Compositional Strategies in Music for solo instruments and electroacoustic sounds

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To Delfina and Augusto

who have always valued the gift of creativity

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Mannam for kayagum and electroacoustic sounds

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Declaration

Abstract

Part I of this dissertation examines five works by the author for solo instruments and electroacoustic sounds composed between 1986 and 1992. Chapter 1 deals with the conceptual framework which underlines the different compositional strategies employed in the works discussed. Chapter 2 examines the integration of instrumental sounds with electroacoustic sounds in the work *Papalotl* for piano and tape and its use to generate a dynamic structure. Compositional techniques are discussed in detail. In Chapter 3, the author discusses the work *On going on* for baritone saxophone and electroacoustic sounds focusing on improvisation as a significant element in the composition process and the structuring of instrumental and electroacoustic material. In Chapter 4 the generation of rhythmic objects is examined as the basis for the formal strategies in *Acuerdos por Diferencia* for harp and electroacoustic sounds. The design and integration of rhythmic objects are then discussed in the context of the composition process. Chapter 5 deals with the appropriation of an instrumental technique as the compositional instigator of choreomusical design in the conception and composition of *Así el Acero* for tenor steel pan and electroacoustic sounds. Chapter 6 focuses on the use of different stylistic traits as the basis for a compositional *genesis* , and the elaboration of instrumental and electroacoustic sound materials in *Mannam* for kayagum and electroacoustic sounds. In Chapter 7 the author discusses the dilemmas presented to the *composer* when discussing his own compositional strategies. The general context of the works discussed is analysed from the perspective of electroacoustic and acousmatic music, attempting to assess how such works may contribute to the changing æsthetic enunciates of a young medium. A number of general theoretical and practical issues pertaining to mainstream electroacoustic music are then examined in closer detail. The author then puts forward the thesis that a significant advancement of experimental composition in general can be brought about by a renewed cross-fertilisation between instrumental and electroacoustic thought and practice.

Part II includes recording details, a score and a complete studio recording of each of the works discussed in Part I.

Part I

Introduction

0.1 Foreword

The written word may be self-explanatory. But in the case of music, the intention of the written word is clearly to link the music in the objective world (the concert hall, for instance) with the music in the most subjective of spaces: the mind. And yet, sonic images only appear when sound is heard; they exist *because* they are heard. Music has no existence other than through our ears. It is always heard in successive contexts; first by the composer in the seclusion of his workplace, secondly by the performers who rehearse and perform it, and finally, by the audience listening to the work. From there on, these listeners - each in his own way - create their own music from an initial sonic proposition. Like everybody else in the audience, the writer on music adds to it his own preconceptions, culture, memories, fears, opinions, sense of humour, and so on. But if music really only exists while it is heard, can he ever be objective in writing about music once the experience has gone by ? It is no wonder that discussing music carries quite a hefty responsibility.

For the composer writing about his/her own music, the danger of unintentionally obscuring and washing over the music in the process of criticism and explanation is considerable. For whenever a composer listens to music, he is also aware of himself as a listener : in reflecting *upon* the music, he *reflects* the music. Writing is for him a re-enaction of his poetic musings, with the complication that in his case, the artist, the critic and the judge become one and the same person. Facile arguments and self-important artistic judgements are common and likely to become hazardous because they can potentially deform a work's appeal or create a false expectation of

what may in fact amount to dispensable ideas. Such alternatives for the composer-turned-writer are terrifying. Experience reminds us that the ideal critic is he or she who remains "in between" composer and listener. Is it possible then to separate the experience of composition from the experience of listening to the music ?

A more favourable alternative lies not in writing about *music* but on the *experience of composing it.* In the case of the works discussed below, this is perhaps more appropriate given the special condition in which they were composed, that is, in the environment of an electroacoustic studio. Suffice to say at this point that many of the explanations and examples in this thesis are written approximations of aspects which can only acquire their complete sense when listened to. The word on the page tell us, after all, how sounds come to be, not what they are in becoming. This approach might render the writing too abstract at times, fragmented at others or simply not entirely fluid. It may, however, prompt the reader to glance through the lines and place the emphasis of his final appraisal on the *aural* conception, origin, intention and being of the music.

