'Ritual Melodies' is less obviously goal-orientated than 'Madonna', therefore, a progression of a more subtle kind does take place. In comparing the two works, it is important to remember the different forces employed: full orchestra with live electronics in one and tape in the other. The scale of 'Madonna' required contrast of musical material, not just at the level of the melodies but in the pacing of the different sections: writing thirty minutes of dense thematicism for large orchestra, with only occasional respite and without the support of traditional tonal harmony, was a mistake Harvey made in 'Inner Light (3)'. The necessity for macro-level contrast in 'Madonna' gave Harvey the framework for his spiritual metaphor, and the opportunity to exploit his electronic resources to that effect. The more intimate nature of 'Ritual Melodies' demanded a different approach, allowing a more subtle progression, from density to clarity, to be realised.

In 'Madonna of Winter and Spring: some structural and aesthetic thoughts', Harvey defines his rationale for the 'seemingly contradictory' aspects of 'Madonna' as follows:

> Madonna of Winter and Spring has the form of a spiritual evolution. Conflict - Descent - Dark Night - Illumination. What is the relation of art to spiritual evolution? Do we not require from great art that it uplifts in some way? Where is the 'up'? We must be careful not to exclude art that is tragic or even violent by making too narrow a definition. What all responses such as 'that is great art' have in common is that we have experienced a loss of self in their presence. And that sort of expansion or transcendence of the narrow ego may be called the uplift of spirit. We may be strongly uplifted by Bach's Art of Fugue, following its discourse closely. Intellect can soar: but if it soars is it still intellect or does it lead imperceptibly to inspiration - the breathing in of spirit?

Experiencing the subtle dialectic of intellect (or musical discourse) and spirit (beyond ego), where <u>one</u> leads into the other, is, I submit, the nature of intelligent, sensitive listening.

It may be objected that spirit is immanent within a manifestation rather than portrayable as such. But....for this artist...there is..no hesitation in trying to portray, sometimes as directly, naively as possible, the experience of spirit in itself; of course always failing (because spirit has to be mediated).

Broadly speaking, spirit lies <u>within</u> discourse. It is the Ground, the All, the background level of the Schenkerian tree which contains everything, yet which seems almost empty of content. It is the

> Silence from which every sound is born.[20]

In <u>'Madonna'</u>, the first twenty melodies are used to provide both the foreground thematic details and the background texture of the first section; by contrast, the 21st, 'Mary' melody is heard largely in unison (like the macro-melody of <u>'Bhakti'</u>) and accompanied by halos of string sounds and electronic sonorities. This distinction in the treatment of the melodies is significant. The whole work presents a vision of the transformation of society, from the turbulent, aggressive one with which we are familiar to an ideal one of tranquillity and harmony. The 'spirit within the discourse' of the first section is only realised, or discovered in the stasis of the central sections, and cannot be revealed until the final section through the 'mediation' of the 21st melody. For this 'revelation' to be really effective, the new state has to be seen to grow out of the old: hence the development of the use of the electronics through the work - firstly as integral parts of the orchestra, then breaking away from the orchestral activity, and finally returning to the orchestra in a new guise.

In <u>'Ritual Melodies'</u>, there is no new, transcendent theme at the end; rather, the 'spirit within the discourse' of the opening sections

becomes revealed through the changing treatment of the existing melodies as the piece progresses. To the listener who knows nothing of Harvey's cycle-of-melodies technique, this is apparent only through the emerging *gestalts* of the melodies from the contrapuntal mass: those *gestalts*, or identities, are made clear as much through their timbral qualities as through their pitch and rhythmic characteristics. By using the tape medium to focus the listener's ears on to this aspect of the music, Harvey is able to make his spiritual message inherent in the sounds themselves.

CHAPTER FIVE

Trevor Wishart

> In particular, the notion that to understand how the sounds are put together constitutes understanding the music is a fallacy propogated through the visually-distanced logic of some avant-garde music. It is important to emphasize the distinction between the musical process, and the process of composition. The visually-based constructivist aesthetic equates the perception through sound of the organisation of notes on paper with experiencing the musical process. In most music, in fact, the process of composition (as opposed to the ordering principle which seems to underlie the resulting organisation of notes on paper, or sounds on tape) is hidden from view, while the musical process is something which arises from the organisation of sounds (via notes on paper in the case of scored music).

Wishart's preoccupation with the desirability of direct aural response to music has given rise to a somewhat anti-intellectual stance which he has articulated frequently in his writings. He denies the value of an 'intellectual' or academic study of music (on whatever level) and maintains a preference for the musical understanding of what he calls the 'average intelligent listener'.[2] His own theories on music, as elaborated in his book 'On Sonic Art' (and themselves couched in surprisingly academic language) are linked closely with his view of Western culture in general, where intelligence is equated with the ability to be verbally articulate: Western musical tradition, he believes, wrongly restricts the sonic continuum to a system of neatly defined and notatable parameters (pitch and rhythm) and a finite set of timbral possibilities. In this context, he argues, an academic study of music implies a study of notatable (and notated) parameters which ignores a

direct response to sound itself. It is possible, he believes, to analyse the construction of a conventionally notated work to the smallest degree through the score, using formulae and contrived analytical techniques, without reaching the essence of the music - to use his phrase, 'music is not translatable'.[3]

Wishart's observation of the distinction between musical process and compositional process applies particularly to the electroacoustic medium, in which composers may be responsible for 'composing' not only musical works but also their constituent sounds. As Michael Bridger's studies reveal (see chapter three), the musical processes in conventional and electroacoustic music may be very similar - the ebb and flow of tension and resolution, the unfolding of musical ideas and so on often follow roughly familiar patterns in whichever genre. The compositional processes, on the other hand, may vary widely both between the two genres and also within them: in electroacoustic music, they will be governed to a greater or lesser extent by the very technology used (see chapter one). Musical ideas which may be conceived in conventional terms need to be translated into terms appropriate for new technology, either by the composer himself or by a technical expert working closely with the composer (as in the case of Jonathan Harvey). Denis Smalley's catalogue of new definitions and musical terminology is a manifestation of this, and is representative of a common attempt amongst electroacoustic composers to find new ways to understand and think about sound.

For many listeners, the distinction between musical process and compositional process is arguably academic, since listening is usually a matter of following and comprehending the musical process as it

unfolds, without reference to the composer's working methods. As Wishart's statement implies, the ordering principle which seems to underlie a given composition may be perceived through the organisation of the sounds, without necessarily revealing anything of the composer's procedures. The distinction becomes more relevant if the listener chooses to look beyond the immediate aural experience, in a search for a greater understanding or a more informed appreciation of the music. It may be felt, for example, that an awareness of the compositional process behind a given work may shed light on the musical process in some way, if not on the composer himself and his attitude to his music.

Wishart's fear appears to be that the compositional process may be seen to be an end in itself rather than the means to the end (ie. the musical process), in which case he argues that the music fails to fulfil its proper function, which is to be a meaningful sonic link between different people. However, an increased awareness of the compositional process behind a work need not jeopardise the aural impact of the music. Even 'clever' music may also be communicative: Wishart himself retains an affection for the elegance of 'clever' contrapuntal writing in the music of Mozart and others, and his own piece, 'Vox 3', uses complex rhythm games to illustrate this intellectualised aspect of human behaviour. For a musical process to exist and be perceived at all there must be a change or development of some kind either in the musical material itself or in the listener's conception of it: for that development to be meaningful, the musical material must first of all be understood (or at least recognised and remembered) by the listener. As unfamiliar sounds, and the relationships between them may be easily misunderstood, a knowledge of the composer's intentions and working methods, and a

recognition of his use of sound material, can be of considerable help to a listener keen to hear a new piece with an open mind.

For Wishart, a sound's recognisability is its most potent musical characteristic, and his predominant choice of concrete (including vocal) sound material for his compositions is a reflection of this. Using concrete or vocal sounds deliberately for their associative effects is a way of ensuring immediate contact with the listener, however complicated the composition. Wishart's early compositional efforts were inspired by the pieces he learned as a piano student, but the death of his father was an early impetus for him to develop away from the models of his piano studies, and prompted him to compose a piece along rather different lines which he felt would have been 'relevant' in some way to his father's life. The project involved recording factory sounds; although it did not culminate in a completed composition, it was to form the basis of Wishart's later piece 'Machine'. This was, perhaps, the first sign of his developing interest in Art and Music as reflections of the human condition as seen in its social environment - a theme which recurs in 'Red Bird', the 'Vox' pieces, and more blatantly in his environmental pieces. It was also an early example of his use of concrete material to convey a particular meaning rather than for the intrinsic acoustic qualities of the sounds themselves. This has developed into a regular compositional device for Wishart, who tends to choose sound material to fit a given idea rather than to let the ideas be generated from the qualities of the sounds.

The use of concrete material suggested by Wishart's experiment with factory sounds indicates an acceptance, even a deliberate employment of the associative effect of concrete sounds on the listener, one of the

facts of the electroacoustic medium which has been problematic for composers since Schaeffer. For Wishart, no sound is without associations; the richer the association, the greater he feels is his musical freedom to manipulate sounds in a composition. The association therefore becomes a positive rather than a negative part of the musical process, which itself takes on a reciprocal and highly personalised quality - each listener's own associations become an active part of the musical process in that work. Wishart's concept of 'landscape' (outlined in chapter two) makes reference to this idea by focussing on the listener's ability to interpret concrete sounds according to their relationship with other sounds, their perceived methods of production, and the acoustic environment in which they are produced:

> the landscape of a sound image [is] the imagined source of the perceived sounds[4]

Wishart creates 'imaginary' or 'surreal' landscapes (see chapter two) in his compositions by placing familiar sounds in unexpected relationships with each other, or by altering their normal acoustic context (for example, by use of reverberation, spectral manipulation, and so on) so that the listener's conception of the sounds is changed even while the sounds remain recognisably familiar. The recognition of individual sound objects by a listener is, therefore, crucial to Wishart's compositions, not solely within the context of a given piece but with reference to that listener's external experiences. It is probably for this reason that synthetic sounds are of less interest to him as a composer, since the extent to which they can take on meanings and associations from a listener's wider experiences is limited. His fascination with the human voice as a musical tool, on the other hand, is entirely consistent

with his desire to explore sounds in a rich web of cross-references and human associations.

As noted in chapter two, Wishart devotes a whole section of 'On Sonic Art' to the concept of 'Utterance'. An 'utterance' is any sound which is made by a living creature (not just human), and is understood to communicate meaning:

> In most normal cases...where (human) beings are heard to produce sounds, then we will tend to impute intention to the sonic event. We will hear it at some level as an Utterance. In particular, whenever the human voice is used as a source of sound in whatever context, the concept of Utterance will enter at some level into our apprehension of the event. This becomes particularly important in the sphere of electro-acoustic [sic] music projected in the virtual space of loudspeakers where we can no longer rely on the physical and social cues of the concert hall to convention-sanitise the vocal events. In general, non-music sounds produced by individual creatures may be taken to indicate or express something about internal state, reaction to environmental events, responses to utterances by other creatures and so on, becoming more involved, convoluted and to some extent detached as we move up the cerebral hierarchy, finally reaching the etiolated heights of Artistic manifestation. At whatever level, the sense of Utterance, whether as indicator, signal, symbol, sign or syntactic or semantic-syntactic stream enters our perception of the events.[5]

Wishart's concept of an 'utterance' involves more than one being, since the purpose of an 'utterance' is to communicate meaning in some way. That meaning will be a mixture of the intention of the being making the 'utterance' and the interpretation of the being hearing the 'utterance', and will depend to some extent on whether or not the two beings are of the same species and share a common repertory of sounds (see chapter two). 'Utterances' may be direct and unambiguous (such as a scream of terror), or formalised, structured and governed by rules (such as verbal language), with many overlapping categories in between which Wishart explores in 'On Sonic Art'. 'Utterances' may also be intentional and/or unintentional: both intentional utterances (such as

speech), and unintentional utterances (such as laughter) communicate meaning. This gives rise to the possibility of ambiguous 'utterances', where the intention of the 'utterer' is open to interpretation. In verbal language, the inflection and tone of voice used by the speaker may be as meaningful as the words themselves; in some cases, perhaps, even more so. It is quite possible, for example, to interpret different intentions behind a given verbal 'utterance' depending on the way in which it is delivered. These modifying aspects of linguistic communication are known collectively as 'paralanguage' (see note 22, chapter two); Wishart devotes a section of his book to this alone, and explores it repeatedly in his compositions as we shall see.

In order to use these resources in his compositions, Wishart has conducted painstaking research into extended vocal techniques, and allocates a large part of 'On Sonic Art' to a detailed explanation of their modes of production. His compositions involving live vocal ensembles demand considerable facility in such techniques, and he has developed a complex (though not entirely consistent) method of notation to communicate precise instructions to the performers. His explorations of 'utterance' go further than use of extended vocal techniques, however. The electroacoustic medium, he believes, is the ideal medium for the creative exploration of 'utterance' in music, since electroacoustic manipulation of sounds opens up the possibility of discovering or inventing what he calls the 'utteranceness'[6] of every sound, whatever its origin.

Wishart's argument that a knowledge of the compositional process behind the music contributes nothing, indeed should contribute nothing, to an understanding of the music itself poses certain problems to the

analyst (of Western classical music) who is accustomed to believing that knowledge of a work's structural details enhances the musical understanding of that work. In most cases, recognition of a composer's use of sounds and structures in the context of the work of his contemporaries and predecessors does impart extra meaning to the particular work in question - musical works do not exist in a vacuum, whether or not they are intended to be great works of art. This applies even to works which purport to be flexible in form and content (for example, chance compositions), or works written according to alternative artistic criteria (such as John Cage's 4'33"), as they will be perceived and interpreted in the context of the listener's own experience (or lack of it). In the case of electroacoustic music where both the sounds and the technology used to produce them may still be relatively unfamiliar to the listener, or where the use of concrete sounds which are familiar from everyday life may still be a strange concept in a musical composition, the benefit of such information is arguably even greater.

How, then, do we approach Wishart's music in the context of this study? Do we accept his stance, and ignore the details of his compositional processes? Or do we take the view that Wishart's control of this rich material and his creative exploitation of the emotional resources inherent in the sounds he chooses contributes directly to the musical process itself and is therefore worthy of investigation? Given that much of Wishart's music makes use of sounds which are rich in non-musical associations to the listener, and that a significant part of Wishart's compositional processes involves matching sounds to preconceived, not necessarily musical ideas, this chapter takes the latter path and seeks to establish a clear link between the music and

the compositional processes behind it, in the belief that Wishart's music is best understood with a heightened awareness of our emotional response to this kind of sound material, and of his creative control of it.

* * *

Sound images as symbols - 'Red Bird' and 'Anna's Magic Garden'.

Wishart does not claim that his music has a 'message'. Nevertheless, he chooses his sound material specifically to suit ideas which he wishes to convey through his music, and the particular use which he makes of certain concrete sound images within a self-confessed framework of social ideals, both in overtly political works such as 'Red Bird' and in others, leaves a vivid and direct impression of his preoccupation with various issues such as creativity, oppression/suppression, the conflict between the rational and the irrational, and so on. The question of whether or not such pieces are justified only by extra-musical concepts rather than a purely musical rationale, may be raised, and the following discussion looks at two of Wishart's tape compositions with this question in mind.

Subtitled 'a political prisoner's dream', 'Red Bird' (1977) represents an attempt to present a fundamental philosophical dichotomy through concrete musical images and associations in a semi-narrative form. In this piece, Wishart identifies two opposing 'world views' - the 'open' world view, characterised by creativity, freedom, renewal and progress, and the 'closed' world view, characterised by oppression, automation, rigidity and reason. The conflict between these two

conceptions of reality is presented by Wishart as a 'contemporary myth'; articulated through the 'story' of a prisoner whose attempts to liberate himself through poetry and creativity are repeatedly crushed by the rigid and rational structures of a mechanised society. The drama of the story does not unfold in a linear way, but takes the form of a dream-like sequence of contrasting scenes connected by a complex system of sound references.

Wishart's intention in using concrete sounds in his compositions is to create the illusion that the listener is hearing natural events. Transformations between one sound and another are designed to be heard as if they were recordings of strange natural happenings rather than studio-contrived sound effects. For this to be effective, he claims, it is necessary to create the illusion of a constant 'landscape', or acoustic environment, for the different sounds as they are being transformed. Wishart's comments regarding the sound-projection of 'Vox 1' make a similar point:

> The sounds of the amplified voices (from loudspeakers) must always outweigh any direct (acoustic) vocal sounds or the spatial projection will be destroyed....Reverberation MUST be added to the voice parts so that they appear acoustically compatible (in the same perceived acoustic space as the sounds on tape). Achieving a convincing reverb-space for the voices is a second reason why direct (acoustic) vocal sound is to be avoided.[7]

Wishart shares the same objective here as Denis Smalley in 'Clarinet Threads', where the live clarinet is instructed to be mixed and diffused with the tape. Wishart's motivation, however, is slightly different from that of Smalley. Effecting a transformation between one concrete sound and another (as opposed to a transformation between two synthetic sounds or between two related sounds) involves creating an

aural illusion, or 'tricking' the listener into hearing a smooth continuum where the mind would normally switch between two discrete perceptions (Jonathan Harvey tried to achieve this in 'Inner Light (3)' by distancing the transformations between different instrumental sounds from the actual instruments on the stage - see chapter four). A constant acoustic environment around the sounds being transformed can help to create this illusion, according to Wishart, and thus contribute to the persuasion that the sounds represent natural events. This manipulation of 'landscape' to contextualise sounds can have further implications: for example, the illusion itself can take on a symbolic function according to the particular sounds used, and a sudden, deliberate change of acoustic environment can have a dislocating effect on the listener which can be exploited for dramatic purposes (see later).

Wishart has produced a booklet entitled 'Red Bird; a document' which exists separately from the recording of 'Red Bird' and is not intended as an accompaniment or 'programme note' to the music (it is available from Wishart's publishers, Universal Edition, but does not come with the record). In this document, Wishart gives details of the technical aspects of the work's composition (the compositional process), suggests a narrative interpretation of the drama, outlines its formal characteristics, and offers a lengthy explanation of its symbolism and the ideas behind it (Appendix 4).

The technical explanations provide an invaluable and straightforward insight into both the constraints and the freedoms of working with concrete sound material in the analogue studio, and contribute in no small degree to an appreciation of the use of the material in the

composition, despite Wishart's assertion that such knowledge is irrelevant to the aural experience of the music. In particular, Wishart's desire to find suitable sound objects to fit pre-conceived ideas, rather than to let the ideas develop from the qualities of the sound objects, led to the choice of certain concrete sounds despite the fact that they did not necessarily lend themselves to being recorded, either because of environmental 'noise' which interfered with the clarity of the recording, or because the sound itself was not convincing aurally when it was transferred to tape without extra filtering or enhancement. For example, he notes (on page 8) that birdsong presented particular difficulties, since the ambient noise of the surrounding environment was in the same frequency range as the birdsong itself, and could not easily be filtered out; instead Wishart had to remove the noise from sections between birdsong 'phrases' (replacing it with sections of silence on tape) and let the birdsong itself mask the noise as much as possible. Reverberation then had to be added artificially, to replace the natural reverberance of the environment which had been removed from the sections between birdsong phrases. Similar difficulties were presented with the recording of the fly, where necessarily high recording levels resulted in considerable problems with ambient noise. Varying dynamic levels reflecting the fly's normal flight movements had to be created artificially, since the fly had to be stuck to a rod (!) for the recording to be feasible at all.[8]

Wishart's working method appears from the document to have been painstaking and methodical: from a set of four pre-conceived sound symbols (see below), he created a 'field of possibilities' consisting of various recordings, permutations and manipulations of these, alone and in combination with the other sounds, over a period of several months,

from which he was able to select those sounds most appropriate to his needs in the piece *according to their perceived characteristics.*[9] Any sound conceived to fulfil a given idea which was not perceived in that sense was discarded (compare Smalley's desire in 'Vortex' to stress percept rather than concept).

In 'Red Bird; a document' Wishart gives a brief breakdown of the sections of the piece and a sketch of the most important symbolic cross-references between sections (see example 1 - the terms used in the following discussion are Wishart's).

The 'opening area' (c. 18'15", concluding with the sound of breaking glass) introduces most of the sound material and presents sections of contrasting musical dynamic which form the basis of the work's drama. For example, the first (linked) sections are characterised by rapid change and juxtaposition of strong musical gestures, while the second, 'garden' section is more static (Wishart's diagram gives no indication whatsoever of the relative length or structural importance of the various sections, but merely outlines the development of symbolic cross-references between them). These two contrasting dynamics are explored in the 'central area', where sound-symbols from the 'opening area' are developed in relation to each other. The 'final area' (beginning at c.32') recapitulates and distils earlier material, working many of the sound-symbols into one much larger symbol ('universal factory') before a contrasting 'coda'.

Example 1

Structural diagram of 'Red Bird'

OPENING AREA	INTRODUCTION	TORTURE	BREATH AS WIND	TRANSFIGURED WORDS	PRISON COURTYARD	SCREAM DOWN WELL	PHILOSOPHER	GARDEN
name of section some anticipations and recapitulations	"Whispermix" (PHILOSOPHER)	"Lis→Birds" (EROS) "Word-Machine" (UNIVERSAL FACTORY) "Clipped-Door" (EMPTY) "Book" (BOOK & FLY)	"Creaking Door" (DEATH) "Hounds of Reason" (PRISON COURTYARD) "Bird behind breathwind" (ends BIRD CADENZA)	Bird (from Scream→Bird) (INTRODUCTION) "III"-texture like water (end of POET)	(Hounds of Reason) "Doors" (BOOK & FLY) "Interrogators Voice" (UNIVERSAL FACTORY)	"Body/Machine" (EROS) "multiple screamed-'rea'" (DEATH) "scream down well" (WELL→BIRD)	"Book" (BOOK & FLY) "Whispermix" (INTRODUCTION)	"Fly" (BOOK & FLY)

CENTRAL AREA	EMPTY	EROS	BOOK & FLY (DOORS)	BOOK PAGES →POET	DEATH→CLOCK
name of section some anticipations and recapitulations	"flocking-words" (POET)	"Lis→Birds" (TORTURE)	machines etc. (EROS) philosopher/book/whispermix (PHILOSOPHER) distant birds / animals (GARDEN)	"whispermix" (opening of GARDEN)	"multiple screamed 'rea'" (SCREAM DOWN WELL) "philosopher's voice" (PHILOSOPHER) "breath-wind" "creaking door" (BREATH AS WIND)

FINAL AREA	BIRD CADENZA	UNIVERSAL FACTORY	WELL→BIRD (Coda)
name of section some anticipations and recapitulations	"bird-behind-breathwind" (BREATH AS WIND) "machine-squeak bird" (EMPTY) (condensation of) "beat-up sequence" (TORTURE)	NUMEROUS ending with "Scream down Well" (SCREAM DOWN WELL)	Bird (from Scream→Bird) (INTRODUCTION)

Wishart describes 'Red Bird' as a contemporary myth, articulated, like other myths, by universal symbols. The four main symbols of the piece are as follows ('Red Bird; a document' p. 4), and provide the basic framework for a complex group of subsidiary symbols:

Words (derivations of the phrase 'listen to reason'); these are used only in the context of the closed world view. They are spoken by massed voices ('voices of dissent') and by individuals (a 'philosopher', who tries to rationalise, and an 'interrogator', who tries to subdue - the characters are identified by Wishart in the 'document'). The poet/prisoner never uses words; his vocal expressions are restricted to grunts and cries (in torture) or different types of breathing (erotic, fearful, etc). The implication is that the poet communicates through 'Direct Utterance' (= uninhibited, expressive), while his oppressors use conventionalised, highly structured (= restrictive) 'utterances'.