Chapter 1 Points of departure

1.1 Strategies: questions of method and conception

The five works discussed in this thesis were composed in the environment of an electroacoustic music studio. Therefore, the label "solo instrument and electroacoustic sounds" responds primarily to the necessity of analytical clarity in the text. Yet it also describes a manner of musical production, a method of composition.

I believe that the nature of the working method - the composer's *musical behaviour* - determines to a large extent how he articulates large structures and musical form. Method - a manner of doing - responds to the strategies chosen by the composer to achieve an imaginary goal. Thus to discuss the structuring processes in composition is virtually impossible without constantly referring to the interplay between the composer's imagination and rationale with regards to the listener: his methodology and perception, his material and language, his preconceptions and projections.

Compositional strategies as analysed by the composer himself in a way tips the enquiry in the direction of the composer *as a practitioner.* In electroacoustic music, because the composer is dealing directly with sonic raw material, experimenting with sound becomes a norm to invent and establish strategies: where to go next or how to articulate structures whose qualities and relations he can differentiate and categorise. In addition to the pöetic implication of perceptually-based decisions, other external images and experiences influence the composer and therefore also constitute important strategic points to consider.

I have always been fascinated by motion and its images; how people dance, how insects fly, how shadows are cast etc. In practice this has been the starting point of many of my musical explorations. As a composer, I have for a long time been interested in directly influencing my ideal listener's awareness of musical motion . Through practical experience as a performing musician, I have found *rhythm* to be paramount in imprinting a sense of motion and temporal progression which incites my own compositions and enjoyment of music. This has acquired a significant bearing on my attitude towards formal design in that very often the organisation of structure has evolved from the articulation of an initial rhythmic idea. Through this I have mostly attempted to create works that could not be characterised as contemplative or self referential, but rather, works that compel a feeling of things moving, of time passing, of "things elsewhere". This has been my goal in the works discussed below. The strategies and procedures have varied according to the available sonic material while, in a way, the method has reflected somewhat similar concerns: shape, gesture, pitch, timbre, dynamics have been understood, as it were, "rhythmically", as elements serving a deliberate formal intention. In order to clarify this method, and before I describe my works in detail, I will begin by exposing a general conceptual framework which lies at its foundation.

1.2 A case for rhythm

The analysis and description of form in Western art has often been rooted in the opposition between the quantifiable and the qualitative. Concepts such as symmetry, balance and proportion have dominated the discussion on phenomena such as colour, texture, motion and time. In many ways, Western musical rationale has inherited this dichotomy, incorporating it into its conceptual and compositional framework. A vivid example can be found *par excellence* in notation and in the supremacy given to the musical score. Trevor Wishart has pointed out that musical notation enables us to deal only with

those qualities which can be quantitatively expressed (Wishart, 1985). Indeed, the notational advocacy of much Western musical thought has nourished a two-dimensional conceptualisation of hierarchical relationships. This in turn has required a conceptual reduction of other - non-quantifiable - forces, such as dynamics, timbre or time into what Pierre Boulez referred to as "secondary" forces supporting pitch and duration[1].

Leaving aside the historical benefits and failings of notation itself, one of the pitfalls of this reductionism has been to assume that manipulation of separate musical parameters can foster successful compositional and /or analytical methods without recourse to what goes on in the perception process. In the last decade important experiences in psychoacoustics have shown that the separation of parameters may be useful at basic levels of description, but that parametric boundaries in the sonic phenomenon are far more intertwined than can be grasped by the notational prescription. It has been shown, moreover, that the evolution of these boundaries is not as clear-cut in the perceptual process as the Boulezian argument seems to propose[2]. As Jonathan D. Kramer points out "there are no isolated events, no independent parameters no single processes... an appropriately human analysis must consider the isolated parts (of music and people) as metaphorical, not literal, contributors to the ongoing unity of the musical experience" (Kramer 1988: 322). We know now that within a passage of music, timbre, pitch, rhythm, dynamics, motion, texture etc. all contribute to each other in time in complex interdependent, multidirectional, qualitative, quantitative and contextual ways.

Generally speaking views stemming from post-serialism on the interplay of musical forces have been supplanted by the learnings of sound recording and computer technology. Computer synthesis has allowed better ways to describe and understand how musical dimensions interact, and how, for instance, aspects of timbre play a crucial role in the apprehension of meaning

in speech and the structuring of form in sound and in music. By enabling composers to analyse and create unique timbre streams whose characteristics can be accurately changed over longer spans of time than possible instrumentally, technology has helped to supersede the Helmholztian ideal of timbral "stability" found in conventional instruments, leaving behind the æsthetic paradigms they embodied. Thus, in addition to the compositional gains, we are now generally better equipped to describe many sound qualities in relation to real sensory experiences. So for instance, we talk of "grain" as in a tactile sense or of "density" as in the act of lifting a weight, etc. The relevance of such metaphors is that they have helped to bestow a concrete value on our perception of notationally non-quantifiable properties of sound and music.

However, in spite of a body of experimental, technological and theoretical work, I feel that problems persist with regards to both the description and organisation of temporal qualities and what is understood by rhythm. Contrary to the case of timbre, in talking about time in musical composition without recourse to the norms of the musical score, we are dealing in a more abstract territory, and metaphors taken from the realm of sensation are insufficient to describe it. Significant propositions in contemporary musical thought depart from the idea that we must approach time in terms of other, more general experiences, acts or successions of events. The French composer François Delalande, for instance, has recently suggested that, in order to circumvent the "abstractedness" of time, we should only concern ourselves with the *organisation* of sound events that take place within it. He goes on to say that this global approach may be a more practical way to conceptualise time (Delalande 1992). At this level of description, however, time in itself ceases to be the centre of attention; rather there exist concrete *durations* of the events, sounds or experiences that are *inscribed in* time. In similar terms, now from the point of view of *reduced listening* [3], the Schaefferian approach focuses on the events themselves (the sound objects) suggesting a temporal classification

according - amongst other phenomenological criteria - to three types of duration: short, medium and long[4].

A detailed critical discussion of the full implications of this approach is beyond the intentions and scope of this writing. However, it is relevant to the present discussion to note that, whilst a classification abstracted from the "objectiveness"of sounds has opened up stupendously far-reaching analytical and compositional possibilities, the ensuing durational scheme is not entirely consistent. For example, impulsions and long sounds fit uncomfortably in Schaeffer's own conception of the sound object as a morphological unit[5]. This is because by definition a sound object should correspond to a "manageable" perceptual time-scale, one that allows a certain apprehension and manoeuvrability of its form. (Just as we cannot comfortably describe an atomic particle or a building as objects, neither can we conveniently describe impulsions or long sounds as sound objects). The point may be made clearer with respect to long durations. A long sound is grasped by necessity in stages. Even when the source of the sound is not abstracted , if the listener is to perceive a shape to the sound, it will be necessary to recall what was its initial state and compare it to the present state, reconstituting - by comparing successive instants- what is its general form. It is an elaborate and musically time-consuming process. Therefore, it is the second type of sound - that of medium duration - which seems the most consistent with the conception of the sound object. For these sounds, Schaeffer spoke of "formed objects", that is, sounds which are perceived as having a complete form. In the perceptual plane, we can still recall the beginning as we start to listen to the end, thus we are capable of perceiving the sound's complete temporal evolution. Nevertheless, what interests me about these sounds is that, because they retain a duration within the range of short-term memory, they tend to present in themselves more immediate and possibly better defined temporal and rhythmic implications than short or long sounds.