Birds; these represent the open world view, as they do in different guises in other pieces by Wishart. Of non-human 'utterances' researched by Wishart, birdsong has had possibly the most fascination for him. He notes in 'On Sonic Art'[10] that birdsong has a high level of redundancy, the same or similar 'phrases' being used in a variety of contexts. From this he deduces that the 'syntax' of birdsong is conventional, in the sense that individual units of a phrase do not necessarily correspond directly to individual states or gestures (see chapter two). Of greater significance still is the parallel Wishart notices between birdsong and music, in that both forms of conventionalised 'utterance' still retain aspects of Direct Utterance

which may be perceived and responded to by the listener. Language, by contrast, is more detached - hence the distinction made between the vocal 'utterances' of the poet/prisoner and those of the 'philosopher' and the 'interrogator' (see above), as well as the symbolic use of birdsong in the piece. The 'garden', spiritual refuge of the fleeing poet/prisoner and symbolically the antithesis of the 'universal factory', is dominated by birdsong and bird-like calls.

Machines (also part of the closed world view). While the image of the industrial society could have been used to represent progress and liberation from physical labour, it is instead used to symbolise the denigration of human creativity in the face of material production. Wishart's symbol is made more potent by the fact that the 'universal factory' image in the piece is sometimes made up of words (as above) but at other times made up of human and animal sounds (symbols of the open world view) which have been subjected to rhythmic ordering and transformed by reverberation.

Animal/body; these include breath and vocal sounds and are of the open world view, but subjugated by the power of rational oppressors. The first section of the 'opening area' of the piece is dominated by Animal/Body symbols, some violent (like the gasps and cries of the tortured poet/prisoner) and others more static (such as breath/wind sounds). The machine-cum-animal sounds of the 'universal factory' image fall into this category.

In addition to these four main sound-symbols, Wishart describes several subsidiary sound-symbols and archetypal 'characters' in 'Red Bird; a document' (Book, Fly, Clock, Door, Well, Poet, Philosopher,

Interrogator etc), all of which are subject to different interpretations according to their context in the piece. For example, Wishart uses context to govern whether the 'Book' symbol suggests the 'book of the law' (= deterministic, rule-bound, ordered and finite), or the 'book of the poet' (= repository for new ideas, creativity and liberation). Conventional symbolism is deliberately used to help determine the interpretation of the symbols in their different contexts: juxtaposition of 'Book' sounds with the sounds of birds, which are traditionally associated with flight, liberation and transcendence quite apart from their symbolic associations in the context of this piece, suggests the 'open' world-view (book of the poet); juxtaposition of 'Book' sounds with the sound of ticking 'Clocks', which are associated with regularity, order, rationality and rigidity, suggests the 'closed' world-view (book of the law).

Various aural illusions also play a part in the symbolism, as in the 'Machine' symbol mentioned above. There are numerous instances of such illusions throughout the piece, some quite momentary, such as the transformation of the spoken syllable 'Lis..'(ten to reason) to the sound of massed birdsong (= closed world view transforming to open world view), or the implied connection between the sound of the 'philosopher's' voice and the creaking door (= relationship between reason and restriction). Other illusions are more extended, such as the end of the 'garden' landscape where voices emerge from bird and pseudo-animal sounds (actually created vocally) in a massive upbeat to the noise of breaking glass. The latter sound is an especially powerful sonic image for Wishart, who uses it in 'Vox 4' as well (see later). In 'Red Bird' it is used to disrupt the tranquillity of the 'garden' section, and marks the end of the 'opening area' of the piece.

Certain key sound gestures provide structural as well as narrative demarcation. Wishart's structural diagram of the piece (example 1) refers to them as follows:

a) Scream - bird (Wishart's 'shorthand symbol' of the whole piece). The scream is present in all 'torture' sections and is mirrored by the multiple scream of the syllable 'rea..' by the massed voices. The scream also occurs in the antithetical gesture, scream-well: this gesture is the dynamic opposite of scream-bird since it falls rather than rises in pitch (indicating submission rather than liberation, defeat rather than victory). The bird part of the gesture is present by implication throughout the 'garden' section, and in various transformation passages; it is also incorporated into the 'universal factory' image. There is also the extended idea of scream-well-bird. This never appears as a whole gesture, but is implied at the end of the piece: the bird sound from the opening gesture is heard 'emerging' from the 'well' of scream-well at the end of the previous section. The idea functions as a statement of optimism - creativity rising above oppression.

b) Swat/slam This relates to the subsidiary sound-symbols of 'Book' and 'Door', but includes other sounds as well. The clipped word fragments at the opening of the work and in the 'central area', and the abrupt, chord-like interjections which herald the 'final area' also fall into this category. Without exception, these gestures are associated with violence, aggression, subjection and control.

c) Breath/wind Breath sounds vary from regular breathing patterns to the uneven exhalations and gasping of the tortured poet/prisoner. The regular patterns provide Wishart with an ambiguous symbol, suggestive on one hand of nature or repose and on the other hand of the rhythmic motions of the machine.

d) Massed voices. Presented in deliberate contrast to the poet/prisoner's voice, the massed voices are intended to function sometimes as a commenting chorus, sometimes as the agents of the mechanised society, sometimes as dissenting voices either inside or outside the poet/prisoner's mind.

Wishart's professed intention in 'Red Bird' is 'condensation of the complex, and NOT (sic) elaboration of the complicated'[11]: hence his presentation of the work as a 'contemporary myth'. For the piece to function as a myth, however, it is necessary that Wishart's sound-symbols have a common relevance to many listeners and do not simply take on meaning by virtue of his written explanations. On the whole, the sound material does fulfil the associative functions Wishart desires and in many cases the relationship between the flow of sound-symbols and the implied flow of ideas is quite straightforward. For example, towards the end of the 'central area' the swatting sounds which punctuate the fly's buzzing become more resonant, and gradually metamorphose into the sound of heavy (iron?) doors slamming; these, in turn, change into the ticking of a clock whose alarm, when it sounds, transforms into the cries of a flock of birds. The implied development from a situation of repression to a situation of freedom is clear, and individual sound symbols do have the desired associations (such as the sound of the fly which symbolises disease or death). Similarly, the violation of tranquillity which is implied by the sound of shattering glass at the end of the 'garden' section, is unambiguous. The differentiation between the scream which leads to release (scream-bird) and the scream which goes unanswered (scream-well) is also clear enough for the 'bird' and 'well' symbols to be understood independently and used in different sections to contextualise other sounds.

An interesting comparison may be made between this piece and Jonathan Harvey's 'Inner Light (3)'. The works are of similar length and compositional complexity, and both have an underlying (non-

musical) theme which the composers seek to make expressive through the musical process. Each has a complex system of cross-references, both musical and symbolic, and each piece elaborates ideas which are fundamental to its composer's musical language and compositional philosophy. Both pieces make striking use of sound transformations for musical, structural and symbolic purposes. In both cases, the composer has written an extensive account of the compositional processes involved and the artistic rationale behind them.

Whereas 'Inner Light (3)' suffers from a superfluity of unmemorable musical ideas, 'Red Bird' is almost overburdened with powerful, memorable sound images which the structure can hardly contain. Of the work's emotional power and technical dexterity there can be little doubt. However, whilst these symbols and the careful cross-references which Wishart effects through his use of transformation and juxtaposition of sound images are clear enough, the individual images themselves are too many and too vivid for the underlying idea of the conflict between the open and closed 'world views' to be perceived except through Wishart's written analysis.

In contrast to 'Red Bird', 'Anna's Magic Garden' (1982) uses only two main concrete sound symbols, with other material forming an atmospheric backdrop. The work does not have a weighty social or ideological function, although Wishart does use it to illustrate, in a simple manner, his personal philosophy regarding man's relationship with the natural world. Written in 1982, this is a fantasy piece which attempts to portray the sense of wonder that a child (Wishart's daughter) might feel in the presence of Nature. The two main sound

symbols (birdsong and human (child's) vocal sounds) are familiar from 'Red Bird', though used in slightly different contexts.

The dream world of 'Anna's Magic Garden' is both a representation of childish imagination (as remembered or observed by the adult) and also a reflection of adult nostalgia for childish innocence. The idealised innocent state is symbolised by the redundancy of verbal language: the child's emotions and responses to external stimuli, such as fear, curiosity, amusement, excitement and so on, are portrayed largely through inarticulate vocal sounds such as laughter, tearful sobs, jubilant cries and wordless singing (the only words used are numbers counted in a sequence in the manner of the build up to a game of hide-and-seek). The adult's understanding of these 'utterances' is a subtle mixture of recognition of the childish noises themselves and an awareness of the remnants of Direct Utterance in his or her own 'adult' verbal communication (ie. inflection, tone of voice, etc).

Birdsong is used on two levels. Its presence, in a resonant, wood-like 'landscape' gives a sense of reality to the scene. At the same time it strengthens the poetic image being created, for the same reasons that it does in 'Red Bird' - associations of flight, freedom and transcendence are common to both. Since the child's voice and the birdsong are the only recognisably concrete sounds in the piece, a connection is implied between them, the implication being that both represent idealised states of being.

The 'Magic Garden' itself is portrayed through the invented sounds of imaginary creatures and plants. Iterated noise sources subjected to different kinds of dynamic shaping create the illusion of animal life

from breathing or purring sounds to rasping calls; sounds representing the creaking and breaking of branches, splashing water and even thunderclaps also feature to complete the fantasy environment. The manipulation of acoustic space is an important factor in the creation of this picture. In order to present images as though from a child's viewpoint, Wishart creates a larger-than-life 'landscape', the sounds of the imaginary creatures or elements being distorted so that their presence is heightened: thus the bubbles in a stream of water, or the noises of insects and animals all appear to be closer and louder than they would normally. The perception of the little girl as a symbolic figure also depends upon the perceived acoustic space: at one instant the voice is a sound-symbol, representing innocence and natural harmony; at the next (for example when the sobs suddenly come into close proximity), the voice takes on the character of Wishart's daughter, a real and vulnerable human being.

Where 'Red Bird' presents a philosophical argument through the use of sound-symbols in a musical discourse, 'Anna's Magic Garden' attempts to portray a moment in time, a fleeting glimpse of a child's imagination through adult eyes. The symbols, such as they are, are not transformed or developed as they are in the earlier piece - in a sense, the music has no beginning or end but presents a slice of an ongoing (imaginary) event. The musical processes in these two pieces are quite different from each other, but linked by one factor, namely that in both, the listener's subjective response to the actual sound material is designed to be an integral part of that process. Unlike *musique concrète*, which sought to manipulate concrete sound material in order to present it out of its natural context and to divorce it from the listener's customary associations, in other words to make it 'abstract', Wishart's music

makes use of concrete sound material specifically in order that the listener should have an associative response and be put in mind of the ideas the composer is trying to convey.

In conventional Western music, such an approach might be described as programme music. The best programme music, however, is usually felt to be that which succeeds as a satisfying composition irrespective of the programme: in other words, it fulfils established artistic criteria dictated by the musical material rather than by the poem, painting or historical event which may have inspired it. The musical material of Wishart's compositions challenges the accepted notions of what constitutes 'music' so the artistic criteria are understandably difficult to assess in conventional terms. The musical processes in 'Red Bird' and 'Anna's Magic Garden' arise from the organisation of sounds which have a potent meaning quite different from that of the pitches, rhythms and timbres of conventional music; so it is necessary to take that meaning into account, insofar as it is possible, when studying the music. These meanings, or associations are carefully manipulated by Wishart to form part of the musical process, each one affecting the perception of the other sounds and the experience of time passing. The structures of these two works are articulated as much through these meanings as through the recognition of repeated and/or developed sound objects - in effect, the sounds and their associations are treated (and understood in an individual way) as one and the same.

The use of sounds as symbols is discussed by Wishart in a chapter of 'On Sonic Art' entitled 'Utterance' (see chapter two). In this chapter, he makes a connection between the sounds of tiny creatures and the 'etiolated heights of Artistic manifestation' (see note 5): any sound

event made (or designed) by a living creature which is perceived to be meaningful is understood by Wishart as an 'utterance' of some sort. This implies that pieces of music, including his own, are also 'utterances'; in his case the description is particularly apt since the very sound material he uses includes 'utterances' of different kinds, from recordings of birdsong and buzzing insects to human vocal sounds both articulate and inarticulate. An important compositional preoccupation for Wishart is to discover what he calls the 'utteranceness' of sounds (in other words, the degree to which they can be perceived as 'utterances' in a given context); this concept, along with his fascination with the portrayal of human social environments familiar from 'Red Bird' and 'Anna's Magic Garden', form the unifying factors in his 'Vox' cycle, to which we turn our attention at this point.

Utterance and 'utteranceness': the VOX cycle

This collection of works for voices and live electronics ('Vox 5' is the exception, being for tape alone) was written between 1979 and 1988, and is devoted to a study of extended vocal techniques and the perceived meanings of vocal sounds and gestures within a given social and cultural context. Ranging from primaeval soundscapes to intellectual word and rhythm games, vocal drama and social commentary, the pieces provide a catalogue of human vocal expression, loosely bound together with the themes of creation and destruction found within the mythology of the Hindu god Shiva which provided Wishart with a metaphor for his view of growth and decline in human societies and cultures. 'Vox 6' is the only one of the series to use words and constructions from an established language (English). 'Vox

1 - 4' are all concerned with the articulation of different kinds of meaning through paralanguage.

In 'Vox 1' (for 4 amplified voices and 4-channel tape), for example, the vocalists struggle towards the enunciation of a 'magic text' which is distinguished from the preceding sounds by being declaimed in pitch and rhythmic unison (over a drone) with an 'ecstatic' mode of delivery (see chapter two); the emerging cohesion of the vocal parts here represents both developing social cohesion and also a higher, 'spiritual' unifying force which is inaccessible except through ritualised forms of expression.

In 'Vox 2' (4 amplified voices, stereo tape and live electronics), vocal sounds are made in simulation of animal and bird sounds in the tape part, indicating a relationship between the human being and his natural environment; vocal sub-harmonics typical of certain Oriental singing techniques are also explored, and an oblique reference perhaps made to Eastern philosophies (eg. Buddhism) which place special emphasis on harmony between Man and Creation. On a more technical level, 'Vox 2' sets out to explore the inner articulations of vocal sounds (for example subharmonics, which produce slow pulsations or 'clicks' rather than defined pitches) in relation to the external harmonic context in which they are placed - an interesting musical exercise in its own right but also a useful metaphor for the relationship between the individual and his environment (whether natural or social).

'Vox 3' (4 amplified voices and computer generated synchronisation-tape) moves away from the general metaphors of 'Vox 1' and 'Vox 2' to explore a particular aspect of human behaviour - games. The piece

is a series of highly intellectual rhythmic exercises interspersed with interludes depicting the social interaction of the participants, inflection and vocal gesture taking the place of verbal communication. The interludes take the form of imaginary conversations, and the score is peppered with instructions concerning the articulation of these passages ('as if an exciting possibility has been discovered' (p. 4), 'with gathering enthusiasm' (p. 4), 'as if the solution is obvious' (p. 15) as well as panting, laughter, and other 'utterances'.

The social interaction depicted in 'Vox 3' is at a deliberately superficial level, the whole piece being a light-hearted look at an intellectualised human activity. 'Vox 6' (1988, for amplified voices, tape, and click track) has echoes of this light-hearted treatment of human attributes, though its implications are more sinister. Written in the form of a piece of rap, the work clothes notions of self-annihilation and the cycle of life and death in the trappings of modern throw-away culture. It is a heavily ironic work, full of contradictions and juxtapositions - it is rap (essentially a black American musical style) written for white singers; a piece of pop (or pop-like) music designed for classically trained vocalists which lasts for 16 minutes (most pop songs last about 3 minutes); a story of death and destruction written in the language of ebullient youth in the rhythms of dance (for the text, see Appendix 5). In his program note for the 1988 Henry Wood Proms, at which the entire 'Vox' cycle was performed, Wishart wrote:

> in literature Shiva is associated both with the joyful dance of life and with the insistent drumming of the dance of death on the battlefield. For me this remains a potent contemporary symbol.[12]

In conversation with Dick Witts he adds:

> Dance is a universal metaphor for sexual energy; it refers to any dynamic aspect of human life, or to living as a social cosmos, and Shiva's dance of creation-destruction is a terrific double-edged image of human life, exciting and terrifying at the same time. I chose funk because that's what people dance, just as Classical composers wrote minuets or Baroque composers wrote gavottes.. Vox 6 was written without a text, the rhythms first, and the words were added to those very precise rhythms. So this is music-setting rather than text-setting....The idea of the rap came about as a counterpoint to the poetizing vision of the singers (some of the singing and rapping is pre-recorded, up to 12 voices in total, 3X4) The rappers have a foolish innocence, becoming more knowing and pointed as the piece progresses. The rapping is my narrative.[13]

Wishart insists that the piece is intended neither as parody nor as a 'real' piece of rap, and feels that the 'trained/white singer' quality of a typical performance by the vocal group Electric Phoenix (for whom the piece was written along with the other 'Vox' pieces) is not a significant factor of its presentation. He is equally untroubled by possible comparisons between the tape part of 'Vox 6' and other, genuine pop songs whose identity is as much a result of sophisticated post-production techniques in the studio as of the words and notes. Wishart's piece displays an intuitive and sympathetic understanding of this style of pop music but the final tape sounds like an amateur attempt simply by virtue of the equipment used (Steinberg Pro-24 sequencer, and Phase Vocoder running on the Atari-ST under the Composers Desktop Project). This may be of little significance to the composer, but is potentially distracting for a listener accustomed to the sound of commercially produced music, since it counteracts to some extent the very image being created by the use of rap (the cultural associations of new sounds in pop music is discussed in chapter one).

In 'Vox 4' (4 amplified voices and 4-channel tape), Wishart adds another dimension to the forms of behaviour studied in the previous

three pieces and in 'Vox 6': psychological and social drama. Whilst 'Vox 1-3' concern themselves with generalised aspects of human behaviour (eg. use of ritual, imitation of nature, use of games), 'Vox 4' provides the vocalists with particular dramatic contexts in which to set their 'utterances' - once again Wishart refrains from using verbal language, but allows the drama to be interpreted from the tone of voice and inflection used to articulate a nonsense language of his own construction. The work is subtitled 'a dramatic scenario', and the nine different 'scenarios' portrayed during the course of the work are outlined in the preface to the score: Mechanism, Vilification, Scapegoat, Oath-taking, Cocktail-Party, Farmyard, Atavistic Rite, After Dinner Speech, and Wicked Stepmother. In addition, Wishart lists four categories of text: Words Referring to Scapegoat Groups (divided into polite forms, normal form, and expletive forms), Heresies, Words Central to the System of Belief, and the Unspeakable. All of the 'scenarios' are designed to be representative of aspects of Western culture (though they are not exclusive to it) and the 'utterances' themselves are intended to have familiar overtones to the (Western) listener. The categories of text, on the other hand, are more generally defined and could refer to any or all cultures.

According to Wishart, 'Vox 4' is a portrayal of social breakdown. In his notes to the Proms 1988 performance of the 'Vox' cycle, he precedes the comments about 'Vox 4' with a quotation from the Revelation of St John the Divine ('And there went out another horse that was red; And power was given to him that sat thereon to take peace from the earth, and that they should kill one another; And there was given unto him a great sword.'), and concepts such as fear, mass hysteria, imprisonment (ie. denial of freedom), personal social

responsibility, different relationships of the individual to the crowd (eg. entertainment, oppression, leadership, family etc), violence, gossip, relief, malice, accusation, and many more, are all explored and made expressive throughout the piece. The work is punctuated by the sounds of beating on a door and shouts (Joseph K's interrogators - the sound image was taken from a text-sound piece by Bernard Heidsiek): this becomes clearer and more insistent as the piece progresses, provoking different responses from the 'characters' in the drama, and finally being taken up by a 'mob' whose protests culminate just before the end of the piece in the sound of shattering glass. The score is marked at this point with the word 'KRYSTALLNACHT', referring to a notorious night in German (Nazi) history when the windows of Jewish shops and homes were methodically smashed. It is the same sound as that used to shatter the 'Garden' scene of 'Red Bird', and Wishart employs the same technique of sudden juxtaposition of different acoustic spaces to maximise the emotional effect of this violent image - the shattering glass appears close by while the 'angry mob' were distantly threatening, and the listener is briefly changed from being an observer to being a participant in the drama.

If 'Vox 4' explores the drama of 'utterance', 'Vox 5' explores the concept of 'utterance' itself. Written between 1979-86, it is subtitled 'the voice of Shiva' and takes as its subject Wishart's idea of the 'utteranceness' of natural sounds. In 1979/80, Wishart submitted a project to IRCAM based on the the idea of using detailed manipulations of the human voice, and was commissioned to write a piece after attending an induction course the following year. The project required software which would permit the spectra of vocal sounds to be interpolated with the spectra of other natural sounds or to be altered to

take on the qualities of other sounds - Wishart's previous work in the analogue studio, as demonstrated in 'Red Bird' and 'Anna's Magic Garden', had already been exploring such ideas. Wishart himself wrote the computer programs to manipulate sound data from Mark Dolson's Phase Vocoder program at IRCAM.[14] As this tool was an integral part of Wishart's composition process for 'Vox 5', a brief summary of its characteristics is appropriate at this point.

The Phase Vocoder is a signal processing technique which converts a sampled signal into a time-varying spectral format. To analyse a sound, a set of band-pass filters is provided which divide the signal into narrow spectral slices, or channels. For re-synthesis, a bank of sinusoidal oscillators is provided which have frequency and amplitude control inputs. In order to re-synthesize an analysed sound, the frequencies of the separate oscillators are tuned to the central frequencies of the different analysis filters, while the amplitudes are driven by the amplitude envelopes measured in the analysis. The Phase Vocoder allows independent modification of frequency, amplitude and temporal evolution, so sound data from an analysis may be manipulated and transformed to produce new sound data for re-synthesis.

Wishart describes the two main techniques used for 'Vox 5' as *spectral manipulation* and *spectral interpolation*.[16] Spectral manipulation involved expanding or compressing the analysed vocal spectra in two ways: either the relationships between harmonic components could be preserved (Wishart's term is 'shifting'), or they could be altered depending on their position in the spectrum - for example, components could be shifted more at the bottom of the spectrum and less at the top, or vice versa (Wishart calls this 'stretching'). Using these techniques,

Wishart was able to make one sound take on qualities of a completely different sound without losing its original identity: he was particularly keen to experiment with stretching vocal sounds to take on inharmonic, or bell-like qualities (a similar idea to Harvey's in 'Mortuos Plango Vivos Voco').