Outside the perspective of reduced listening, however, it is not really practicable to describe sounds solely in terms of duration, because, without a reference to the concrete gestural characteristics of the sound in question, duration becomes too vague a perceptual category. If it is a psychotemporal quality that the composer wishes to accomplish, then he requires to convey more than a just a sense of the continuance a sound. This is because as listeners, we can only confront this problem by comparative re-constitution, that is, by approximating a sound's duration to preceding and successive time spans. Past a certain time threshold (possibly around 5 or 6 seconds) - even more so if the sound does not consist of distinct salient features - its duration inevitably becomes ambiguous in terms of functional "pregnancy". Of course, this does not imply that long homogenous sound streams, for example, do not have musical potential or interest, or even some functional potential, but in my experience, their structural effectiveness is so inextricably bound to context that it largely depends on an exceptional perceptual skill and attention on the part of the listener. Thus I would conclude that in general, sounds of long duration, whilst allowing the listener to apprehend global time demarcations, are often not sufficiently strong to define precise formal relations unless their inner gestural elements are memorable enough to *function* as temporal context for each other element, or other sounds[6]. With regards to impulsions, temporal implications - certainly when heard in isolation - are entirely context-dependant . However, because their spectral structure is fused , impulsions and many other short sounds heard in succesion are susceptible of being categorised by the listener more for their placement in time than for their timbral qualities. Therefore consecutive impulsions can potentially be ascribed a function as part of a larger formal ordering more readily than with isolated long sounds or streams.

Rhythm may constitute a renewing approach to such varying questions of temporal structuring and may help to circumnavigate the insufficiencies of a

pre-compositional categorisation such as time-duration within a given compositional strategy. Naturally, in order to clarify why and how this may be useful in the realm of electroacoustic music, we need to free the familiar concept of "rhythm" of its ties with customary instrumental technique, tonal harmony or the manipulation of summative durations on theconventional musical score. Just as with sound synthesis, computers allow us to create unique and perplexing rhythmic structures and establish extraordinary relations between them. Whilst performers may find it difficult to perform such structures other than by approximation, complex non-instrumental rhythmic strands produced by computers are nonetheless readily perceived. Therefore the analysis of rhythmic phenomena, whether performed or composed, is better served if we approach rhythm from the perspective of perception, rather than of production. A starting point may be Richard Parncutt's view that rhythm can be regarded as a sequence of *perceived* events, each of which is specified by its position and by its salience in time, relative to other events. (Parncutt 1987). At this point, we should also question the misleading assumption that rhythm may only refer to periodic events. Whilst it holds strong connections with pulse and meter - themselves 'periodic percepts - rhythm as produced through the agency of conventional instruments touches upon other perceptual non-periodic aspects, such as the kineticism of gesture and motion. This clearly suggests that rhythm is a complex non-linear phenomenon. Kramer's definition of rhythm as "a force of motion" (Kramer, 1988: 81-122) is particularly illustrative of the kind of dynamic relation I wish to point at.

Rhythm relates to gesture in two essential ways. Firstly, in that, like gesture, it is caused by the flow of one kind of energy shaped in time. Let us draw an analogy: when we dance we balance the weight of the torso with movement at the extremities. In order to sustain continuous motion, we apply force to shape the ensuing movement (gesture), and counterbalance the weight as it regains equilibrium (rhythm). In both instances, surges of energy convey a structure

and contour as if invisible points in space were being drawn. Gesture and rhythm in this case have a similar causal origin. On the other hand, drawing the analogy towards the perspective of *reduced listening* , rhythm relates to gesture in the sense of a perception of a *form* : in listening to a sound object's spectral trajectory we retain a sense of motion, a memorable temporal remnant. As an analogy to this motion remanence we can think of the physical sensation felt when one has stopped practicing an energetic excercise: we are left with the remanence of the energy excerted. It is thus reasonable to suggest that rhythm - as gesture - can be abstracted in terms of motion. Otherwise put, we can speculate that the evolution of a given sound object projects a kind of *short- term rhythmicity* (force) and can be thought of as a "formed time-object" capable of functioning as an unambiguous temporal context to other sounds. This relational capacity immediately suggests myriads of compositional strategies which may originate in an interpretation of gesture in terms of its rhythmic *penchant* - its kineticism - and as the basis of self-contained "time-form" models which can be used referentially[7]. Of course, there are sounds that are more suited to this interpretation than others, in which case it may be more convenient to talk of *rhythmic objects* , rather than of the more familiar concept of *sound objects* [8]. In my view, one relevant compositional implication of this distinction is that the ambivalence between rhythmic/sound objects is in itself an ideal vehicle which may serve, on one hand, to relate instrumental and acousmatic gesture, and, on the other, by means of stringing such "rhythm-imbued" objects, to control the design of motion and musical time. Let us re-consider that, if a symbolic equivalence between sound and physical movement seems natural to us, it is because it rests not only upon the sensory experience of movements that produce noise, as François Delalande singles out (Delalande 1992) , but also on movements that articulate rhythm. Thus invoking metaphors that link rhythm with, say, dance and other physical gestures, may help us to achieve a holistic and broader understanding of rhythm and its kinetic properties.

One other interesting aspect of rhythmic objects is that their successive stringing produces a kind of apportionment of time which allows the recognition of patterns. I shall not delve here into how grouping and patterning in general is inferred by the listener as this has been discussed in some detail by psychoacousticians and psychologists[9]. However, I would like to focus on two particular kinds of rhythmic pattern: pulse and metrical flow. According to Parncutt (1987) pulse can be thought of as a chain of events or 'points' that are perceived as being equally spaced in time. Pulse points are said to "emerge" by the existence in short-term memory of two salient events. The period and phase of the successive pulse points is determined by the temporal position of the accented events[10]. Metre on the other hand, refers to the percept of a cyclical flow of motion through the perception of an order of importance amongst those perceived accents. Compositionally speaking, the fact that pulse and metrical flows emerge from the stringing of rhythmic objects presents great potential to serve as a multilayered temporal reference, as a kind of transparent and strong background force against which other sonic dimensions (ie. timbre, dynamics, etc.) are susceptible of being perceived as being formally related to each other under different kinds of transformation.

This heuristic raises even more other enticing compositional avenues concerning the interdependence of manipulating rhythmic objects, metres and pulses , and their temporal properties, that is, the "flows" that may be made to emerge from their interactions. These interactions may assist the listener in attributing a form to the passing of time - and not exclusively to the objective properties of the sound - for instance, by creating a sense of time expectancy or latency, or a sense of time flowing faster or slower, etc. Kramer suggests that time itself *can be directed* in multiple ways , " not an objective time out there, beyond ourselves, but a very personal time created within us as we listen deeply to music" (Kramer, 1988: 6). With regards to the structuring of musical form, this statement seems to invoke scrutiny into how can the

composer influence the pacing and the fluctuation between ontological (real) time and experiential (musical) time.

Today we notice in music, especially electroacoustic music, a specialisation in the compositional use of timbre. There is no question that the production of spectacular nuances in timbre and of astonishingly beautiful soundscapes is something for which electroacoustic means are ideally suited. However there is, in my view, a need to use this enormous potential hand in hand with an equally accountable attention to the organisation of time, temporal relations and *processes* that organise the perception of musical dimensions. Findings in psychoacoustics and cognitive phsychology tend to point out that it is no longer possible for the composer to rely exclusively on the local or the "concrete" temporalities of sonic dimensions to potentiate formal proposals ; it is also necessary to investigate strategies through which we may engender time and form at the higher hierarchical levels of musical discourse, whatever these hierarchical rules may be. The underlying proposition in this thesis thus suggests that formal structuring may be greatly enhanced by a compositional cognisance of rhythm. I shall presently discuss strategies used in my own works and specific instances of the use of rhythmic structures and their interaction as the basis of such an inquiry, hoping that these may serve as suggestive pointers towards the understanding of a compositional prospective.

Footnotes on Chapter 1

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[1] " Pitch and duration seem to me to form the basis of a compositional dialectic, while intensity and timbre belong to secondary categories.The history of universal musical practice bears witness to this scale of decreasing importance as is confirmed by the different stages of notational development." (Boulez, 1966: 37)

[2]See for instance McAdams and Bregman (1979) where the authors discuss the principles of how various musical dimensions affect the perception of continuity in music.

[3]Reduced listening (écoute réduite) as proposed by Pierre Schaeffer (Schaeffer, 1966) , is a way of listening by which the sound's source or causal references are ignored in favour of its spectral and morphological characteristics.

[4]These durations correspond to a perceptual time threshold varying from 50 milliseconds for short sounds, through 3 to 4 seconds for medium length sounds, to 5 or more seconds for long sounds. The first type refers to sounds perceived as impulsions to which definitive timbre or pitch can hardly be attributed. Sounds of medium length are perceived in their entire form. Long sounds are perceived in stages.