Interpolation was used when a smooth transformation between two original sound sources was required, and involved mathematical calculations of frequency and amplitude values from the data in the two separate analysis files. The exact details of the interpolation depended upon various factors, such as the degree of similarity between the two source sounds (it is easier to interpolate between two similar spectra than between entirely different spectra - Harvey's work with Jan Vandenheede on the source sounds for 'Ritual Melodies' also illustrates this point). Another crucial factor was the ear's tendency to categorise sounds rather than to hear a smooth transition; the most effective interpolation was only achieved after much trial and error, but the musical context in which the interpolated sounds were placed was designed to disguise the transformation process itself, and to encourage the listener to interpret the sounds in a certain way. Perhaps the most obvious example of this is the fact that almost all the sounds in the piece develop from vocal sources, so in cases where the ensuing sound is a strongly recognisable natural sound (eg. a horse neigh) the listener's memory of the original vocal sound is not entirely supplanted but is reinforced by preceding and following examples.

Wishart has described the sound world of 'Vox 5' as a collection of 'poetic images of the creation and destruction of the world contained within one all-enveloping vocal utterance (the 'voice of Shiva')'.[17] The

image of the 'voice of Shiva' was created using the manipulation and interpolation techniques described above: almost all the sounds in the piece are made to relate to vocal sounds, by metamorphosing from a vocal source, and/or by being enveloped in a way which suggests vocal articulations. In order to create the illusion of a vocal stream for the 'voice of Shiva', individual 'utterances' had to be created or implied, and then linked together by shaping the beginnings and ends of sounds to suggest the opening and closing of a 'vocal cavity'.[18]

The various sounds of nature (sea, wind, thunder and rain), birds, insects and animals, individually identifiable on one level, serve to make up the articulations of an implied single being on another level in this piece. Spatial projection, in addition to the careful enveloping of sound events, was used to create the effect of a 'mouth' at the centre of the front stage (ie. between the two front loudspeakers) from which the sounds are 'ejected'. This contributes powerfully to the sense of 'utterance' which Wishart is trying to convey, since there is both an implied physicality behind the movement of the sounds, and an implied intent - the sounds are 'sent forth' as if to communicate directly with other beings. Wishart's spatialization of the sound material (realised during the final mix-down) also helps to contextualise the transformations. The movement of the sounds away from a central focus to the rest of the acoustic space helps to create the illusion of smooth transformations, just as it does in Harvey's 'Inner Light (3)'.

'Vox 5' lasts for 6 minutes, and was composed as both a 'bridging recitative' between 'Vox 4' and 'Vox 6', and a 'poetic summary' of all four preceding 'Vox' pieces.[19] The work begins and ends in environmental sounds, and falls into sections loosely defined by

different kinds of articulation: the 'utterances' of the 'voice of Shiva' develop from unpitched vowel-like shapes, through pitched humming sounds, to explosive and sibilant consonant-like sounds which themselves become merged with elemental sound masses towards the end of the piece. In each case, the kinds of articulation are designed to correspond with other sound gestures in that section: for example, vowel shapes occur in the context of the sounds of gusting wind and of bird calls; nasal humming sounds metamorphose into the buzzing of bees; hard consonant-like shapes are integrated with rhythmic chord sequences (made up from bell-like vocal sounds); and sibilant and noise-based sounds eventually merge into the crashing of thunder.

As a 'poetic summary' of 'Vox 1-4', this piece is highly effective. The illusion of the 'supervoice' is convincingly achieved, and the main ideas from the preceding works subtly recapitulated. The elemental opening and evolving 'utterances' of 'Vox 1' and the bird- and animal-like correspondences of 'Vox 2' are reflected both in the sound material itself, and through the voice-like articulations of it, while on another level the drama and social dimensions of 'Vox 3' and 'Vox 4' are encompassed by the images within the supervoice's 'utterances'. To think of 'Vox 5' as a 'bridging recitative' to 'Vox 6' is perhaps to undermine the power of the piece as a statement in its own right. Its very conclusiveness after 'Vox 1-4' suggests a different interpretation of 'Vox 6', as a 'coda' rather than a culmination of the series, especially since its message is couched in such ephemeral musical terms. The images of 'Vox 5', in contrast, are constant and universal.

* * *

Wishart has said:

> One problem I have had in my own musical career is the rejection by some musicians and musicologists of my work on the grounds that 'it is not music'. To avoid getting into semantic quibbles, I have therefore entitled the book "On Sonic Art" and wish to answer the question what is, and what is not Sonic Art....Sonic Art includes music and electro-acoustic [sic] music. At the same time, however, it will cross over into areas which have been categorised distinctly as Text-Sound and as 'sound effects'. Nevertheless, focus will be upon the structure and structuring of sounds themselves. I personally feel there is no longer any way to draw a clear distinction between these areas. That is why I have chosen the title "On Sonic Art", to encompass the arts of organising sound events in time. This, however, is merely a convenient fiction for those who cannot bear to see the use of the word music extended. For me, all these areas fall within the category I call music.[20]

Wishart's claim that his focus is on the 'structure and structuring of sounds themselves' raises the important question of the way in which the musical processes in his compositions are perceived and understood, and the relationship they have to the musical material itself. The claim appears to contradict to some extent his deliberate choice of sounds for their extra-musical associations, since it is arguable that the sounds in his works are too 'pregnant' (to use Manoury's term) to be understood simply in terms of articulating a musical structure. As noted with regard to Denis Smalley's compositions in chapter three, unfamiliar sounds, or sounds presented in an unfamiliar context do not always submit to structuring as abstract units of a musical argument: some sounds, by virtue of their strength as sonic entities, impose themselves on the music in a disproportionate way.

For Wishart's claim to have credence, therefore, his focus on the structure and structuring of sounds must take into account the effects of such associations, especially in view of his desire to communicate with the 'average intelligent listener'. As discussed earlier, the musical processes in 'Red Bird' and 'Anna's Magic Garden' function as much

on the level of the associations, or sound-images, as they do on the level of the sounds themselves: the distinction between the two levels is, in effect, artificial (except insofar as an inexperienced listener - ie. one who is unfamiliar with the use of concrete sounds in music - might focus more on the associations than on the subtleties of the sounds and their transformations). Similarly, the social connotations and the human emotions implied through Wishart's use of the voice in the 'Vox' pieces are intended to be perceived and understood directly through the sounds, rather than as a result of the performance situation.

The heart of the question lies in Wishart's conception of sound, and his notion of music as the 'art of organising sound events in time'. Unlike both Smalley and Harvey, whose musical preoccupations lie with the acoustic qualities of sounds, and the perception of their internal structures which has been facilitated by the development of technology, Wishart's concern is with sounds as a means to an end. Music, or 'sonic art', for Wishart, involves creating a perceptible 'intention' behind the organisation of sounds in time - in other words, to make an 'utterance' out of every sound or combination of sounds. What distinguishes this radical concept from the idea of Romantic self-expression is the material itself. It remains to be seen whether or not an increasing acceptance of this kind of musical material within the mainstream of contemporary composition will, in time, detract from the contentiousness of Wishart's vision.

CHAPTER SIX

Conclusion

It is dangerous to talk of a common language of electroacoustic music, even fifty years after the first experiments in the genre. However, common themes do emerge from a study of the work of these three electroacoustic composers, which are not only of a general nature to do with the fundamental aesthetic or technical questions discussed in the opening chapter. Rather, these common themes arise from the idiosyncratic ways in which all three composers address the fundamental questions through their music, either consciously or unconsciously, and have as much to do with common musical and artistic principles which are recognisable in the works of instrumental composers as well.

The opening up of the sonic continuum through increasingly sophisticated methods of recording, synthesis and manipulation of sounds has presented arguably the most consistent of all the challenges to the electroacoustic composer as well as to his audience. Just as conventional composers struggled in the early decades of this century, and continue to struggle, with the liberation of music from the structural principles of diatonic harmony, so electroacoustic composers have struggled to organise and articulate the larger concept of the sonic continuum in artistically satisfying and musically meaningful ways. In

both cases, the solutions found by composers to these questions have presented equal challenges to the listener, whose basis for understanding 'what is music' has had to evolve at an unprecedented rate.

Ideas of gesture and texture, and of high- and low-level focus have taken their place in the vocabulary of musical discussion, whether of electroacoustic or conventional music, alongside the traditional concepts of melody, harmony and rhythm. Does this denote a real change in the way we are learning to listen to and construct music, or is it merely a reinterpretation of the most universally meaningful features of music, given the diversity of styles which now exists within our own culture, and the ever-increasing familiarity we have with music from other cultures? There is no doubt that the theories put forward by composers, not least the three discussed in this thesis, appear to challenge some of the traditionally accepted concepts of music. For example, Wishart's creation of the concepts of 'utterance' and 'landscape', Smalley's definitions of 'motion types' and 'motion style', and to a lesser extent Harvey's explanations of musical activity-within-stasis all seem to suggest different musical concerns from the traditional ones.

On the other hand correlations can be found between these ideas and more familiar concepts, which imply that any difference is a matter of emphasis and terminology rather than a fundamental change: as noted in chapter three, a 'convergent sound stream' as described by Denis Smalley is essentially a passage of contrary motion. Regarding 'direct utterance' and 'conventionalised utterance', Wishart himself refers to the communicative power of music (traditional or otherwise) as a

manifestation of 'utterance', implying an emphasis on the fundamental importance of communication through music of whatever genre. In the case of Jonathan Harvey, his metaphysical preoccupations aside, few new terms are necessary: his music is most appropriately understood in terms of melody and harmony, concepts which he himself uses when describing his investigations of the inner structure of sounds. The questions of high- and low-level focus which all three raise directly or indirectly apply as much to cantus firmus, counterpoint, tonality (eg. harmonic rhythm) or serial technique as they do to 'motion style', linguistics, or spectral structure.

Trevor Wishart's suggestion of the existence of an 'average intelligent listener', typified perhaps by the student subjects in Michael Bridger's analysis experiments, hints at the real nature of the problem posed by the opening up of the sonic continuum - how to comprehend and control more than the primary impact of unfamiliar sounds in a composition. The problem exists to some extent in conventional contemporary music as well, although the use of familiar instruments (in however unfamiliar a fashion) in a familiar performance-situation does at least guarantee a certain point of contact between composer and listener. Whilst it may be argued that electroacoustic music involving live instruments has similar guarantees, the same cannot be said of music for tape alone. Given that an electroacoustic composer explores a wider area of the sonic continuum than does a conventional composer, it becomes apparent that his choice and consequent use of particular sounds will be crucial factors in deciding the levels on which his music may be understood.

A composer's choice of sound material for a particular composition, and his preference (if any) for a certain kind of sound material in general, define the sonic parameters of his music and characterise it in relation to the sound worlds selected by other composers. An electroacoustic composer's personal 'voice', as it is perceived by the listener, has much to do with this choice. As we have seen in the preceding chapters, Smalley, Harvey and Wishart have remained relatively consistent in their choice of sound material, and the music of each is recognisably stamped with the signature of its composer as a result. After fifty years of research and development in the technology of electroacoustic music, and with the knowledge of fifty years' accumulated electroacoustic repertoire, composers are now able to make much more informed choices about the sounds and sound relationships they wish to explore than their predecessors in the medium. The continuum is no less of a mystery, but the prospect of exploring it is perhaps less daunting as a result.

The pioneers of electroacoustic music were well aware of the artistic desirability of creating integrated sound worlds within pieces of music, and related knowledge from the sphere of information theory confirmed the intellectual need to limit the degree of novelty within a given communication (musical or otherwise). However, the research undertaken from the earliest experiments of Schaeffer onwards to discover the qualities of sounds which have most *perceptual* relevance to human listeners has had possibly the most profound influence of all on both the development of the technology used in the manipulation and synthesis of sounds and also the establishment of a common aesthetic. The very necessity of articulating the sonic continuum has been reinforced by a growing understanding of the perceptual processes

involved in hearing and comprehending sounds, and research in this field has contributed not only to a clarification of compositional aesthetic but, on a more practical level, to the means of realising it as well.

This common aesthetic couples the desire, if not the obligation felt by many composers to take advantage of the new sonic resources opened up to them - and to expose the limits of the available technology in so doing - with the requirement to ensure that the sound world they create is perceptually valid and contained within an appropriate and comprehensible structural framework. Expressed in such general terms, this common aesthetic can be seen to be applicable to more conventional contemporary music as well, the only distinction being the degree to which the composer himself is responsible for the perceptual validity of the sounds in the piece (assuming that the perceptual validity of conventional instrumental sounds may be taken for granted).

It is important to note that perceptual validity in this sense involves not only the dynamically evolving spectrum of a given sound and its gestural significance in the context of other sounds, but also the extent to which the listener can relate the sound to his or her previous experience. This explains in part the widespread interest in the use of instrumental sounds, both live and sampled, in electroacoustic music. The familiar formats of voice/instrument(s)-plus-tape and voice/instrument(s)-plus-live electronics give the composer scope to explore a range of new sounds in relation to a perceptual 'given'. An interesting manifestation of this occurs in popular music, particularly jazz/rock styles, where the development of different kinds of 'controllers' (such as the Yamaha wind controller) has enabled sounds

to be generated during performance which bear no morphological relation to the performer's physical gestures. In such cases, the notion of perceptual validity depends as much on newly-established cultural norms as it does on the intrinsic properties of the individual sounds.

A composer's personalised manifestation of the common compositional aesthetic is closely linked with his choice and use of sounds from the sonic continuum. Jonathan Harvey, for example, writes music in both the conventional and electroacoustic spheres and his explorations of the possibilities beyond instrumental sounds tend to be restricted to the continuum between recognisable instrumental identities - the 'fertile borderland' which lies between one familiar sound and another. Works like 'Bhakti', 'Ritual Melodies', 'Inner Light (3)' and 'Mortuos Plango, Vivos Voco' all take strongly idiosyncratic instrumental (or vocal) sounds as their starting point and, by doing so, ensure that new sounds are perceived and understood within a framework of coherent sonic identities: the perceptual validity of the new sounds is guaranteed by reference to already existing models.

By contrast, the occurrence of instrumental sounds in works by Denis Smalley is quite rare. Although his sound material sometimes originates from instrumental models, this relationship is usually not intended to be perceptible to the listener, and when he does use recognisable or live instrumental sounds, as in 'The Pulses of Time' or 'Clarinet Threads', the instrument is used to produce sounds which are quite unlike its normal repertoire. As has been demonstrated earlier, Smalley has developed a personal, highly individual but somewhat restricted repertoire of sounds and sound types in his compositions which lie outside the normal compass of both instrumental and concrete

sounds, though making reference to natural models through their morphological design.

The cultural effect on perceptual validity is particularly relevant when concrete sounds are used in a composition. Almost all concrete sounds conjure up associations and images in the listener's mind, which have a direct effect on the extent to which the sounds are perceived to integrate within the composition. As Philippe Manoury puts it (chapter one), certain sounds are 'pregnant' with meaning and impose more rigid structural constraints on the composer than 'neutral' sounds. A simple example is the sound of shattering glass used by Trevor Wishart in 'Red Bird' and 'Vox 4': its connotations are so strong that it can only be used effectively at a point of musical and dramatic climax or to imply a sudden change of musical direction - in 'Vox 4', the sound is used as a symbol of social breakdown, and appears at the end of a long section of increasingly agitated crowd sounds; in 'Red Bird', the sound again appears at the end of a crescendo, and serves to destroy the preceding scene of tranquillity and provide the impetus for the 'development' section which follows.

Wishart's preference for concrete sounds (and vocal sounds - the connection he makes between the two resources has been noted in chapter five) leads back to Schaeffer. When such powerful sonic images are used in a composition it is the individual sound objects themselves - the *objets sonores* - which will be understood as the lowest units of the structural hierarchy. Because of its associative implications and coherence as a perceptual entity, a recognisable concrete sound in a piece of electroacoustic music will resist description, or aural analysis in terms of its constituent partials. This is true, generally speaking, of

traditional instrumental timbres as well - as McAdams has observed, the mind appears to retain a pattern, or 'template' of a given coherent timbre which enables the ear to recognise the same timbre at different pitches, with different articulations, and so on. However, where instrumental sounds are associated with 'music' specifically, concrete (and vocal) sounds are burdened with a much wider range of associations. This being the case, the problem of bringing together diverse sound sources in a coherent musical structure for which there may be no precedent becomes very great. The difficulties encountered by Schaeffer, both in defining the characteristics of an *objet sonore* and in integrating dissimilar sound sources are still being encountered today.

The range of sound material used in electroacoustic composition is not always easily described in terms of individual sound objects, however. Sound masses generated by means of granular synthesis, such as those designed and articulated by Barry Truax in his compositions, are a good example. It is possible to compose a section of a piece, or even a whole piece out of a continuous granular texture which is shaped and moulded according to structural parameters on a higher level than that of the individual 'grains' of which the texture is made. In such a case, the question of whether the individual 'grain' is understood as a sound object in its own right, or as an equivalent to the individual partials which make up a concrete or instrumental sound, depends on the vertical density of the sound (that is, the number of oscillators generating 'grains' at any particular moment), and the length of each 'grain' (which determines the number of 'grains' heard per second). Given that the mind requires a certain length of time to recognise and remember a sound - a matter of microseconds for familiar instrumental

or vocal sounds, but longer for less familiar artificially generated sounds - it follows that the longer the grain, the more likelihood of its being perceived as a sound object in its own right and of its being understood as a coherent low-level structural unit.

Whatever the choice of sound sources, the composer is faced with the task of building relationships between different sounds in order to create a satisfying musical structure. All three composers under discussion are concerned with choosing or creating sounds which are similar enough to integrate or which can be made to integrate using today's advanced technology. Harvey varies in his approach. His works using commercial technology usually focus on the aspects of electronic instruments which can be incorporated into the traditional context of live instrumental performance associated with either classical or pop styles (his use of synthesizers and sound processing equipment in 'Madonna of Winter and Spring' and 'From Silence' has been noted in chapter four). The exception is his use of the Fairlight in 'Nachtlied', and the failure of this instrument to provide the sound quality necessary to perform the integrating function required is noticeable. When Harvey has had access to more sophisticated technology such as that at IRCAM, and the collaboration of technical experts such as Stanley Haynes on 'Mortuos Plango', Haynes, Denis Lorrain and Jean-Baptiste Barrière on 'Bhakti' and Jan Vandenheede on 'Ritual Melodies', Harvey's approach has centred on finding the most appropriate methods of sound analysis, synthesis and transformation/interpolation to integrate his chosen sound material, and on emphasizing the timbral integration through strong characterisation of musical motifs and gestures. For example, different methods were used to synthesize the different instrumental sounds in 'Ritual Melodies'

in order to preserve as accurately as possible the peculiar spectral makeup of each one, and interpolation procedures had to be written in order that the identities of each could be dissolved and transformed into others. At the same time, the monodic traditions of the instrumental models were underlined by the structure of the work, and the particular gestural profile of each melody in the cycle.

Trevor Wishart has, on several occasions, voiced his concern to find sound sources for his compositions which will integrate. In both 'Red Bird; a document' and his article on the composition of 'Vox 5', he makes reference to the desirability of finding 'similar' sound sources which will facilitate the interpolation process, and his comments on the trial-and-error process necessary in deciding the exact timing of a transformation are revealing. He notes, for example, that

> 'no matter how smooth an interpolation may be acoustically or mathematically, we are perceptually prone to make sudden leaps in our perception of unfamiliar objects....when perceiving a continuously changing object that we initially recognize, we continue to interpret it as the original object until a certain threshold is reached. At this point there is likely to be a sudden switch to the recognition of the new object.'[1]

Wishart's awareness of this phenomenon has guided him in both the timing of specific interpolation processes in his compositions and also the contextualisation of the sounds: as seen in chapter five, he is at pains to create a continuous 'landscape' in which sounds can metamorphose more convincingly, unless he particularly desires an abrupt juxtaposition of dissimilar sounds for dramatic effect. His preoccupation with the human voice as a resource has much to do with its ability to copy all but inharmonic sounds: 'Red Bird' and 'Vox 5' are full of instances where transformations are effected between vocal

and other natural sounds, the malleability of the vocal source ensuring a greater possibility of integration between the sounds.

Denis Smalley integrates his sounds as much through gestural or morphological correspondences as through spectral similarity. In 'The Pulses of Time', for example, the electronic 'bounced' sounds are quite unlike the clavichord sounds in timbre but they are related through Smalley's exploration of the attack-resonance shape which is inherent in one and imposed upon the other. In pieces using instruments or voices, Smalley attempts to provide the familiar sounds with a neutrality that will enable him to create links with new sounds: in 'Chanson de Geste', the vocal sounds consist of noise-like exhalations, pitched humming and percussive consonant-streams which combine effectively with strummed notes on the clavichord, the resonance of the tuning fork and the tapping of the wooden ruler and the stones, but which make little reference to words or language-like structures. Similarly, the clarinet part in 'Clarinet Threads' concentrates on isolated characteristics of the instrument to emphasize gestural or textural aspects of each section of the piece, from sustained tones and glissandi to key clicks, breath noises and high pitched flurries of notes. The traditional character of the instrument is not denied in the piece - the tape part is constructed largely from transformations of clarinet sounds and reflects the bias of the instrument towards the articulation of clear pitches and the suggestion of the harmonic system - but the nature of the solo part moves away from instrumental tradition and suggests a new kind of structural hierarchy.

Those instances, noted in chapter three, where Smalley fails to find the right context for certain instrumental sounds (such as the cymbal crash

or the piano chord) in the musical process, or where his transformation of sound material for use in different works is not sufficient to destroy the original identity of the source (such as the pipes melody in 'Pentes' and 'Ouroboros'), serve to illustrate the point made earlier: that in electroacoustic music recognisable sound objects or streams of sound objects tend to be perceived and understood as the lowest units of the musical structure. A sound which will not integrate into a piece of electroacoustic music because its timbral and cultural identity is too strong for the purpose for which it is intended, will impose itself on the listener's mind in the same way that a 'wrong note' would in a conventional piece of (diatonic) tonal music. The difficulties experienced by many listeners to serial and aleatoric music, and to contemporary instrumental music where tonal focal points might not be easily perceived, are similar: familiar sounds will seem to have a disproportionate importance in the piece if the relationship between them and less familiar sounds is not made clear.

In view of these observations, it is not surprising to find that the discovery or creation of new sounds *and the association of those sounds with a particular composer* has become a central issue in the field of electroacoustic music. Since an individual sound object is of such importance perceptually, there is an implication that the establishment of a valid new musical language is closely bound up with the establishment of a new, broadly acceptable range of sounds and sound types from the sonic continuum, the peculiar use of which will define the personal 'voice' of any given composer. In fact, it is the very choice of the sounds, as well as the use of them, which characterises the composer's musical identity. It has been noted throughout the present discussion that many composers, including Smalley, Harvey and

Wishart, are interested in the structural implications of sounds. Harvey develops melodies, harmonies and tonal structures according to the data from analysed spectra of instrumental sounds; Smalley relates morphologies on the level of the individual sound object to higher level structural demarcation; and Wishart, conscious of the associative dimension of many of the sounds he chooses, selects or discards sounds according to their perceived qualities relative to a particular idea he wishes to express.