[5]The concept of sound object corresponds to a a short entity with specific sonic characteristics, such that at subsequent hearing, the object can still be identified as being the same: "*...L'objet sonore s'inscrit dans un temps que je n'ai trop tendence à me confondre avec le temps de ma perception, sans me rendre compte que le temps de l'objet est constitué par an acte de synthèse, sans lequel il n'y aurait pas d'objet sonore, mais un flux d'impressions auditives; enfin comme il est éphémère, l'expérience que j'en fais reste unique, sans suite.* (Schaeffer,1966:269)

[6] According to McAdams and Saariaho (1985: 1), one important criterion of form-bearing potential is that "...the categories and functional relations and orderings within a classification system are susceptible to learning by listeners..."

[7]See for example Julio D'Escrivan's comments on the pöetic potentiality of *time-imbued* sound objects. (D'Escrivan,1987)

[8] Sound objects may imply the coexistence of two global aspects. Firstly, they include saliences - accented and unaccented parts. Secondly, they present a characteristic timbral and spectral trajectory. The interaction of these two global aspects determines the shape and behaviour of a rhythmic object and its implied motion. Depending on which of these two aspects predominates, the rhythmic object will range between a purely pulsed rhythmic object to the more familiar idea of a sound object

[9]See for example Parncutt (1987) and McAdams (1982).

[10]The features of pulse are its *period,* or the perceived interval between the events and *phase,* or the actual time at which any particular event is perceived relative to some reference time.

Chapter 2 Papalotl
An experiment of motion as form

2.1 Background

Papalotl for piano and tape was composed during 1987. The previous year, I had worked on a piece for the same combination (on a commission from the Park Lane Group with funds provided by the Arts Council of Great Britain) for pianist Simon Lebens. This work, entitled *Luz Caterpilar* was produced considerable pressure and in very little time. The results were unsatisfactory, so I decided to revise the work. Although I am not one to re-work pieces, I was puzzled enough with some of the results of *Luz Caterpilar* to want to create a second version.

My brief for *Luz Caterpilar* was to compose a short showpiece - not more than 15 minutes - to be included within a programme of purely acoustic works[1]. Given that this would be the only work in the programme with electroacoustic requirements, I decided to keep stage production matters simple and avoid the use of a click-track[2]. This meant a number of pre-compositional decisions. Firstly that I would have to compose a piece where complete synchronization was not a critical element allowing the player enough time to respond aurally to the material on tape with the help of cues written in the score. I therefore decided that the tape part should act as a kind of elaborated rhythm backbone onto which the piano part could easily be superimposed, in a similar way to pop musicians playing to a pre-recorded drum track in a multitrack recording. I therefore set myself the task of using sampled piano sounds to assemble the rhythmic basis on tape, treating it as a percussion part. With regards to the specific choice of sounds, the solution was not so straightforward. My main concern was that, if I used similar sounds to pair up with the live piano, any slight timing difference between pianist and tape would become immediately

apparent. And, given my conscious decision not to use a click-track, synchronization was bound to be inexact. So to pre-empt obvious attack differences, I decided to use entirely dissimilar sounds with very distinct transients, which would still allow me to "shade and tint" the piano part, yet mask inevitable performance errors. I finally chose inharmonic sounds - bells and rubbed wine-glasses - aiming to blend the live with the tape.

The weakness of what I thought was a watertight approach soon became apparent. My "rhythm backbone" strategy proved to be too coarse to prompt a stimulating relation between piano and tape. The instrumental use of sampled piano sounds in the context of a rhythm track implied little more than a fairly simplistic secondary piano part. Sonically speaking, the crudeness of my scheme - I had decided to use the sounds un-processed - put in evidence the low definition of my sounds and further impoverished their quality when in direct contrast to the live piano. Whilst this approach helped the pianist to connect with the tape, it did not allow much room for variation. Had I programmed complex gestures using the same sounds, they could have provided more interesting sound objects, but this would have made things extremely hard to follow for the instrumentalist. Yet in that context my bells sounded static and divorced from the overall resonance of the piece. This lack of depth became more apparent as I tried sections of the work with the player. Finally, and more importantly perhaps, was that my piece yielded little dramatic resonance as a result of the subservient role of the tape part which left the piano part helplessly moored at the foreground of the music.