Each composer builds his own musical language from the sounds he selects. This is confirmed by the fact that the written theories of Harvey, Smalley and Wishart relate directly to the sound material they choose in their compositions. Whilst Smalley is the only one to go to the extent of specifying rules for the categorisation and combination of sounds, all three composers effectively describe their own compositional preoccupations and musical objectives in terms of the possibilities they themselves find in the new sounds at their disposal.

In Harvey's case, this includes familiar instrumental sounds - his musical language seems the most conventional of the three precisely because of this, even though it stretches the conventional parameters of pitch, harmony and timbre by exploring the tension arising from interchangeable instrumental identities. The compositional possibilities suggested to him by his understanding of a new 'artistic ideology' (see chapter two), principally through serialism and electroacoustic music, are specifically to do with a new conception of musical material, from symmetrical harmonies and motifs to electronically transformed acoustic sounds.

At the opposite end of the spectrum, Trevor Wishart's choice of sound material and the musical language he has developed around it are possibly the most contentious of the three, the most likely to provoke the response that 'this is not music'. His written theories take as their starting point the assumption that there is no such thing as an unmusical sound event, and he deliberately sets out to establish alternative criteria for musical expression based on this assumption. His suggestion of the term 'sonic art' as a substitute for 'music' is indicative of this approach: he views the term as a 'convenient fiction' to spare the feelings of those who resist a broader definition of music, whilst arguing a case for the expansion of the idea of 'music' to include alternative sound material and the new languages which it inspires.

* * *

Having established that the new sounds of electroacoustic music are crucial in defining the new languages of the medium, it must be emphasized that these new sounds are themselves dependent for their realisation on the technology available to the composer. As Wishart writes:

> From the final quarter of the twentieth century, it now seems clear that the central watershed in changing our view of what constitutes music has more to do with the invention of sound recording and then sound processing and sound synthesis than with any specific development within the language of music itself.[2]

In order to understand the musical language of any particular electroacoustic composer, therefore, it is important to assess the nature of his relationship with the technology and the extent to which this determines his musical material. The speed at which technology is

superseded means that composers may risk seeing their works dated by the very equipment used to realise them, and it is necessary to distinguish between those areas where the influence of the technology has been profound and transcends immediate new developments, and others where changes in instrument design or improvements in resolution affect only superficial aspects of the music. It is also important to distinguish between the results of inadequate technology and the results of lack of imagination or aural discernment on the part of the composer. A composer's understanding of the capabilities of the technology he uses, and his own judgement regarding interesting sounds and sound quality, will be reflected in his compositions. As noted in chapter one, the equipment is musically neutral but functionally biased, so the composer must either choose the kind of technology whose functions are suitable to his purposes or learn to maximise the potential of a given system or instrument within the framework of a composition.

Both of these choices have been exercised by Jonathan Harvey. In 'Nachtlied', for example, the resolution of the Fairlight was not sufficiently high to allow the kinds of subtle transformations of sounds typical of 'Mortuos Plango' or 'Bhakti', but Harvey took full advantage of the facilities available so that the piece is effective even within the limitations of the instrument and despite the relatively poor sound quality. In this typically instrumental composition, the tape part fulfils its function in instrumental terms and focuses principally on simulating melodic fragments and harmonies from the voice and piano. Timbral manipulations are limited, and do not carry the weight of the spiritual metaphor as they might in other works, so in this case, an updated version would improve the sounds in the tape part but would not alter

radically the effect of the piece. For 'Ritual Melodies', on the other hand, Harvey demanded precise synthesis and interpolation procedures from his assistant Jan Vandenheede at IRCAM in order to achieve both the timbral richness and the kinds of transformations he needed. Although the argument of the piece is expressed through the working out of clearly characterised melodies, it is the instrumentation of the melodies and the timbral subtlety of their transformations which carry the work's intended meaning. It is interesting to consider whether or not the piece would have failed if it had been realised with less sophisticated technology, or with the assistance of a less skilled technical expert: Harvey's own skill is evident in the melodic writing alone, but there is no doubt that the *raison d'être* of the piece lies in the timbral manipulations, the detail of which was dependent entirely on the software written especially for the piece.

In Wishart's case, the choice of technology has been largely a matter of expediency. As a freelance composer, he is a relatively rare phenomenon (at least in the UK), and his access to anything other than commercially available, reasonably priced equipment has been limited. The effect of this has been noted in chapter five with regard to his composition 'Vox 6': the work falls uncomfortably between two stools, being neither an 'authentic' piece of pop music (despite its idiom) nor a satisfying 'classical' electroacoustic piece simply by virtue of the quality of the sounds used.

Whilst Wishart's light-hearted attitude to this deficiency might imply a lack of concern about sound quality relative to the desirable immediacy of his access to CDP and MIDI sequencing technology, the evidence provided by his IRCAM-produced work 'Vox 5' is to the contrary.

The kinds of articulations and sound transformations effected in this piece, through the use of the Phase Vocoder in particular (with necessary software written by Wishart himself), show the workings of an acute ear and an active imagination, quite apart from an aptitude for programming. His earlier, analogue works also reveal this sensitivity: the powerful images of 'Red Bird' in particular show the results of painstaking work in the studio. In the light of this, the problem of 'Vox 6' seems more that the material and the idiom are mis-matched, and the effect is one of parody whether Wishart intends it or not.

An interesting case is thrown up by the set of dance pieces on which Wishart is currently working.[3] These are intended to be orchestral works, but so far exist only in MIDI realisations and the three written to date are all based on different rhythmic and pitch motifs from 'Vox 3' (see cassette of examples). As one might expect, the 'dance' types are of a typically upbeat, funky nature, especially in the third piece which is reminiscent of 'Vox 6' in this respect. The pieces present something of a paradox: the idea behind them appears to be the exploration of complex rhythmic counterpoints on a large instrumental scale in a popularly accessible idiom; however, their rhythmic complexity makes it difficult to imagine a successful orchestral rendition and the style is hardly suggestive of the conventional orchestral medium - on the other hand Wishart acknowledges the MIDI realisation to be a poor (and consequently 'transitional') substitute. It is tempting to think that the idea behind the pieces is of more substance than the music itself: in comparison with 'Vox 3', where a similar collection of rhythmic games is presented through an appropriate medium of extended vocal techniques and live electronics, these

MIDI/orchestral dances suggest another possible mis-match of sound material and idiom.

Whilst it is a reasonably straightforward matter to understand both Harvey's and Wishart's attitude towards, and use of the various technologies represented in their respective compositions, and the implications these have had for their musical material, it is more difficult to assess Smalley from this point of view. As his comment, quoted in chapter three, regarding the composition of 'Pentes' revealed, the necessity of realising a work in a very restricted amount of time has often dictated the compositional process in a direct way. In such cases, Smalley's particular preference for a certain kind of sound material coupled with a pressing deadline has resulted in the re-use of sound material from previous works to minimize the necessity of generating new material. The pattern of his composition has been to generate new sounds on visits to other institutions which can be incorporated into new compositions on his return to the studio at the University of East Anglia: 'Clarinet Threads', for example, uses material generated at the University of Toronto (Computer Systems Research Institute), the GRM digital studio, the Finnish Radio Experimental Studio and the University of Birmingham Electroacoustic Music Studio.[4] The result, demonstrated in chapter three, has been that the resulting 'tape library' features to some extent in almost every new composition.

This differs significantly from Harvey's predilection for bell-like sounds or instrumental sounds from Eastern musical cultures, and from Wishart's preoccupation with the human voice. In these cases, the sounds themselves are not exclusive to the two composers, although the sound objects they build from them are recognisably their own. The

sound material has a certain neutrality by virtue of being common property. In Smalley's case, by and large, both the sound sources and the sound objects are distinctively his, with the effect that re-used material in different compositions can impose itself on the listener's memory and seem out of place, or appear disproportionately meaningful in a given passage of music. The pipes melody in 'Pentes' (a sound source not exclusive to Smalley but successfully integrated into his sound world in this piece) resists being used as a texture in 'Ouroboros' since, with knowledge of the earlier piece, the ear focuses in on this sound object irrespective of its relatively minor function in the later work. Even if 'Ouroboros' were to be heard before 'Pentes' it is arguable that the significance of the pipes melody in 'Pentes' and its inevitability in the musical process of that piece would call into question its use in the other work.

It is interesting to note that in several of Smalley's works using live instruments or featuring instrumental sounds in a distinct way (such as 'Clarinet Threads', 'The Pulses of Time', and 'Pentes') the instrumental sounds have the dual effect of providing a focus for the sound material within the piece and of broadening the associative scope of the music by reference to more conventional material (this does not apply to the piano and cymbal sounds in 'Darkness after Time's Colours' and 'The Pulses of Time' which function as one-off sound events within a broader musical texture). Smalley has been cautious only to use instruments whose sounds he feels lend themselves to electroacoustic manipulation (the clarinet is a good example), and his intention is that their sounds should be heard and understood 'electroacoustically': a possible interpretation of this is that the instruments are selected specifically to integrate with his pre-existing sound material rather than

for their potential for generating new sounds. The fact that the presence of these instrumental sounds effectively contextualises the electroacoustic material in these works and adds a new dimension to the repeated material from other pieces is indicative, perhaps, of a fertile musical imagination which is not always used to the full.

* * *

Of the refinement of Smalley's sound world there can be little doubt, a testament to his understanding of the various technologies at his disposal and his own creative priorities. Whilst the deliberate restriction of this sound world may be seen as a limitation of his musical language and as an indication of an occasional mis-judgement of context, Smalley's uncompromising attitude towards sound quality and morphological complexity sets a standard in his best works which is rarely equalled. His own comments, made with regard to the various acoustic spaces in which electroacoustic music is performed (see chapter three), reveal an important level on which this kind of music is often judged:

> The fifth spatial aspect is involved in the listening process where the music is transferred via loudspeakers into a new acoustic space - the listening environment. Neither the electroacoustic means of transferral nor the final space is neutral: both affect musical substance and structure. In performance it is this fifth aspect which may make or break a musical structure....This is the fragile art of sound diffusion. *In a medium which relies on the observation and discrimination of qualitative differences, where spectral criteria are so much the product of sound quality*, this final act becomes the most crucial of all.[5]
>
> (My italics)

The musical and perceptual necessity of creating or realising coherent, high quality sounds in electroacoustic music is such that any

compromise on the part of the composer is likely to undermine seriously the effect of the music. This has been demonstrated with regard to Wishart's 'Vox 6' and, to a lesser extent, Harvey's 'Nachtlied' (although it may be argued that the latter piece functions more as a piece of conventional instrumental music and the limitations of the Fairlight do not destroy the integrity of the music in instrumental terms). These exceptions aside, all three composers under discussion have contributed significantly to the standards expected of electroacoustic material, both in its conception and in its realisation.

As discussed earlier, the musical language of an electroacoustic composer is inextricably linked with his choice of sounds from the sonic continuum. The extent to which these sounds are selected from the conventional instrumental spectrum, and the reasons for selecting them thus have important implications for a composer's language, as we have seen with regard to Harvey in particular, but also with regard to Wishart and Smalley. It follows that the technology used to realise or create the sounds also has an influence on musical language, though the extent of this influence varies from composer to composer and from piece to piece, and also depends on circumstantial factors: Harvey's musical language in 'Madonna of Winter and Spring' and 'Ritual Melodies' is the same despite the different resources used whilst there are significant differences in language between Wishart's 'Vox 5' and 'Vox 6'; Smalley's language is consistent if only by virtue of its limited scope.

Whilst the individual musical languages of these three composers are distinguished by their choice and use of sounds and technologies, however, they reveal common musical preoccupations which transcend

the boundaries of the genre (as it is currently perceived) even while finding expression within it. Far from being a separate category of creative endeavour, electroacoustic composition can be seen to be a vital and integral part of Western musical tradition in its contemporary manifestation. Whilst the label 'electroacoustic' remains a valid one in denoting a different conception of musical material and a different approach to the compositional process between such composers and others who work within more traditional boundaries, it is possible to foresee a time when even this distinction will become superfluous.

NOTES

Introduction

1 D. Gareth Loy, 'The composer seduced into programming', Perspectives of New Music 19 (1980/81) p. 191.

2 David Burrows, 'On Hearing Things: Music, the World and Ourselves', Musical Quarterly Vol 66 no 2 (April 1980) p. 186.

3 David Burrows, op. cit., p. 191.

4 Max Mathews, Introduction to Foundations of Computer Music, ed. Roads and Strawn (MIT Press, 1985) p. ix-x

5 D. Gareth Loy, op. cit., p. 187

6 Artificial intelligence is another controversial issue: AI applications to music are the focus of considerable research.

7 Alexander Goehr, 'An answer to Pierre Boulez', Times Literary Supplement (10 June 1977) p. 703.

8 P Gaboury, 'Electronic Music: the Rift Between Artist and Public', Journal of Aesthetics and Artistic Criticism, no. 28 (1970) p. 347-8

9 Simon Emmerson, 'Introduction', The Language of Electroacoustic Music, ed. Emmerson (London: Macmillan, 1986) p.1.

10 In this thesis the term 'electroacoustic composer' is used to describe those who make use of electronic technology to synthesize or manipulate sounds in the preparation and/or performance of any or all of their compositions; it does not include composers of instrumental music who use computers to assist their pre-compositional calculations (although there are several composers, such as Xenakis, who fall into both categories and are therefore included in the term).

11 Jon H. Appleton, 'Electronic Music: Questions of Style and Compositional Technique', Musical Quarterly Vol 65 no 1 (January 1979) p. 104.

12 IRCAM - Institut de Recherche et Coordination Acoustique/Musique, Paris.
MIT - Massachusetts Institute of Technology, U.S.A.

Chapter One: Tools and Aesthetics

1 Gareth Loy, 'The Composer Seduced into Programming', Perspectives of New Music, vol 19 (1980-81) pp. 184-198.

2 The word 'tool' is used here, and throughout, not just to mean a physical implement, such as a pencil, but in the sense of a means to an end: thus a computer program and a synthesis technique are also tools.

3 John M Chowning, 'The Synthesis of Complex Audio Spectra by Means of Frequency Modulation', Journal of the Audio Engineering Society, Vol 21 no 7 (September 1973). Reprinted in Computer Music Journal (April 1977) pp. 46-54.

4 Jean-Claude Risset, 'Computer Music Experiments 1964-...', Computer Music Journal, vol. 9 no. 1 (1985), p. 12.

5 Iannis Xenakis, Musiques formelles: nouveaux principes formels de composition musicale (Paris, 1963); Eng. trans. as Formalized Music: Thought and Mathematics in Composition (Bloomington, Indiana, 1972), p. 8.

6 Iannis Xenakis, op. cit., p. 9.

7 Barry Truax, 'The POD system of interactive composition programs', Computer Music Journal, vol. 1 no. 3 (1977), pp. 30-39.

8 Curtis Roads, 'Introduction to Granular Synthesis', Computer Music Journal, vol. 12 no. 2 (1988), pp. 11-13.

9 Rodet, Potard & Barrière, 'The CHANT Project: From Synthesis of the Singing Voice to Synthesis in General', Computer Music Journal, vol. 8 no. 3 (1984), pp. 15-31.

10 J M Clarke, 'VOCEL. New implementations of the FOF synthesis method', Proceedings of the International Computer Music Conference 1988, pp. 357-363.

11 Rodet et al, op. cit., pp. 16-17.

12 R Berry, 'Experiments in Computer Controlled Acoustic Modelling (a step backwards?)', Proceedings of the International Computer Music Conference, 1988, pp. 333-348.

13 Pierre Boulez, 'At the ends of fruitful land...', Die Reihe, vol. 1 (1958), p. 19.

14 David Keane, 'At the Threshold of an Aesthetic', The Language of Electroacoustic Music, ed. Emmerson (London: Macmillan, 1986) p. 98.

15 Luciano Berio, Score (March 1956), quoted by Manning in Electronic and Computer Music (O.U.P. 1985) p. 79.

16 Karlheinz Stockhausen, 'Electronic and Instrumental Music', Die Reihe, vol. 5 (1961), p. 61.

17 Karl H Wörner, Stockhausen. Life and Work (1963, ed./trans. Hopkins, Faber, 1973) pp. 138-9.

18 The question of whether this has led to the development of a consistent musical style, or whether Smalley's output consists only of re-workings of the same piece, will be addressed in chapter three.

19 James A Moorer, 'The Use of the Phase Vocoder in Computer Music Applications', Journal of the Audio Engineering Society, Vol 26 (1/2) 1978, pp. 42-45.
The phase vocoder is described in more detail in chapter five.

20 This is the basis of information theory, which postulates that:

> one of the fundamental characteristics of the human receptor is the existence of a maximum limit to the flow of perceptible information. When this maximum flow is exceeded, the individual selects, with the aid of criteria derived from his previous experience, forms from the message presented to him. Forms are abstractions, elementary stages of intelligibility. If these criteria fail him, the individual is overwhelmed, left behind by the originality of the message; he loses interest.

Abraham Moles, Information Theory and Esthetic Perception (Urbana 1966), p. 74.

21 Philippe Manoury, 'The arrow of time', Contemporary Music Review vol. 1 (1984), pp. 134, 151.

22 Peter Manning, op. cit., p. 46.

23 Stephen McAdams, 'Spectral fusion and the creation of auditory images', Music, Mind and Brain: the neuropsychology of music, ed. Manfred Clynes (New York, 1982).

24 David Wessel provided several examples of this phenomenon in his tutorial on psychoacoustics at the International Computer Music Conference held at the University of Illinois in 1987.

25 Stephen McAdams, op. cit., pp 14.

26 Xenakis, op. cit., p. 132.

27 G M Koenig, 'The use of computer programmes in creating music', UNESCO report published in La Revue Musicale (Paris 1971) pp. 93-115.

28 Ibid., pp. 93-94.

29 Brian L. Schmidt, 'A Natural Language System for Music', Proceedings of the International Computer Music Conference (1986) pp. 119-125.

30 Henning Lohner, 'The UPIC System: A User's Report', Computer MusicJournal, vol. 10 no. 4 (1986), pp. 42-49; also G. Marino, J-M Raczinski and M-H Serra, 'The New UPIC System', Proceedings of the International Computer Music Conference (1990) pp. 249-252.

31 Manoury, op. cit., p. 134.

32 Pierre Boulez, Conversations with Celestin Deliege pp. 70-71.

33 Pierre Boulez, Conversations..., p. 106.

34 R Dannenberg and Hirofumi Mukaino, 'New Techniques for Enhanced Quality of Computer Accompaniment', Proceedings of the International Computer Music Conference (1988) pp. 243-249.

35 Barry Vercoe and David Cumming, 'Connection Machine Tracking of Polyphonic Audio', Proceedings of the International Computer Music Conference (1988) pp. 211-218.

36 MIDI, the Musical Instruments Digital Interface, is the standard communications protocol for interconnecting commercial digital synthesizers, samplers, signal processing equipment, etc.

37 The Hands feature in 'Touch Monkeys' by Michael Waisvisz. A description of the instrument is found in Waisvisz's programme note to the work in the programme to the International Computer Music Conference 1986, The Hague, pp. 74-76.

38 The Daton is used in Richard Boulanger's composition 'Shadows', for electronic violin and daton. A description of the instrument is found in Boulanger's programme note to the work in the programme to the International Computer Music Conference 1987, Illinois, p. 20.

39 Denis Smalley, 'The listening imagination', unpublished.

Chapter Two: Theories and Ideas

1 Denis Smalley, 'Spectro-morphology and Structuring Processes', The Language of Electroacoustic Music, ed. Emmerson (London: Macmillan 1986), pp. 61-93.

2 Peter Manning, Electronic and Computer Music (Oxford: Clarendon Press, 1985), p. 34.

3 Brian Fennelly, 'A descriptive language for the analysis of electronic music.', Perspectives of New Music, Vol 6 no 1 (Fall/Winter 1967), p. 80.

4 Denis Smalley, op. cit., p. 73.

5 Denis Smalley, op. cit., p. 75-76. Note that 'centric' motion types are not a new phenomenon in music: there are many instances in the conventional Western repertoire of repetitive or cyclical motifs used to suggest the idea of circling or spinning.

6 Denis Smalley, op. cit., p. 81.

7 Denis Smalley, op. cit., pp. 87-88.

8 Denis Smalley, op. cit., p. 92.

9 Denis Smalley, 'The Listening Imagination: listening in the electro-acoustic era', unpublished.

10 Pierre Schaeffer, Traité des Objets Musicaux (Paris: Editions du Seuil, 1966, revised 1977).

11 Trevor Wishart, 'Sound Symbols and Landscapes', The Language of Electroacoustic Music, pp. 41-60.

12 Ibid., p. 58.

13 Trevor Wishart, On Sonic Art (Imagineering Press, 1985).

14 Trevor Wishart, On Sonic Art p. 75.

15 Trevor Wishart, On Sonic Art pp. 121 - 169 (chapters 11 - 15).

16 Trevor Wishart, On Sonic Art p. 132.

17 Trevor Wishart, On Sonic Art p. 134.

18 Trevor Wishart, On Sonic Art p. 135.

19 Rodet, Potard & Barrière, 'The CHANT Project: From Synthesis of the Singing Voice to Synthesis in General', Computer Music Journal, vol. 8 no. 3 (1984), pp. 15-31.

20 Trevor Wishart, On Sonic Art, p. 152.

21 Trevor Wishart, On Sonic Art p. 156.

22 Paralanguage is
'the system of non-phonemic but vocal factors in speech, such as tone of voice, tempo of speech and sighing, by which communication is assisted'.
Oxford English Dictionary (2nd edition)

23 Trevor Wishart, On Sonic Art, p. 175.

24 Jonathan Harvey, 'New Directions: A Manifesto', Soundings, vol. 11 (1984), p. 12. Quotation taken from St John of the Cross.

25 Evelyn Underhill, Mysticism. A study in the nature and development of man's spiritual consciousness. (London: Methuen, 7th edition, 1918; reprinted New York, Meridian Books, 1955), p. x (preface).

26 Conversations with the author (unpublished).

27 For example, in 'New Directions...'

28 Paul Griffiths, 'Jonathan Harvey', New Sounds, New Personalities: British Composers of the 1980's, (London: Faber Music, 1985), p. 51.

29 Paul Griffiths, op. cit., p. 48.

30 Jonathan Cott, Stockhausen. Conversations with the composer. (New York: Simon and Schuster, 1973), p. 37.

31 Jonathan Harvey, The Music of Stockhausen (London: Faber & Faber, 1975), p. 92.

32 Jonathan Harvey, 'Reflection after Composition', Contemporary Music Review, vol. 1 (1984), p. 85.

33 Jonathan Harvey, 'The Mirror of Ambiguity', The Language of Electroacoustic Music, p. 185.

Chapter Three: Denis Smalley

1 Pierre Schaeffer, Traité des Objets Musicaux (Paris: Editions du Seuil, 1966, revised 1977).trans. Carlos Palombini (unpubl.), p 9.