As far as I could see, it was too late in the day to re-design the whole piece and devise a way of keeping player and tape together. But even at that late stage, I re-composed freer sections which interrupted the long synchronised phrases which I kept from my first scheme. In formal terms my haphazard solution did not allow the music to gather any kind of consistent momentum as

I had originally intended which inevitably resulted in a very fragmented discourse. However, to my surprise, interesting things started to happen as soon as the player lost synchronization. Firstly, the tape part seemed to take on a life of its own as if it were free from its time constraints. The multiplicity of unintended and disjoint attacks seemed to elicit a constant change of planes, a "something other" between instrument and tape. I was particularly struck by the fact this generated a completely different listening experience than the one I expected. Somehow a motion full of rhythmic poignancy emerged and in the alternation between silence and seemingly unpredictable percussive gestures a sense of pulse unfolded. And although the long breath of phrases disappeared, a sense of inner momentum was clearly felt. The composition of *Papalotl* was the exploration of this accident.

As discussed previously, one of the most immediate challenges in writing a piece for instrument and tape is the creation of a characteristic relation between the two components. It is hard to say at what exact stage the compositional choices governing this aspect of a work are made; clearly this varies from piece to piece and from composer to composer. What is certain, is that any chosen strategy to that effect carries important formal consequences which influence not only the process of composition the choice of sound sources, their combination, transcription from computer representation to conventional notation , but also of performance (the reading and learning) and concert presentation (technical production) of the work itself.

By the time I started composing *Papalotl* , these questions were very much present in my mind. On the other hand, several works had recently appeared on the scene which demonstrated diverse compositional strategies using the same (or similar) combination and which gave me further food for thought. Most of these works explored to an advanced degree the use of the tape as an extension of the live instrument(s). In Simon Emmerson's *Piano Piece IV*[3], for

example, the tape re-creates, extends and "re-tunes" the piano resonances, thus establishing a formal relation between these and the harmonic development of the work as a whole. In Alejandro Viñao's *Triple Concerto*[4], the tape also extends the live instrumental sounds, in the context of individual cadenzas for each instrument.

Both pieces interested me for several reasons. First and very significant to my work was that both works illustrated some of the most interesting techniques ever used on the Fairlight II Computer Music Instrument as a composition workstation[5]. Amongst these techniques was a "layering" technique which consisted in repeating the same short sound to generate longer durations. The sound, which could be looped or not, was repeated eight times, overlapping[6] before the cycle was started again, the CMI having a polyphony of 8 voices. Once the process was set in motion, it was possible to continuously vary the tempo as well as the pitch, volume, envelope and filter cut-off frequency for each repetition of the sound. After careful adjustments of these control parameters, it was possible to create smooth changes in the spectrum and phase relation of the resultant sound and thereafter during the successive appearances of the original source . In brief, from this technique I learnt how it was possible to create an entirely new sound object from a short sound source on the Fairlight - what Trevor Wishart terms to *impose* a morphology (Wishart, 1985: I shall refer to this in the course of this chapter).

The two works referred to successfully integrated the live and the tape by using sounds sampled from the instruments themselves. Realising just how this was done provided me with a model from which I could evaluate the compositional potential of my own sound sources. In the case of *Triple Concerto*, less familiar instrumental sounds served as sound sources. These included flute multiphonics, scraped sounds inside the piano, cello harmonics, etc. which were given the double function of articulating and

extending (in the instrumental sense of the word) the sound world of each individual instrument as well develop the tape as a fourth instrument for soloistic interventions.[7] In sonic terms, what seemed clear was that the success of these works lay in the coherent grammar that was set up between the sound sources, the sound objects extracted from them and the live instrument.

2.2 Instrument and tape relation

In response to the aforementioned pieces, and based on my previous experience, in *Papalotl* I wanted to explore the possibility of integrating tape and live performer not by extending the sound of the latter, but rather, by creating a pointillist frame onto which a virtuoso piano part could be mapped. I relished the idea of re-creating the sense of momentum I had experienced through the unforeseen "misplacement" between piano and tape in the earlier work. Specific questions began to emerge : I needed to know what I was actually hearing, where exactly its interest lay, how I could *make* it happen and, once set in motion, how I could control it.