2 In those of Denis Smalley's tape compositions which include parts for a live instrument, the instruments are used as sound sources to be articulated in reference to the tape part, and not in any way which resembles their traditional use in instrumental music. Similarly, works for live amplified instruments (or voices) are intended to be heard 'electroacoustically': to all intents and purposes, there would be no difference between a live and a recorded version.

3 Jonty Harrison, "Denis Smalley, EMAS and (electro-acoustic) music", Musical Times (August 1989) p 529.

4 Pierre Schaeffer, trans. Palombini, op. cit., p. 15.

5 Ibid., p. 16.

6 Marco Stroppa, "The analysis of electronic music", Contemporary Music Review, Vol 1 no 1 (1984) p. 179.

7 Denis Smalley, "Spectro-morphology", The Language of Electroacoustic Music, ed. Emmerson, (London: Macmillan, 1986), pp. 62-63.

8 Michael Bridger, "An approach to the analysis of electro-acoustic music derived from empirical investigation and critical methodologies of other disciplines", Contemporary Music Review, Vol 3 (1989) pp. 177-196.

9 Michael Bridger, op. cit., p. 147.

10 Bridger's analytical method is derived from that invented by Roland Barthes in 'S/Z', his study of Balzac's story 'Sarrasine',.published.in 1975.

11 Michael Bridger, op. cit., p. 154.

12 Ibid., pp. 154-155.

13 Michael Bridger, op. cit., p. 151.

14 Andrew Lewis, "Motion and the analysis of electroacoustic music: Denis Smalley's 'Vortex'", Electroacoustic Music, Vol 3 nos 3 & 4 (1988)

15 Barry Truax's work 'Riverrun', composed using granular synthesis, is one example of how the concept of fluidity might be conveyed in electroacoustic music.

16 Andrew Lewis, Electroacoustic Music, Vol 3 no 4 p. 11.

17 Andrew Lewis, Electroacoustic Music, Vol 3 no 4 p. 14.

18 Andrew Lewis, "Amplitude and frequency slope profiles in Denis Smalley's 'Pentes'", Electroacoustic Music, Vol 4 no 1/2 (1989) pp. 26-32.

19 Ibid., p. 26.

20 Ibid., p. 29.

21 Simon Emmerson, "Pentes: a conversation with Denis Smalley", Electroacoustic Music, Vol 4 no 1/2 (1989) p. 18.

22 Denis Smalley, sleeve notes to University of East Anglia recording of 'Pentes'.

23 Simon Emmerson, op. cit., p. 19.

24 Andrew Lewis, Electroacoustic Music, Vol. 3 no. 4 p. 11.

25 Denis Smalley, sleeve notes to University of East Anglia recording of 'Chanson de Geste'.

26 The sound world of pop music, which can be considered a branch of electroacoustic music, is an exception to this statement. However, as we have noted in chapter one, the acceptability of new sounds in the context of pop music is governed to a large extent by cultural factors rather than purely musical concerns.

27 Simon Emmerson, op. cit., p. 19.

28 The heritage of 20th-century formalism and the continuing propensity of composers to seek support in non-musical models have produced the undesirable side-effect of stressing concept at the expense of percept. Borrowing concepts from non-musical disciplines is common and can be helpful, but unless concept is cross-checked or mitigated by the ear it is always possible that the listener will be ostracized.
Denis Smalley, "Spectro-morphology..." pp. 62 - 63.

29 A recent addition is 'Piano Nets', a work for live piano and tape, which was not complete at the time of writing.

30 Preface to Smalley's score of 'Clarinet Threads'.

31 Pierre Schaeffer, trans. Palombini, op. cit., pp. 9-10.

Chapter Four: Jonathan Harvey

1 Rudolf Steiner, quoted by Jonathan Harvey in 'Reflection after Composition', Contemporary Music Review, Vol 1 no 1 (October 1984) p.85.

2 Jonathan Harvey, op. cit., p. 84.

3 Arnold Schoenberg, Style and Idea, p. 223.

4 Jonathan Harvey, The Music of Stockhausen, (London, Faber & Faber, 1975) p. 41.

5 Jonathan Harvey, 'Madonna of Winter and Spring: some structural and aesthetic thoughts' (unpublished) p. 3.

6 Jonathan Harvey, 'Inner Light (3)', Musical Times (February 1976) pp. 125-7.

7 Paul Griffiths, 'Jonathan Harvey', New Sounds, New Personalities: British Composers of the 1980's (London: Faber Music, 1985) p. 53.

8 Jonathan Harvey, 'Madonna of Winter and Spring: some structural and aesthetic thoughts', pp. 2-3.

9 Jonathan Harvey, 'New directions: a manifesto', Soundings vol 11 (1984) p.10.

10 Jonathan Harvey, 'Inner Light (3)', p. 125.

11 Translation by Jane Curran, University of Durham.

12 Jonathan Harvey, 'The Mirror of Ambiguity', The Language of Electroacoustic Music, ed. Emmerson (London: Macmillan, 1986) p.181

13 Jonathan Harvey, 'New directions', p. 9.

14 Paul Griffiths, op. cit., pp. 51-2. See Preface.

15 Rudolf Steiner, Knowledge of the Higher Worlds, trans. D. S. Osmond and C. Davy (London: Rudolf Steiner Press, 1969) p.165.

16 Conversations with the author (unpublished).

17 Jonathan Harvey, 'The Mirror of Ambiguity', p. 185.

18 Jan Vandenheede, 'Jonathan Harvey's Ritual Melodies', 1990, unpublished.

19 Jan Vandenheede, op. cit., p. 32.

20 Jonathan Harvey, 'Madonna of Winter and Spring', pp. 6-7.

Chapter Five: Trevor Wishart

1 Trevor Wishart, Red Bird; a document, (Universal Edition), p. 1.

2 Trevor Wishart, Red Bird; a document, p.6.

3 Trevor Wishart, Red Bird; a document, p.1.

4 Trevor Wishart, On Sonic Art, (Imagineering Press, York, 1985), p.75.

5 Trevor Wishart, On Sonic Art, p. 122.

6 Trevor Wishart, On Sonic Art, p. 135.

7 Trevor Wishart, Introduction to score of Vox 1 (Universal Edition, 1982).

8 Trevor Wishart, Red Bird; a document, pp. 8, 11.

9 Trevor Wishart, Red Bird; a document, p. 11.

10 Trevor Wishart, On Sonic Art, pp.130-131.

11 Trevor Wishart, Red Bird; a document, p. 4.

12 Trevor Wishart, Programme note to 1988 Henry Wood Proms, p. 6.

13 Dick Witts, 'Trevor Wishart and 'Vox", Musical Times (September 1988) p. 453.

14 Mark Dolson, 'The Phase Vocoder: A Tutorial', Computer Music Journal, Vol. 10 no. 4 (1986) pp. 14-27. (See also James A Moorer, note 19, chapter one).

16 Trevor Wishart, 'The Composition of Vox-5', Computer Music Journal, Vol. 12 no. 4 (Winter 1988) p. 21.

17 Trevor Wishart, programme notes to 1988 Henry Wood Proms, p. 5.

18 Trevor Wishart, 'The Composition of Vox-5', p. 26.

19 Trevor Wishart, op. cit., p. 21.

20 Trevor Wishart, On Sonic Art, p. 4.

Chapter Six: Conclusion

1 Trevor Wishart, 'The Composition of Vox-5', Computer Music Journal Vol 12 no 4 (Winter 1988) pp. 24-25.

2 Trevor Wishart, On Sonic Art (Imagineering Press, 1985), p. 4.

3 The pieces were in an unfinished state at the time of writing this section (April 1990).

4 See Smalley's programme note to 'Clarinet Threads' in the programme to the International Computer Music Conference 1986 (pp. 68-69).

5 Denis Smalley, 'Spectro-morphology', The Language of Electroacoustic Music, ed. Emmerson (Macmillan, 1986), p. 92.

APPENDIX 1

Recorded examples

DAT examples from Smalley's compositions

1 Vortex: 'metallic' sounds (as defined by Andrew Lewis)
- a) single metallic resonance
- b) superimposed sustained metallic resonances
- c) single, attackless, metallic-sounding complex resonance

2 Vortex: 'electronic' sounds (as defined by Andrew Lewis)
- a) highly energetic and mobile electronic sounds
- b) very bright, momentary electronic sounds

3 Pentes: first short-span descending profile

4 a) Pentes: Northumbrian pipes melody
b) & c) Ouroboros: Northumbrian pipes material

5 Metallic resonances from:
- a) Pulses of Time
- b) Vortex
- c) Clarinet Threads
- d) Wind Chimes

6 Rotating morphologies from:
- a) Vortex
- b) Vortex
- c) Pentes
- d) Pentes
- e) Clarinet Threads
- f) Pulses of Time

7 Noise-like trajectories from:
- a) Clarinet Threads
- b) Pulses of Time
- c) Vortex

8 Complex attacks from:
a) Pentes
b) Pulses of Time
c) Darkness after Time's Colours
d) Vortex

9 a) Pulses of Time: cymbal
b) Pulses of Time: piano
c) Darkness after Time's Colours: cymbal/piano

Cassette examples

Side A

1 Smalley 'tape reductions': a) Pentes
b) The Pulses of Time
c) Vortex

2 a) Melodies from 'Ritual Melodies' (Jonathan Harvey)
b) Sketches for spectral interpolations for 'Ritual Melodies'

Side B

1 Three Orchestral/MIDI dances (Trevor Wishart)

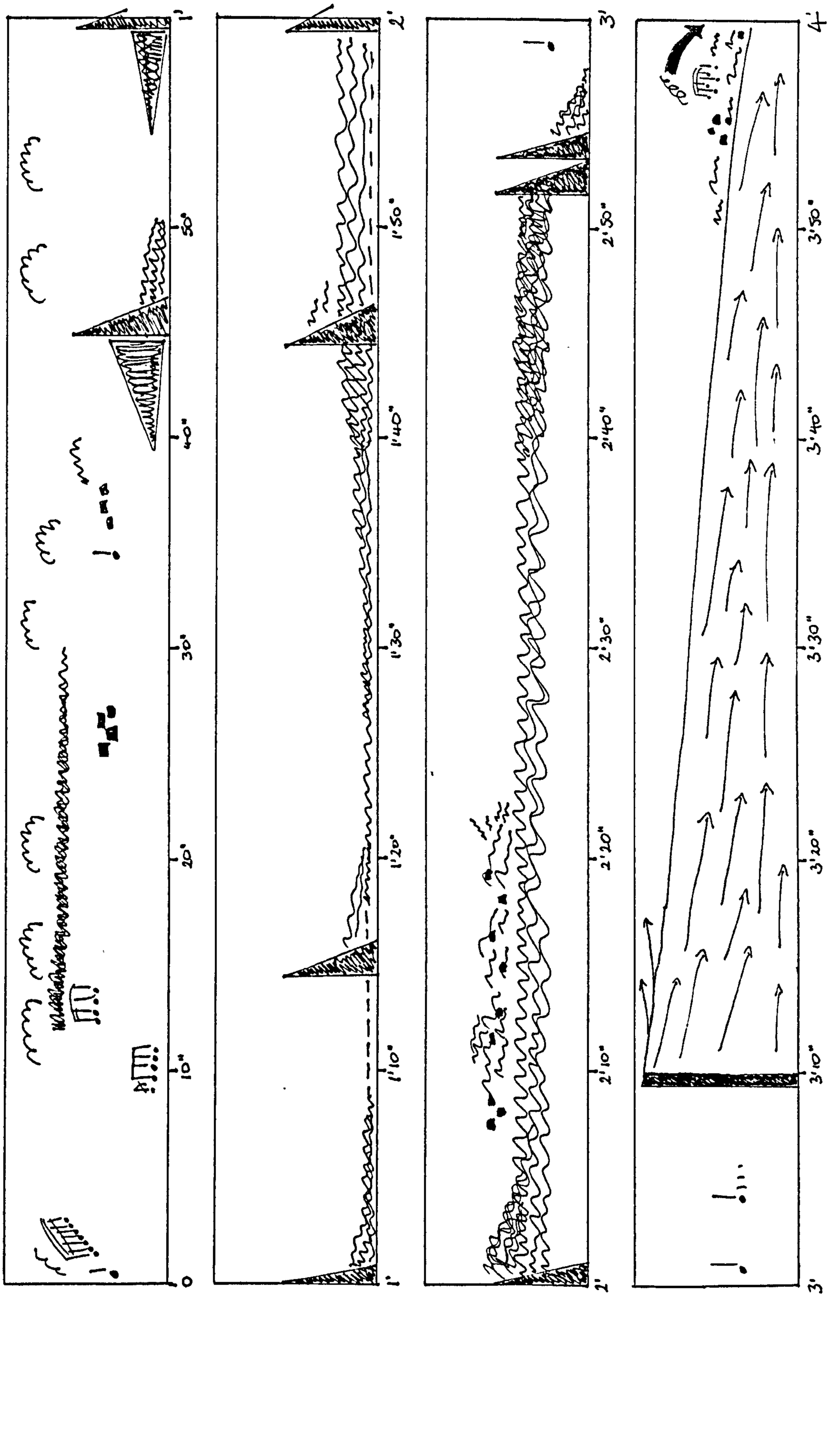
APPENDIX 1a

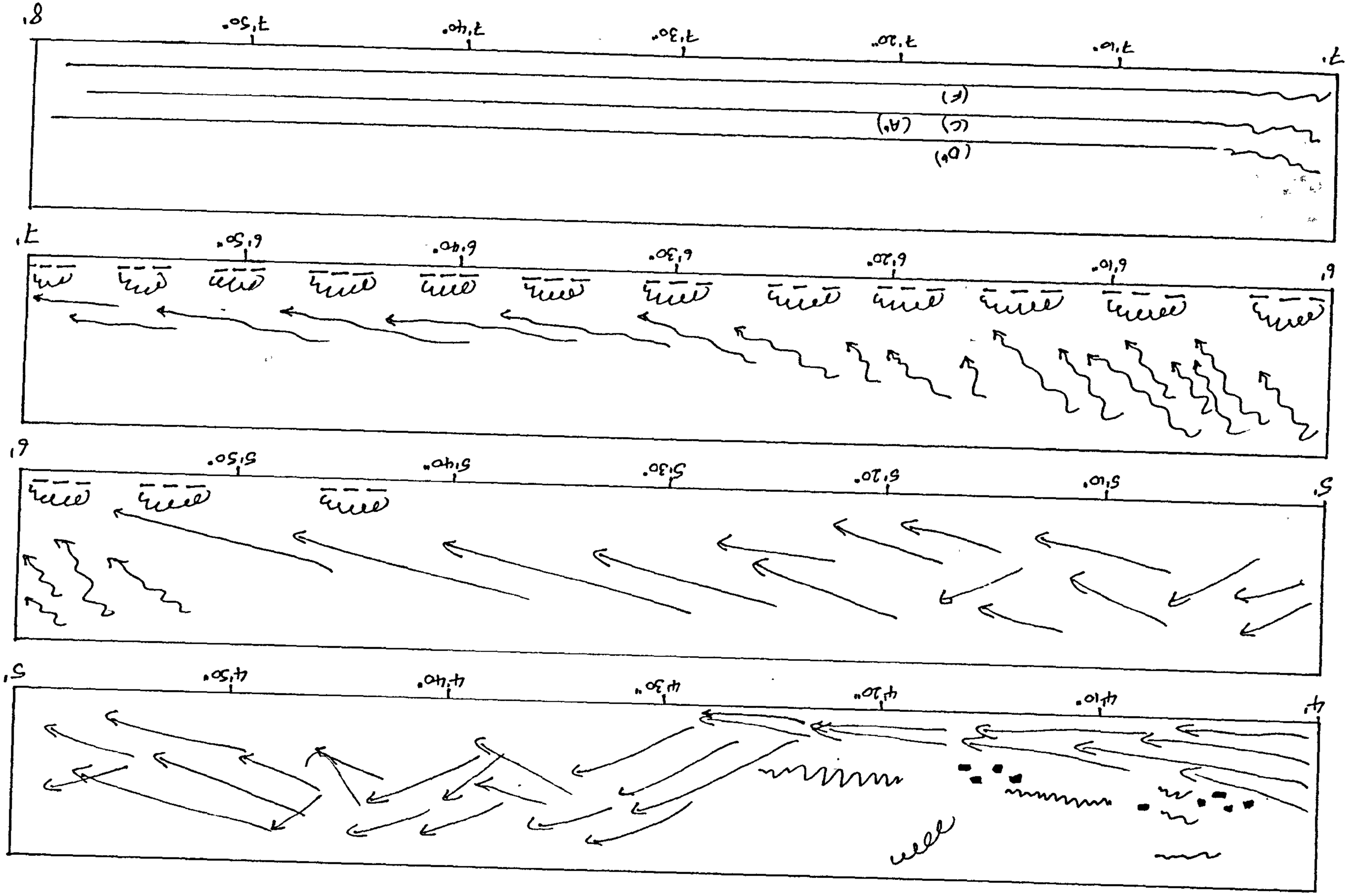
Diagrammatic scores, with legends, of: Pentes
Pulses of Time
Vortex

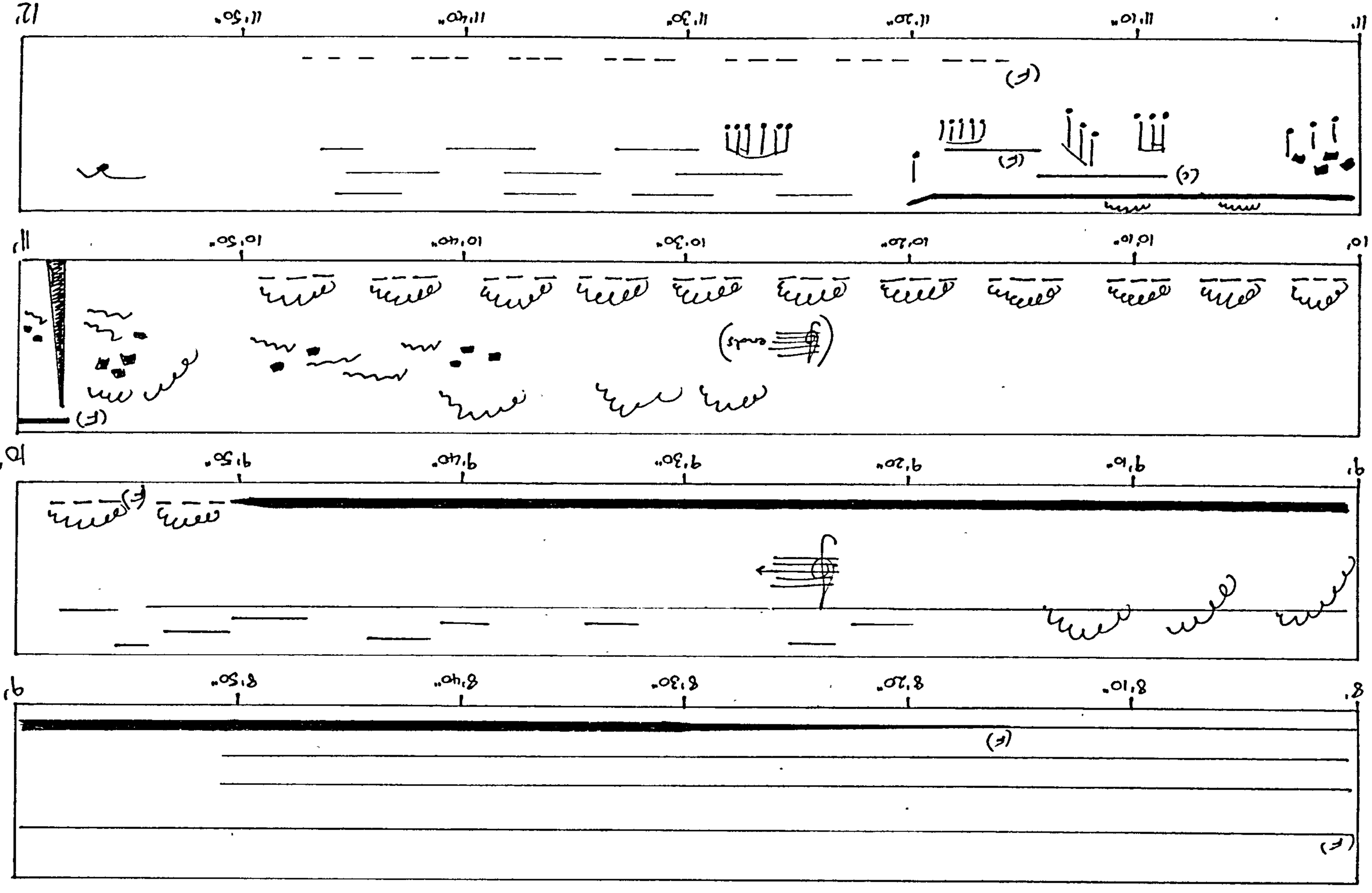
Listings for tape reductions

Observations on tape reductions

PENTES


1'
50"
40"
30"
20"
10"
0
2'
1'50"
1'40"
1'30"
1'20"
1'10"
1'
3'
2'50"
2'40"
2'30"
2'20"
2'10"
2'
4'
3'50"
3'40"
3'30"
3'20"
3'10"
3'

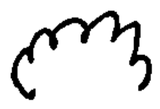

8'
7°50'
7°40'
7°30'
7°20'
7°10'
7°
(D')
(C)
(A')
(E)
7'
6°50'
6°40'
6°30'
6°20'
6°10'
6°
6'
5°50'
5°40'
5°30'
5°20'
5°10'
5°
5'
4°50'
4°40'
4°30'
4°20'
4°10'
4°
4'


8'
8'10"
8'20"
8'30"
8'40"
8'50"
9'
9'10"
9'20"
9'30"
9'40"
9'50"
10'
10'10"
10'20"
10'30"
10'40"
10'50"
11'
11'10"
11'20"
11'30"
11'40"
11'50"
12'

PENTES

Legend

 Discrete blips; stems give approximation of speed.

 Short-span pulsating sound, fading in and out of audibility, either high or low in pitch.

_ _ _ Pulsing low pedal note.

 Large attack of complex noise-based timbre, with short continuation.

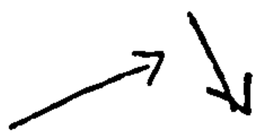
 Upbeat to large attack.

 Beginning of large attack with very long continuation.

 Continuous, rhythmically articulated texture.

Brief electronic sounds.

 Short-span high frequency noise-based gesture ("swoosh").

 Noise-based or drone-based glissando; arrows indicate pitch direction. Also white noise in steady pitch space.

 Pitched drones.or metallic resonances

 Pipes melody (based around notes F, G, A, C, D, Bb)

 Bird-call (same shape as )

PENTES (contd.)

Tape reduction

Large attacks from 45", 1', 1'15", 1'45", 2', 2,55", 10,55".

Rhythmically pulsed sounds with similar morphology and pitch area from 15", 7", 1'10", 10', 11', 11'50".

Discrete blips from 35", 3', 11', 3", 11'10".

Brief electronic sounds from 25", 37".

Downward spiralling textures from 6'10".

Rhythmically articulated texture from 2'30".

Discrete blips from 11'10", 4'10", 11'30".

Brief electronic sounds from 3'55", 4'05", 10'40".

Large attack at 3'10".

Noise-based glissando texture from 4'40".

Drones from 7' - 7'30".

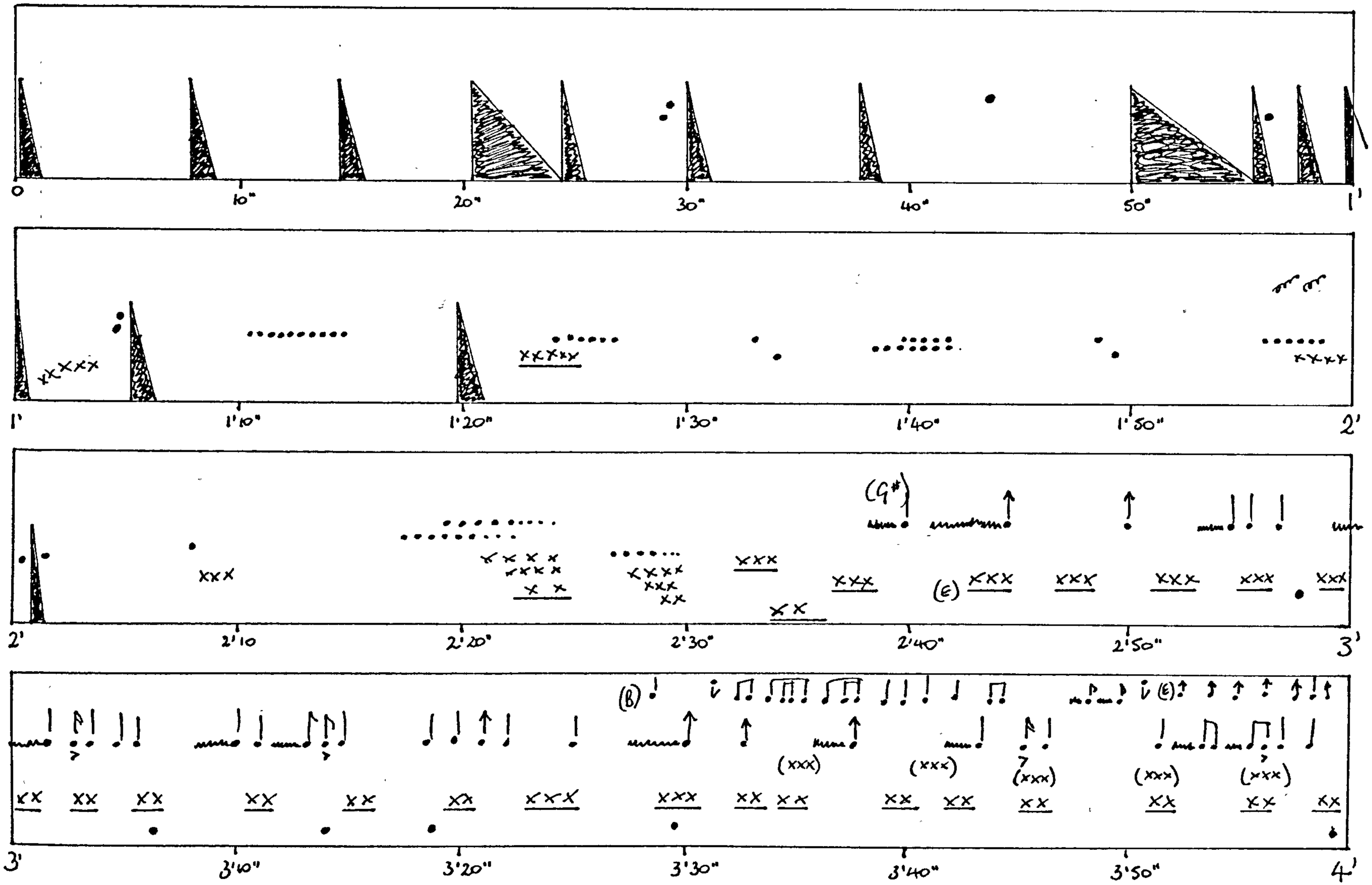
Large attack at 10'55".

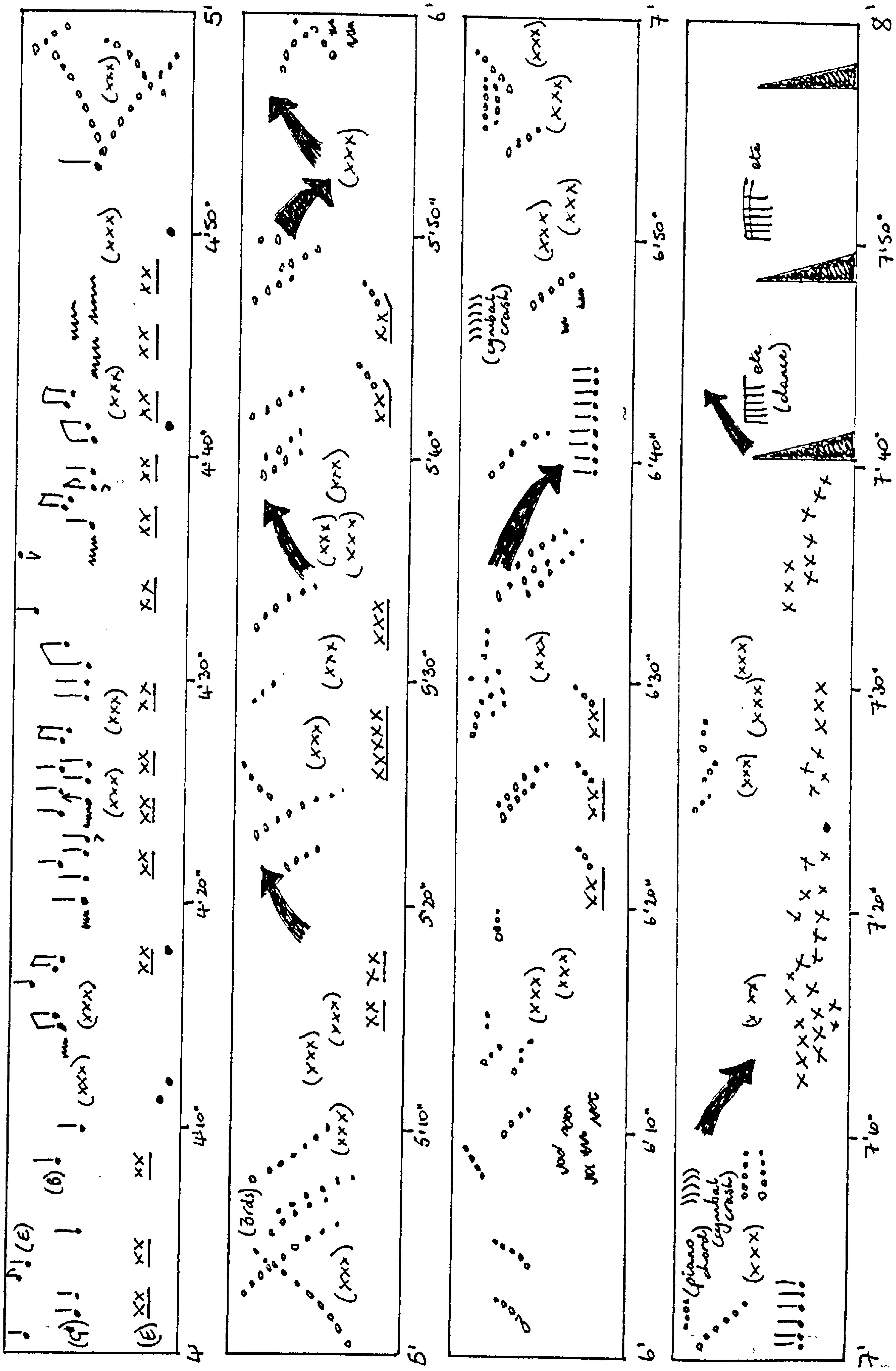
Metallic resonances from 11'30".

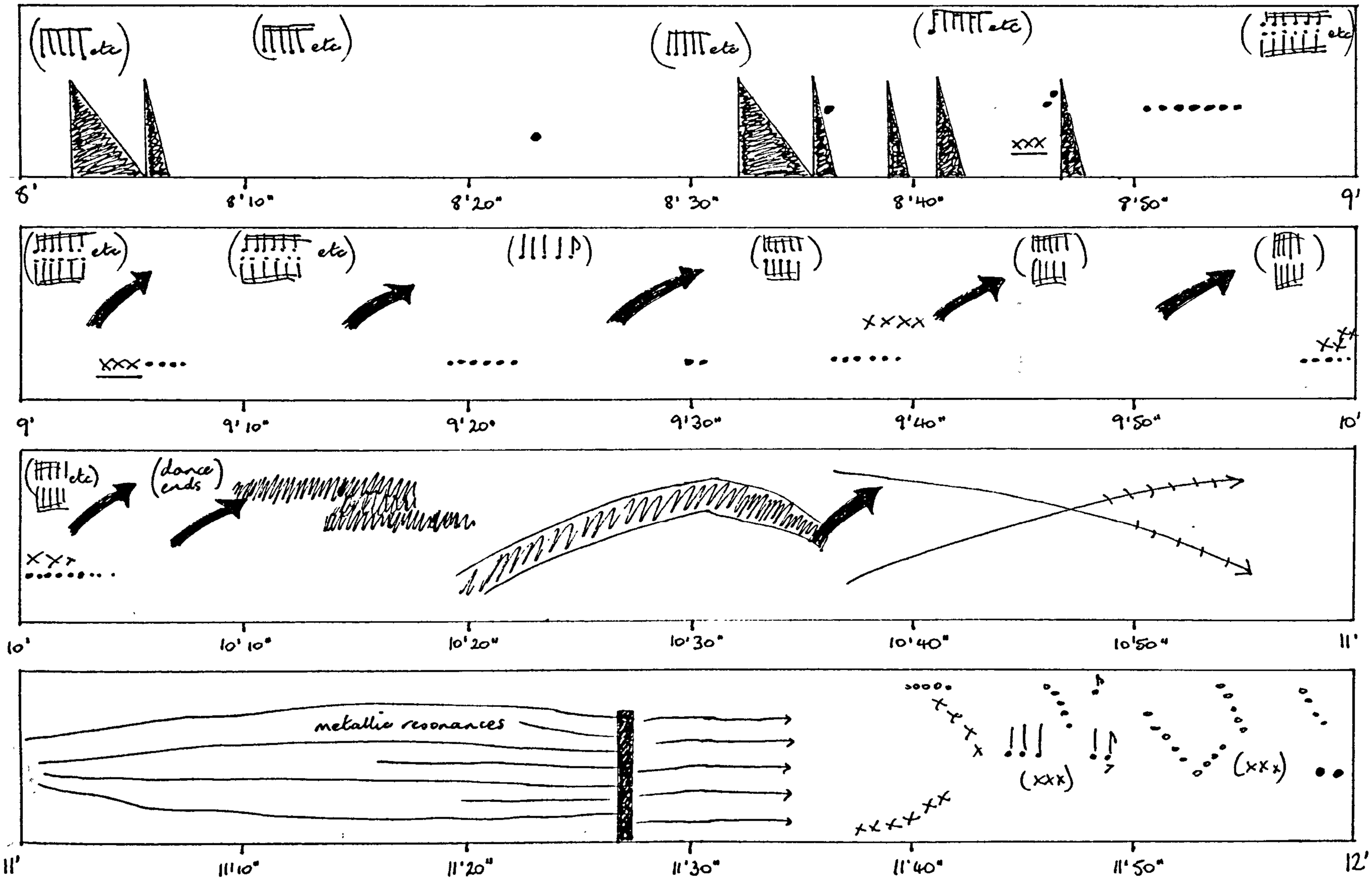
Upbeat from 40".

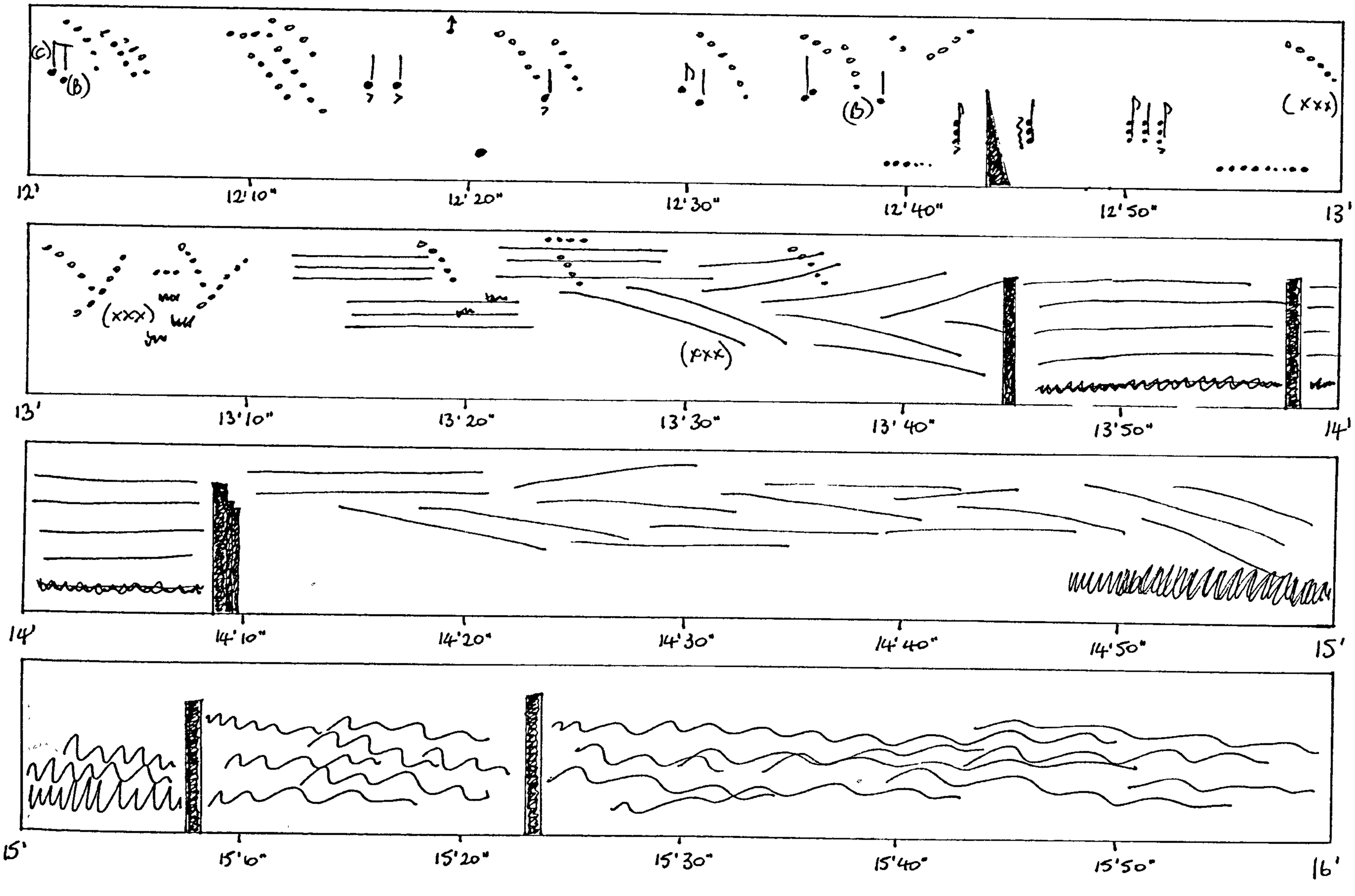
Brief electronic sounds from 4'15".

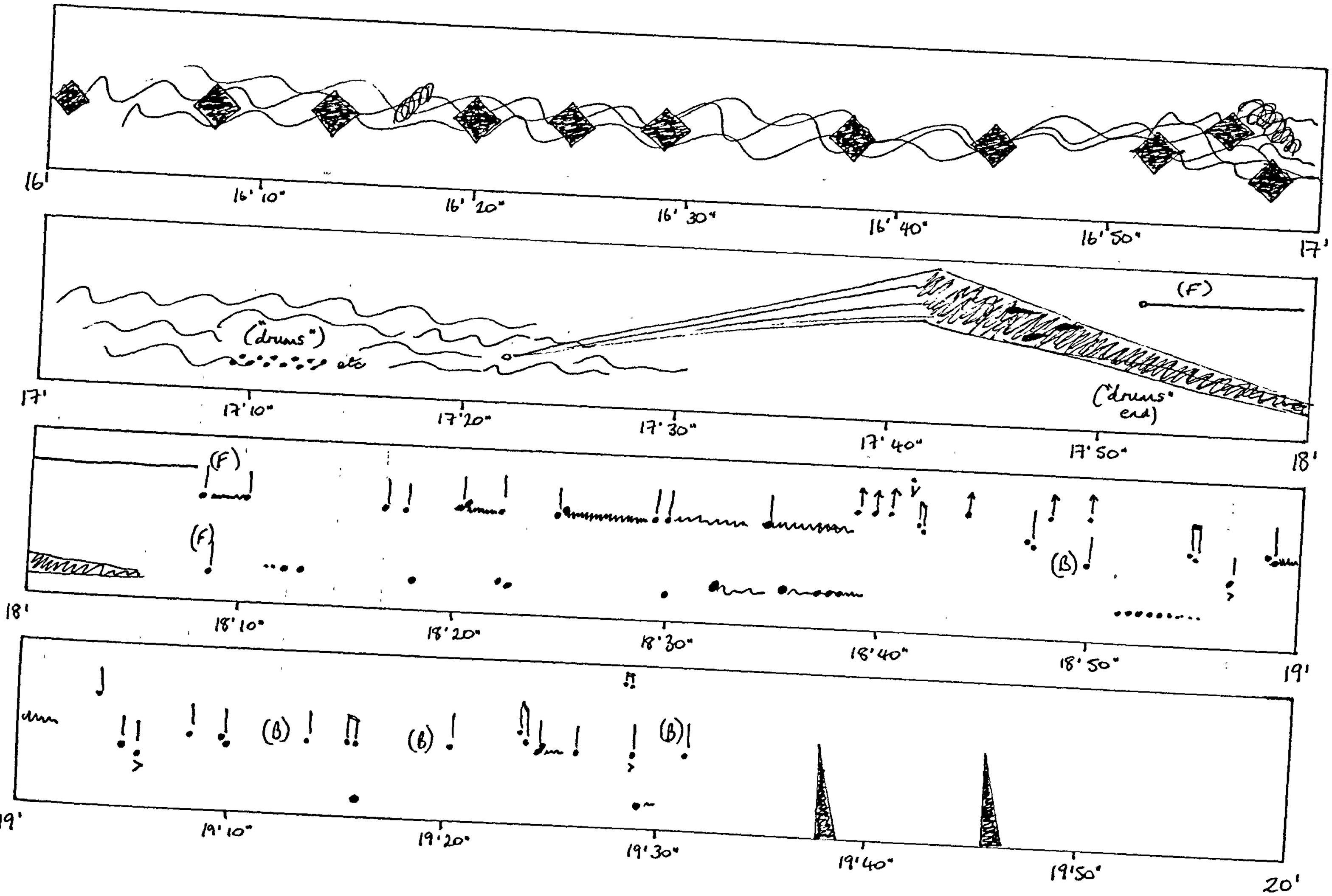
Pipes melody at 9'25".


0
10"
20"
30"
40"
50"
1'
1'10"
1'20"
1'30"
1'40"
1'50"
2'
2'10
2'20"
2'30"
2'40"
2'50"
3'
3'10"
3'20"
3'30"
3'40"
3'50"
4'
(G#)
(B)
(E)


4'
4'10"
4'20"
4'30"
4'40"
4'50"
5'
5'10"
5'20"
5'30"
5'40"
5'50"
6'
6'10"
6'20"
6'30"
6'40"
6'50"
7'
7'10"
7'20"
7'30"
7'40"
7'50"
8'
(E)
(B)
(3rds)
(cymbal crash)
(piano chord)
(dance)
etc
(xxx)


(etc)
(etc)
(etc)
(etc)
(etc)
xxx
8'
8'10"
8'20"
8'30"
8'40"
8'50"
9'
(etc)
(etc)
xxx
xxxx
9'
9'10"
9'20"
9'30"
9'40"
9'50"
10'
(etc)
(dance ends)
10'
10'10"
10'20"
10'30"
10'40"
10'50"
11'
metallic resonances
(xxx)
(xxx)
11'
11'10"
11'20"
11'30"
11'40"
11'50"
12'


(c)
(B)
(B)
(xxx)
12'
12'10"
12'20"
12'30"
12'40"
12'50"
13'
(xxx)
(xxx)
13'
13'10"
13'20"
13'30"
13'40"
13'50"
14'
14'
14'10"
14'20"
14'30"
14'40"
14'50"
15'
15'
15'6"
15'20"
15'30"
15'40"
15'50"
16'


16'
16'10"
16'20"
16'30"
16'40"
16'50"
17'
("drums")
etc
(F)
("drums" end)
17'10"
17'20"
17'30"
17'40"
17'50"
18'
18'10"
18'20"
18'30"
18'40"
18'50"
19'
(B)
19'10"
19'20"
19'30"
19'40"
19'50"
20'

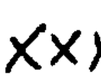
PULSES OF TIME

Legend

 Resonant attack of strings struck inside clavichord.

 Resonant string attack with longer continuation.

• Struck soundboard (also "drums" after 17').

 Unpitched electronic bounce/pulse.

 Low string resonance.

 "Vortical" gesture.

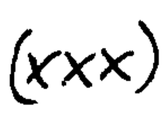
 Tremolando/strummed clavichord strings.

 Plucked string(s).

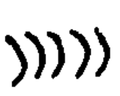
 Plucked string(s) with pitch bend.

 Pitched electronic bounce/pulse.

 Plucked string(s), stopped.

 Background electronic bounces.

 Short-term noise-based gesture ("swoosh")

 Cymbal crash, pulsed.

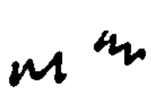
 Rhythmically articulated pulses ("dance").

 Noise-based texture.

 Drones/metallic resonances.

 Complex attack.

 Dynamic articulations in noise-based texture.

 Brief electronic sounds.

PULSES OF TIME (contd.)

Tape reduction

Unpitched pulses and soundboard knocks from 1'23".

Unpitched pulses and soundboard knocks from 9'05".

Soundboard knock from 45".

Rapid soundboard knocks from 1'10".

Unpitched pulses from 1'02", 1'58", 2'20", 2'35" (+ low string resonance), 2'30".

Tremolando string from 2'55".

Low string resonance from 2'50".

Pitched electronic bounces from 4'55".

Downward "swoosh" from 5'50".

Electronic fragments from 6'10".

Piano chord from 7'.

Dance rhythm and clavichord string attacks from 8'45".

Noise-based texture from 10'20" - 10'30".

Glissando drones from 10'40" - 11'.

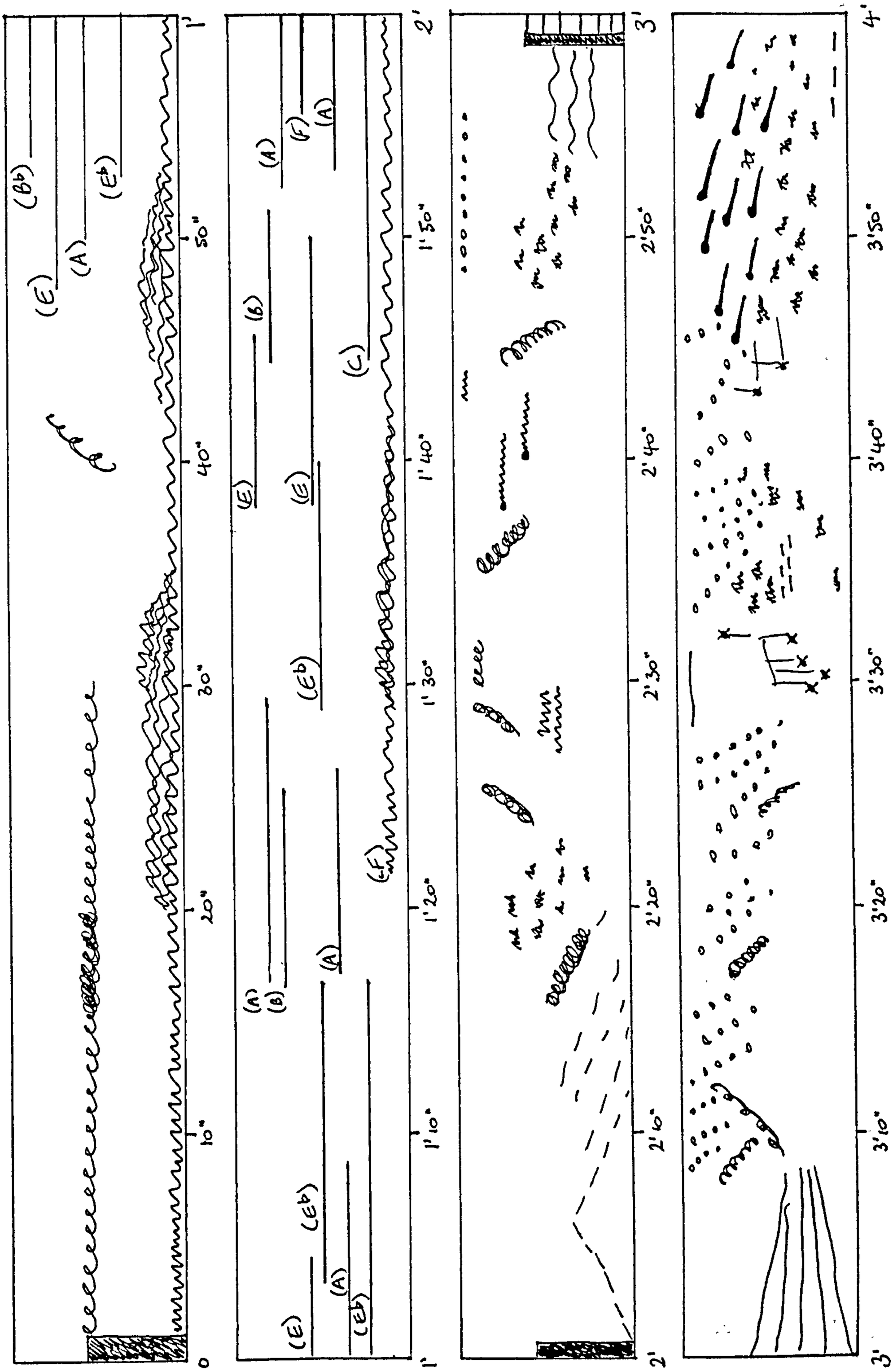
Metallic resonances from 11'10", 13'10".

Clavichord string attacks short/long from 20" - 25".

Complex attacks (+ metallic resonances) from 11'27", 13'45", 13'58", 14'10", 15'08", 15'25".

"Drums" and noise-based texture from 17'10" - 17'40".

VORTEX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50"
40"
30"
20"
10"
0
2'
1'50"
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1'30"
1'20"
1'10"
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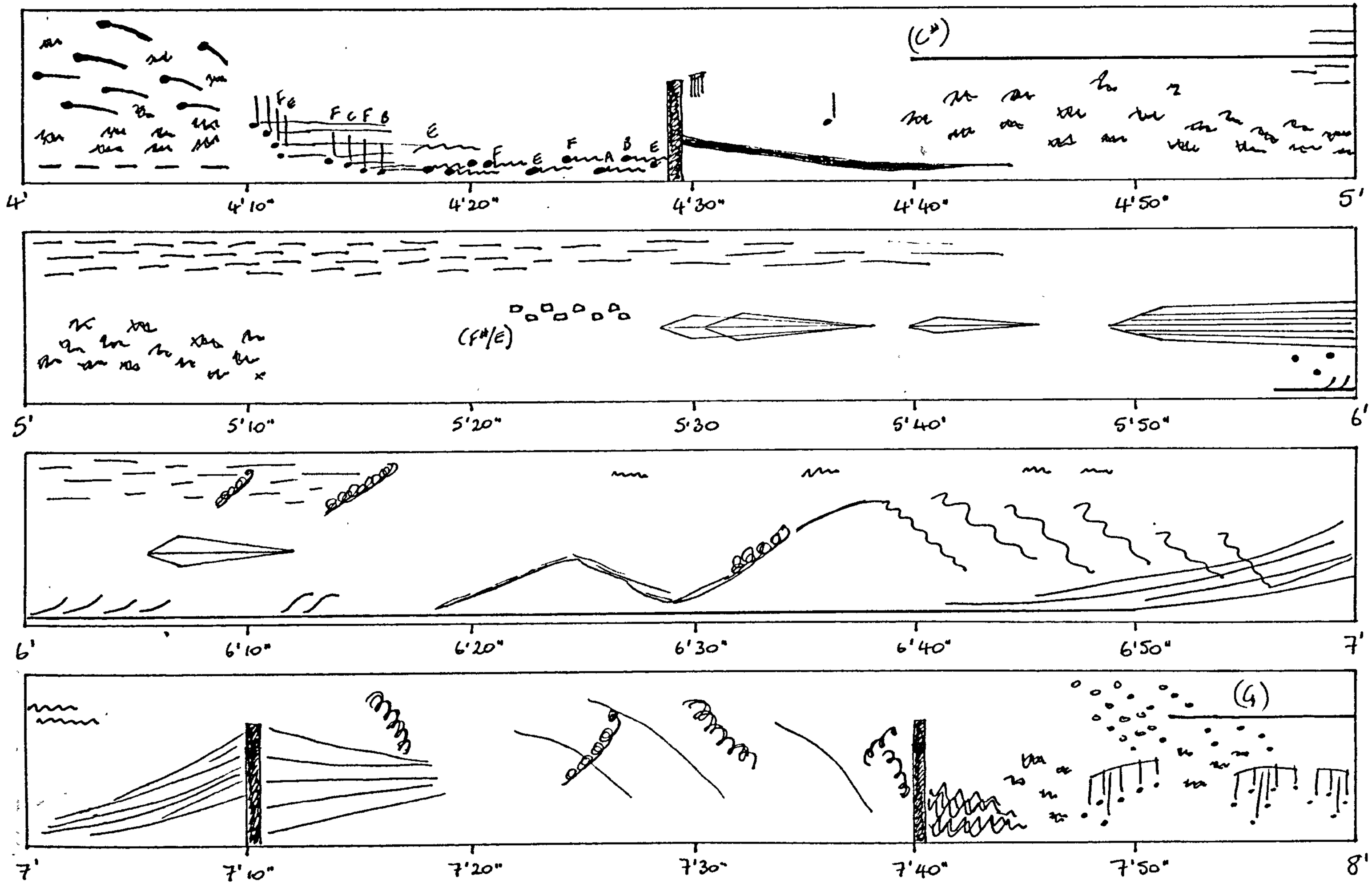
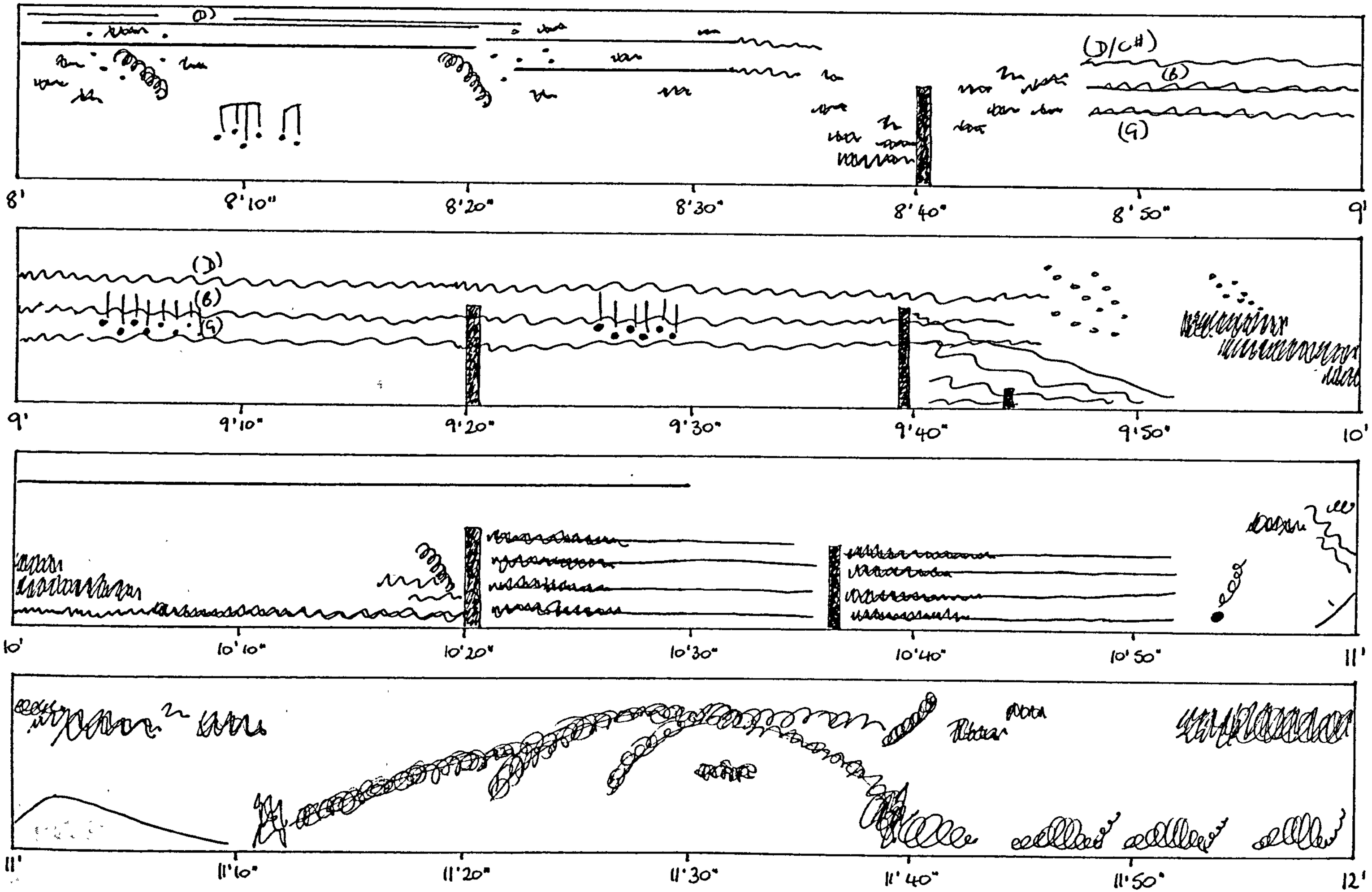
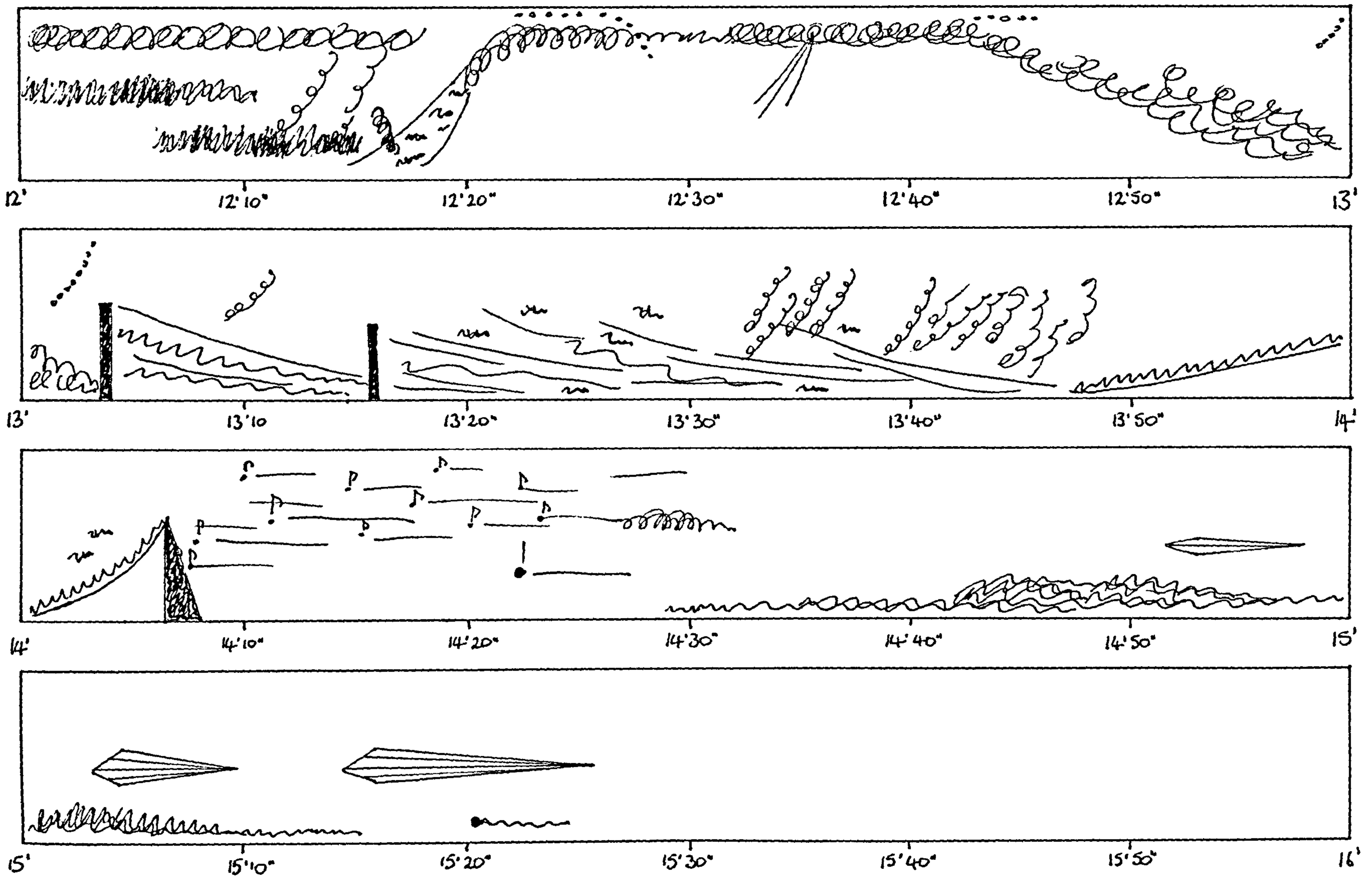
3'
2'50"
2'40"
2'30"
2'20"
2'10"
2'
4'
3'50"
3'40"
3'30"
3'20"
3'10"
3'
(A)
(B)
(C)
(E)
(Eb)
(F)


(C#)
F E
F C F B
E
F
E
F
A
B
E
4'
4'10"
4'20"
4'30"
4'40"
4'50"
5'
(F#/E)
5'
5'10"
5'20"
5'30
5'40'
5'50"
6'
6'
6'10"
6'20"
6'30"
6'40"
6'50"
7'
(G)
7'
7'10"
7'20"
7'30"
7'40"
7'50"
8'


(D)
(D/C#)
(B)
(G)
8'
8'10"
8'20"
8'30"
8'40"
8'50"
9'
(D)
(B)
(G)
9'10"
9'20"
9'30"
9'40"
9'50"
10'
10'10"
10'20"
10'30"
10'40"
10'50"
11'
11'10"
11'20"
11'30"
11'40"
11'50"
12'


12'
12'10"
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14'30"
14'40"
14'50"
15'
15'
15'10"
15'20"
15'30"
15'40"
15'50"
16'

VORTEX

Legend


Drones/resonances.

Metallic resonances with clear pitch, high or low

Gesture made up of metallic resonances.


Short pulses.

Rhythmically articulated/pulsing low frequency texture.

"Vortical" gestures and textures.

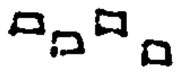

Brief electronic sounds.

Resonant attacks.


Complex attacks.


Downward glissando from pitched tone.


"Wind-like" noise-based contour.


Alternating pitch clusters.


Discrete, rhythmically articulated tones.


Downward spiralling gestures.


Noise band.

VORTEX (contd.)

Tape reduction

Attacks from 0', 2'58".

Alternating pitch clusters from 5'25".

Attacks from 7'10", 14'08", 4'29", 10'35", 13'05", 9'20", 9'40", 2', 10'37", 15'20".

Pulsing textures from after attack at 0'.

Drones from 1' - 1'20".

Metallic resonances from 5'15", 5'40", 7'15", 10'30", 15'.

Descending electronic tones from 4'10" - 4'30".

Downward spiralling gestures from 12'40" - 13'.

Rhythmically articulated low frequency texture from 35".

"Wind-like" contours from 6'25" - 6'35".

Rhythmically articulated low frequency texture and high frequency noise band from 10'10".

Rhythmically articulated low frequency texture from 14'40".

Upward "vortical" gesture from 40".

Brief electronic sounds from 2'20", 2'40".

"Vortical" gestures from 3'10" (+ descending short pulses), 6'10", 6'15", 3'18", 7'25", 7'30", 7'40".

Descending noise bands from 9'55".

Noise-based gestures from 11'10", 11'40".

Descending drones and "vortical" gestures from 13'40", 13'50".

VORTEX (contd.)

Short pulses from 3'15".

Discrete tones from 3'30".

Brief electronic sounds from 4'55", 7'45", 12'20", 3'45", 7'55", 8'45" (+ G major texture).

Downward glissando from pitched tones from 3'50".

Downward glissando low frequency drones from 4'30".

Upward glissando drones from 7'.

Upward/downward noise contour from 11'.

"Vortical" textures from 11'10", 11'55", 12'10", 13', 13'10".

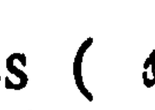
Upward glissando drone from 14'.

Pulses of Time (contd.)

"Swoosh" sounds seem identical or very similar in context of piece but have suprisingly different speeds and textures when juxtaposed in tape reduction. They are related by shape (ie. glissando) to broader noise contours at c. 10'20" and 17'20" and the contrary motion glissando chord and single tone at c. 10'40".

Large complex attacks have similar modulated texture to the 'explosive events' of 'Pentes'.

Vortex

Many 'vortical' gestures () are so strongly characterised by their morphology that timbral or textural differences are not clear until juxtaposed in the tape reduction.

Resonant attacks () become complex multiple attacks () for extra emphasis later in the piece. Final resonant attack at 14'10" is given added significance by exponential upward glissando upbeat ().

Pitched drones and metallic resonances oscillate between tonalities of G and E/Eb. G major texture at c.9'10" is strongly reinforced.

Metallic resonances are similar to those in 'Pulses of Time'.

Complex attacks with modulated textures are similar to those in 'Pentes' and 'Pulses of Time'.

APPENDIX 2

Nachtlied Texts

Goethe: Wandrers Nachtlied

Über allen Gipfeln
Ist Ruh,
In allen Wipfeln
Spärest du
Kaum einen Hauch;
Die Vöglein schweigen im Walde.
Warte nur, balde
Ruhest du auch.

Over all the hill-tops
Is peace,
In all the tree-tops
You trace
Scarcely a breath;
The birds are silent in the woods.
Only wait, soon
You too will rest.

Steiner: Abends

Es tritt bewusst mein Ich
Aus dem Reich der Daseinshüllen,

Zu ruhen in der Welten Wesen.

Ins Göttliche strebet es.
Gewinne Seele dieses Reich:

Des Geistes glänzend Wogenmeer
Des Lichts erstrahlende Gebilde.

Consciously mine I goes forth
Out of the realm of the veils of Being
To rest in the being of the Worlds.
Into the Divine ascending,
Reach, oh my soul, yon realms of Being
The Spirit's glistening Ocean-tide,
Ever-radiant forms of Light.

Steiner: Morgens

Lichterstrahlende Gebilde,
Glänzendes Wogenmeer des Geiste
Euch verliess die Seele.

In dem Göttlichen weilte sie,

In ihm ruhte ihr Wesen.
In das Reich der Daseinshüllen

Tritt bewusst mein Ich.

Ever-radiant forms of Light,
Glistening Ocean-tide of Spirit!
Now hath the soul departed from you.
In the Divine the soul was dwelling
In the Divine my Being rested.
Into the realms of the veils of Being
Consciously enters mine I.

(translations: George and Mary Adams. Taken from Faber score of 'Nachtlied'.)

A

A + B

B

B + C

C

C + D

D

D + E

E

E + F

F

F + G

G

G

G+H

H

H+I

I

I+J

J

J+A

123

Clar.

Vcl.

125

Clar.

Vcl.

Oboe

127

Oboe
Clar.
etc.

'MADONNA OF WINTER AND SPRING' - HARMONIC SPACES

SP 1

SP 2

SP 3

SP 4

SP 5

SP 6

SP 7

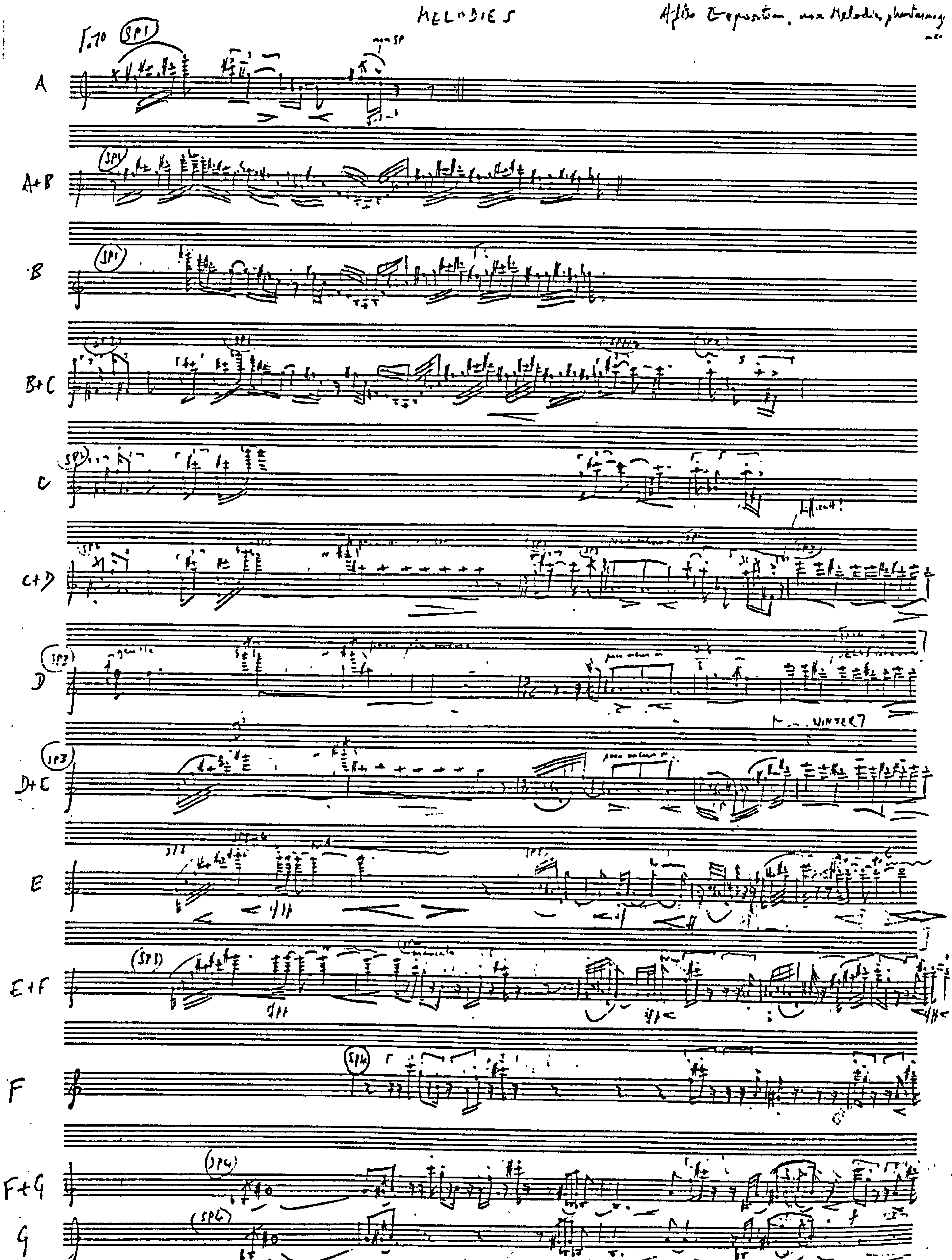
AXES

Conflict

Depths

Mary

MELODIES


A
A+B
B
B+C
C
C+D
D
D+E
E
E+F
F
F+G
G
SP1
SP2
SP3
SP4
difficult!
WINTER
marcato

G

G+H

H

H+I

I

I

1+J

J

I+A

123 Clar.

Vcl

123

Clar.

Vcl

Oboe

127

Oboe

Clar

etc.

SP4

SP5

SP6

"RITUAL MELODIES" — MELODIES.

A

A+B

B

B+C

C

C+D

D

D+E

E

E

B+F

F

F+G

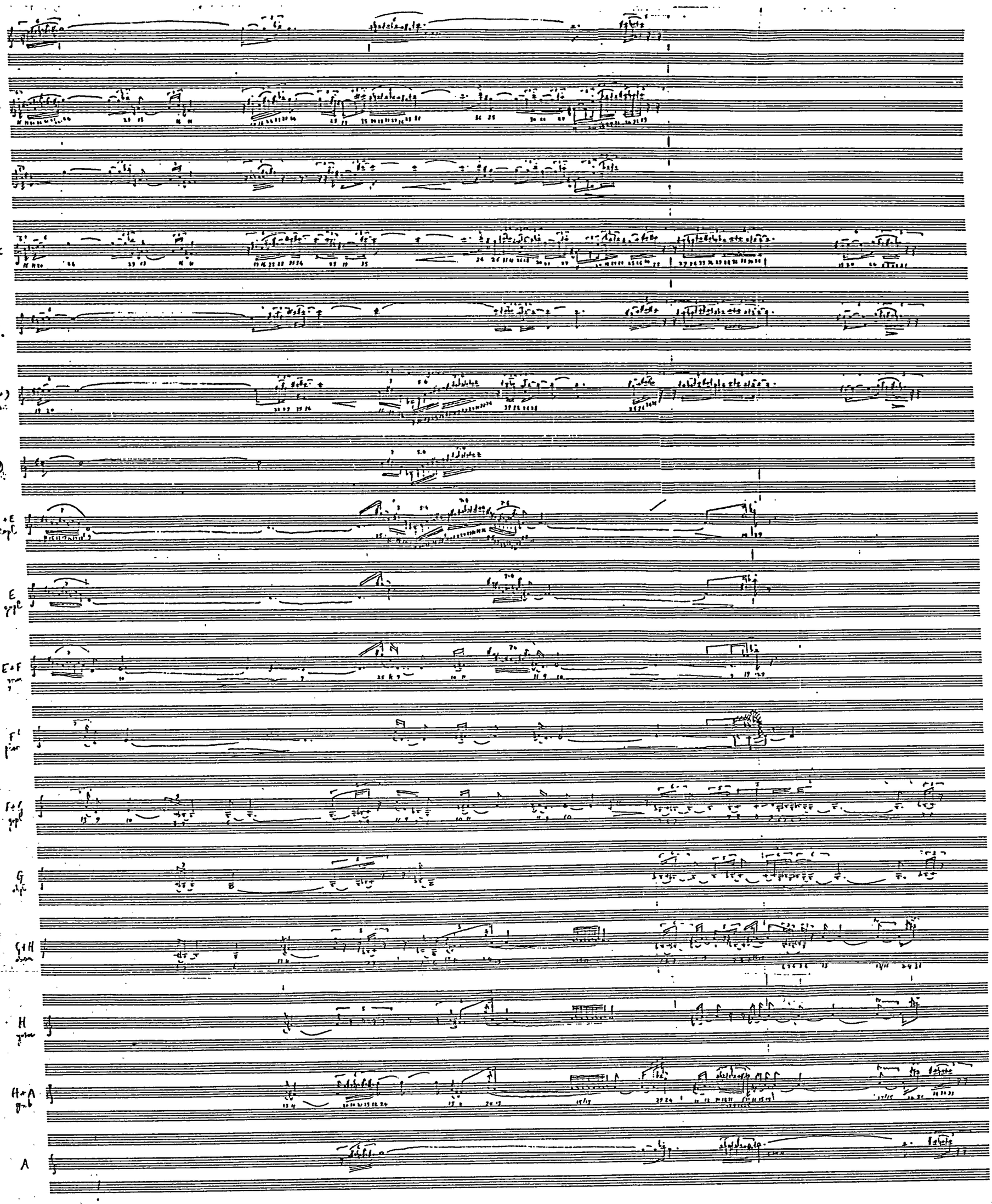
G

G+H

H

H+A

A



"RITUAL MELODIES" — MELODIES

APPENDIX 4

Wishart's 'possible narrative synopsis' of the opening and ending of 'Red Bird' is as follows:

OPENING

The motif "scream-bird" stands as a short-hand symbol for the entire piece, and also relates directly to final symbol of 'Red Bird'. The victim is being tortured (but this is also a symbolic moment; some of the 'sharp' sounds are of books (book-of-the-law), doors (slammed-door), and the word machine. He seems to find release from the tightly ordered violence as the body-landscape travels through the erotic and animal-like to the sounds of breath becoming wind, but this is again violently interrupted by the assault of words. The words appear now ridiculous, now violent, transforming finally into the sound of the opening bird, only to be cut off by its antithesis, the hounds of reason (baying in a prison courtyard?, sound of heavy doors). The victim, fleeing from the interrogator's voice, lets out a cry (opening cry) and falls headlong into the well of the body, only to find this transforming into a machine. The whole preceding section has the feeling of a prisoner's nightmare. The philosopher now states his case, attempting to suppress the whispered voices of dissent by slamming the book of knowledge...instead they transform into the image of...

...the Garden...

ENDING

Final joyful display of bird-symbol is shot out of the sky as the initial torture scene is taken up with a vengeance and the victim thrown into...

....the Torture Chamber of Reason: the victim and his world are finally annihilated.....the Universal Factory: triumph of

the mechanical world-view, as all elements of the piece are absorbed into a mechanical landscape.. This section contains many specific recapitulations: eg the Book (transforming to doors) which tried unsuccessfully to swat the fly, now hammers after the prisoner...what the philosopher's book-of--knowledge could not encompass, the interrogator's book of law will contain by force...etc.etc.etc. The uniting of an image of apparent defeat (Sream down Well) and an image of transcendence (Scream-Bird) in the final transformation (Scream down Well-Bird) negates the interrogator's victory. At the same time, the fact that it is the opening bird which is being recapitulated here at the very end of the piece suggests that the struggle is about to begin all over again.

APPENDIX 5

VOX 6 - Text

Start the Dancin'
Move now, on your feet
Dance through the night
Just feel that rhythm in you
Keep on Dancin'
This time, anytime
Let's do it right
And keep that rhythm with you
Keep on movin'
Dance on from the start
Then outa sight
You got that rhythm in you
Join the Dancin'
Fast, slow, let it go
But keep it tight
Just move that rhythm with you

Join the Dance now
Move it anyhow
Get on your feet
And take that rhythm with you (and now we have a little surprise
Take a chance now we're gonna rap together contrawise)
You know you can Dance
That livin' beat
Just feel that rhythm through you (& maybe play the fool besides)
Can't turn back now
This is just the Dance
For you and me
We'll sing that rhythm with you (that's right, that's o-right)

(Now this rappin' voice is outa sight
That's o-right, that's rightm, that's o-right)

Dance, Dance, Dance ...

Dance with love and Dance with learning
Dance the wave and Dance the turning
Dance with measure, Dance with magic

(& now we'd like to introduce to you
some serious rappin' for the specialist few
so hey! professors, on your feet
this is a serious boogie with a serious beat
minimally serially avant-garde Noh
post-modern post-funk and pizza-to-go
do the mashed potato do the systems clap
do the new complexity finger snap)

It's your dance now
Your turn, have to learn
Get on your feet
And get that rhythm with you
Move that body
Move your head
And then just do it more
And keep that rhythm with you
You can rap but
Dancin' is the thing
We're livin' for
And keep that rhythm with you

(& if you can't stand d-doo-ron-ron
perhaps Schenker analysis will turn you on)
(so now we'll tell some stories
& sing this song
so just Dance along
there's Razzer Bel-shazzar
won't say it again
& John the Baptist, at least his head
let's keep on rappin' the dead
that's what I said
that's straight ahead
so let's sing instead)

(it's no handicap
one more move clap
and that's the rap)

We'll shake the Earth beneath
(Dance, Dance, Dance)
So move your heart and move your feet
(Dance, Dance, Dance)
This time we'll find a way thro heaven's teeth (hey! that's talkin')

Dance with system, Dance with rigour
Dance elusive, Dance enigma
Dance with passion, Dance with reason
Dance thro the world, despair is treason
Dance

(that's right, do the boogaloo
do the gagaku
yeah! do the filly dog, do the funky frog
do the turkey talk
that's right, it's outa sight, do it right
let's dance
the one step two step spider bite, that's right
hey! hear what you say
but we'll do the rappin' as well, OK
that's o-right but keep that rappin' supertight
let's dance)

Dance, Dance, Dance ...

(we're gonna move a little further tonight
OK outa sight
let's just move it along back to the song, that's right)

Dance through cities
Dance through spaces
Dance with masks and
Dance with faces
Dance Dance Dance
Wherever you're flyin'
High above the Earth
Keep with it
Dance

(and thro the river flow

that's too deep, just rap, & keep it low
hey! come on let's go

that's neat, Dance, just a treat
let's Dance, move, feel the new beat
with your feet)

(now Aaron held a disco night
down at the golden cow
but Moses did not like to Dance
and so they had a row

then Moses goes to see his shrink
up on the mountain high
just take these tablets
you'll be OK
so long, I just have to fly)

(do the rap
do the talkin' trap
do the writin' on the wall
Herodias hated old baptist man John
her daughter, Salome, danced on & on)

Keep shakin' it, do the, do the Dance ...

(jivin' for Herod she's offered the best)

Keep movin' it slowly, do the Dance ...

(says I'll take the head you can keep the rest)

We're movin' it now just do the Dance ...

(now when you rap you gotta toe the line
oh yeah, keep it in time
1, 2, 3, 4, 5, 9, oh yeah! we're doin' fine)

Dance, Dance, Dance ...

Let's keep dancing
New beat, on your feet
now

(I hear you've shredded Orpheus
as small as you are able
but before you throw that head away
better start a record label
the singers know it's time to go
get set, get ready now, the fool is
finished & taking a bow)

(the livin' dead & the severed head
well I think that's got to be all)

Back to dancing
Feel that rhythm
Feel the Dance of life
Get ready now, are you ready now for the new Dance

Dance, Dance, Dance ...

(Razzer Belshazzar was havin' a ball
when a graffiti artist
writes up on his wall
says Shazzy, Hey I don't like this pen
you better throw him in the Lion's den
but at that moment the band arrives
it's the Medes and the Persians
and they're playin' live)

(you got the best of the
rappin' tonight)

(just cap the rap and
keep the rest)

(that's heady stuff so take a break, let's Dance
o-right we gotta do it right)

(I tell you the tower of Babel was
bliss, just what can you make of
all this?)
(you've had Razzer Belshazzar &
old uncle Mo, & now that song is
here & it's time we should go,
get ready now we gotta end it
somehow, the foolin' is finished
take a bow)

Dance on mountains, Dance in prisons
(just speak and shout and see the world in dreams without)
Dance in tongues & Dance in visions
Dance with laughter (just keep on dancin'
Dance with sorrow dancin' dancin' tonight)
Dance Dance Dance
Forget there's tomorrow
Dance the night away (put on the shoes do the blues
hear the rhythm man's cues
the back beat the offbeat
to win or to lose)

Dance the night the day
All love, all your life away (Dance thro the night, the day, let's
do it right hear what I say let's Dance)

(do the clam do the chicken (do the itch do the scratch do the
do the autocratic kickin', oh yeah! needle match, that's right, stay
o-right & now do the livin' bright)
& the givin' of sight, that's right)

(and now we will rap some more
you can't stop that talkin' on the dance floor
that's real sure)

(do it straight do it gay do it everyway tonight
cruise, read the news, do the thing in my dancin' shoes)

Don't let the world go by
Now is the time to fly
Dance Dance Dance
Life can be anything we try
The only thing that's certain is you'll die

Dance, Dance, Dance (better keep on rappin' that's no lie sing it high)

Dance by heart and Dance by numbers (sing what the poet wrote
Dance with eagles Dance with drummers hit that note, let's float
Dance Dance Dance wherever you're crying keep it tight, join the
Far across the Earth Dance retreat)

And make the Earth shake, Dance
Don't let your hope break, Dance

(let's rap to fill the gap, keep on rappin'
& do the clever talk, dove, hawk
just get it right (just so you know)
there's no light endless night so get it right)

Dance, Dance, Dance ...

(& now we have a treat for you
more yarns for your delight
& if you think we're all at sea (comotion the bosun has crashed
that's just right, it's darkest night the ballroom floor, let's Dance)
well I hear those sirens
they're singin' to me
you gotta let me, let me go free)

(don't want to spoil the fun and games
but there's an iceberg at the door)

(just tell it to me OK we gotta
hold on, tell it to me, tell
it but hold on)

Dance serene & Dance exquisite
Dance finesse, then Dance disquiet
Dance roughshod & Dance grotesque (deathly)

Dance, Dance, Dance ...

(& when you're not aware
there's rappin' goin' on somewhere
so don't just stand still
time to kill, talk! yeah!
let's do that rappin' fill
it's no frill, that clever talk
trippin' off my lip, it's a skill)

Dance with dread and Dance with laughter
Dance with rage and Dance with rapture
Dance Dance Dance wherever you're lyin'
Deep within the Earth (it's so deep you know)

Keep on dancin'
Don't let go
Before the time is right
You can't take rhythm with you
Time's advancin'
Hold the fire of day
And light the night
You can't take rhythm with you

Take this chance for all it's worth

(wow! let's do it, do the Dance, now!)

Dance, Dance, Dance ...

Dance with hands and Dance with weapons
Dance with flowers
Dance with saints and Dance with heroes
Dancing with cowards but Dance
And let the world flow on
The past is on the run
The future's balanced on the gun
Beyond us there is life or there is none

(leave it, it's gone
so let's move on
yeah! & that's no fun
so do that clever walk
logic talk

Dance wild guesses, Dance conclusions
Dance the truth, Dance disillusion
Dance with age and Dance with newness
Dance and let the river flow through us

Dance that tongue)

Dance the night, day, all love
All your life Dance away

(hold tight do it right tonight
rappin' thro the night & thro the day
it's gotta be rapped with love

(lovin' or leavin' just keep
rappin' away)

(don't ridicule when we're
rappin' the fool)

the last chance in the dance hey!
hear what I say gonna get it right
keep on dancin' thro the night the
same way into the light, keep dancin'
for your life)

(& now gonna wind up the music more
so keep rappin' 4 by 4
& if you're thinkin' this tempo's not the best
well hang on till you've heard the next
(you're always talkin', why don't you take a rest)
think we'd better take a break (popular request))

Dance, Dance, Dance ...

Dance with fire & Dance with flame &
Dance with ashes, Dance with feet &
Dance with wings & Dance with shackles

Dance, Dance, Dance ...

(hey mister Bacchus you're way out o'line
but it's all greek to me so pass the wine
this crazy dancin's just so divine)

(hey Krishna play that flute
caress that blowhole, move
that pleasure pole entrance)

Get ready now, are you ready now
Do the new Dance
Your body now, everybody now
Do the new Dance now!!

(it's gettin' out of hand
now, this rap will get us
banned, let's Dance)

Dance, Dance, Dance ...

Dance the night away just waitin' for the day
Dancin' for your life goes past hold on fast
Grasp it and you'll love dancin'

Dance confusion, Dance precision
Dance decision
Dance belief and Dance sedition
Dance compssion, Dance derision

(the Dance is rushin' past
you can rap that fast
let's try it
rap, it's a snap
do this super clever talk
it's fillin' the gap, let's Dance)

Dance with sweat & Dance with nerve
Yet Dance persistence
Dance compliance, Dance submission
Dance resistance

Dance, Dance, Dance ...

(& stilll the rap goes on
we all have a story & a reason)

(keep dancin' for your life
just keep recitin' the writin' tonight
that's right)

Dance right away do it anyway do the Dance

Dance night and day break Dance

Dance, Dance, Dance ...

Dance the way & Dance the maze &
Dance in riddles
Dance concealed & Dance unveiled &
Dance unravelled

Dance now do the Dance, find ways
by chance, it may enhance, who can
tell the meaning of dancin'

Dance Dance Dance now take your chance
& Dance, more fascinatin' magical Dance
it's the true Dance

(no hesitatin' layout a Dance,
take a little chance with the
new dance)

(keep singin' keep talkin'
we're makin' headway
keep dancin' keep rappin'
dark night stay bright)

(rappin' our way to the end
that clever talk is here again
that's right in the dark or the light
hey! keep it goin' we'll get it right)

(that's right, we're nearin' the end
it's true we can't pretend foresight)

Dance with blood and Dance with water
Dance thro birth and Dance thro slaughter
Dance success and Dance effusion
Dancing eclipse and we're dancing delusion

(keep dancin' keep dancin'
there's no more to say
we're near the end of the telling)

(there's lots more stories I could
lend, but that's it, this is the
end, can't hold the stage you know
it's time to go, hold tight!)

(and so no more to rap the talking trap)

Dance all the night the day
The dark disarray, the light, the way
All love, all your life away

(hourglass all things must pass)

(hour after hour & day after day after day)

(weigh it up deliberate
on your feet it's never
too late)

(do the wolf do the rat
do the snake do the cat
wear the tyrant's hat
we'll laugh at that)

(do the midwife
do the kiss of life)

(the same for the wise man
as the jackass)

(fly the bird stir the herd
know the watchword
Dance, do the absurd)

(and now sound the trumpet that's the last)

Dance, Dance, Dance ...

Dance the tides and Dance the seasons
Dance away the mask of reason
Dance with love and Dance with learning
Dance the wave and Dance the turning
Dance with skull and Dance with skin and
Dance feet and Dance fingers
Dance with clouds and Dance with rain and
Dance with thunder, Dance with thunder
Dance with arms and Dance with steeling
Dance with hands and Dance with healing
Dance with bells and Dance with rattles
Dance in love and Dance in battle
(Keep dancin', can't leave the Dance)
Dance with azure and Dance with sulphur
Dance with crimson, Dance with crimson
Dance through cities, Dance through spaces
Dance masks and Dance faces
Dance by heart and Dance by numbers
(Dance three two one, Dance our Dance, keep dancin')
Dance with eagles, Dance with drummers
Dance sublime and Dance infernal
Dance of now and Dance eternal
Dance the night, yes Dance the night away

Dance, Dance, Dance ...

(you know how, do it fast do it slow
do it now)

(Eli Eli lama sabachthani)

APPENDIX 6

Sources

Harvey

Scores of 'Inner Light (1)' and 'Inner Light (3)' are available from Novello.
Scores of 'Inner Light (2)', 'Bhakti', 'Madonna of Winter and Spring', and 'From Silence' are available from Faber (some are still only available on perusal, not for purchase).

The compact disc of 'Bhakti' is available on NMC label (cat. no. NMCD001).
Cassettes of the other works mentioned are available from their respective publishers on request.

The sketch material on tape for 'Ritual Melodies' was made available by Jonathan Harvey for the purpose of this research.

All unpublished articles and lecture notes mentioned in the footnotes were also made available by Jonathan Harvey for the purpose of this research, in addition to sketches of rows and pre-compositional working for the 'Inner Light' pieces and the melodies for 'Madonna of Winter and Spring' and 'Ritual Melodies'.

Jan Vandenheede's article on 'Ritual Melodies' is as yet unpublished.

Smalley

There are no scores commercially available. Scores for works involving live instruments are available from the composer. Diffusion scores for tape only works were made available by Denis Smalley for the purpose of this research.

'Pneuma' is available on the Hyperion label. 'The Pulses of Time', 'Chanson de Geste', 'Pentes' and 'Vortex' are available on University of East Anglia recordings. 'Gradual' is available on Fylkingen Records.

All other tapes are available directly from the composer.

The paper 'The listening imagination' was made available by the composer for this research.

Wishart

Scores of the 'Vox' pieces, including a diffusion score for 'Vox 5', are available from Universal Edition, as is 'Red Bird; a document'. There are no scores for 'Red Bird' nor 'Anna's Magic Garden'.

'Red Bird' is available on LP from Universal Edition. The 'Vox' cycle is available on Virgin Classics label (CD: cat. no. VC 791108-2; cassette: cat. no. VC 791108-4)

A cassette of 'Anna's Magic Garden' was made available by composer, as were the sketches for the dance pieces, for purpose of this thesis.

On Sonic Art is available from Trevor Wishart (Imagineering Press).

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