I could not help being reminded of an earlier experience: the exhilarating sensation of instability which is often found when dancing. In very simple terms this can be exemplified by imagining you are dancing a waltz. If the music is suddenly changed to a polka with the same tempo the metric accentuation pattern changes from a 3 to a 4 based pattern (from shorter to longer metric flows). As a dancing partner, there is an inevitable period of adjustment, from one to the other. Rather than focusing on the accentuation change between a short and long, I found most interesting that precise moment of unbalance, the "something else" in between. This, in dance, is a provocative sensation, one which questions the way you move. It seemed to me that this was where the poetics of my piece could lie.

Indeed, interesting things had started to happen when the player lost synchronization with the tape. After some consideration, I came to the conclusion that what I was hearing was the accidental conflict between the one hand, the chords and lines played by the pianist and on the other, the pulse implied by the short percussive attacks on tape. What I have called the "something else" was the unstable coexistence of two discrepant rhythmic shapes[8] happening simultaneously. It also became clear that the discrepancy was most successful and interesting when the combination of a short sequence of chords with percussive attacks implied contradictory releases of both rhythmic momentum and harmonic tension. The more the chord sequence and the pulses were easily identifiable in themselves, then the clearer the variance became. In fact, these elements only needed to be simple in order to yield an interesting and complex relation. This need for clarity suggested immediately that I should approach the live instrument as a percussion part. Furthermore, this option suited my conception of the piano as a percussion instrument.

2.3 Integrating material

2.3.1 From sound sources to harmonic material

To generate material to experiment with, I first devised a number of chords as the basic building blocks for the piano part. As I wanted to relate the piano part to the spectral structure of the sound sources I would eventually use for the tape part, I analysed the pitch content of five basic samples recorded from the inside of the piano. These sounds were produced by scraping or hitting with a metallic object the lowest strings, so they resulted in clangorous and almost entirely inharmonic conglomerates. In order to ascertain their strongest partials, I re-played them two octaves below their normal tessitura after sampling. These were charted into a chord scheme and then simplified in

transcription to 4-note type chords for the piano part. (Figs. 2-1a and 2-1b).

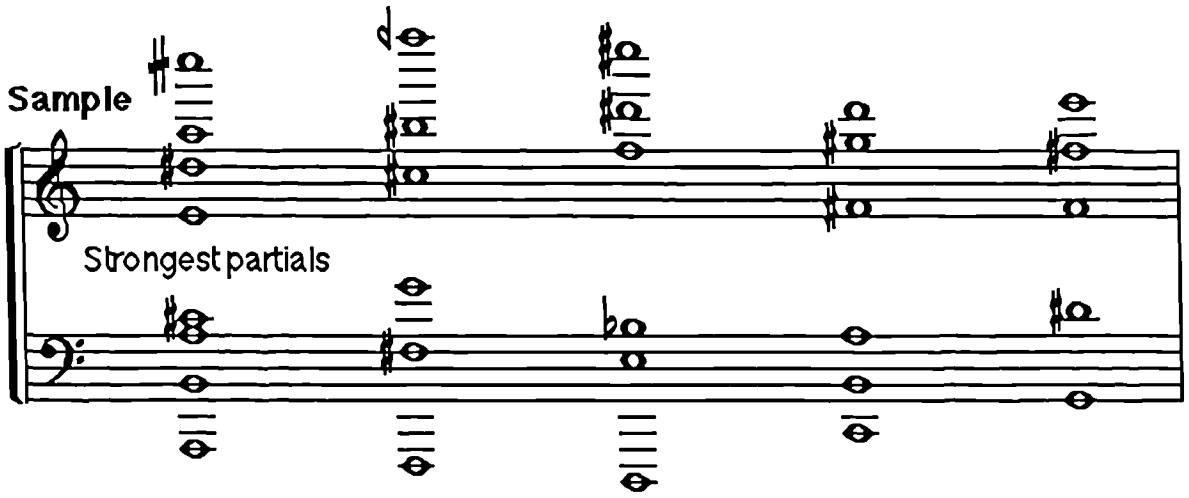


Figure 2-1a: Papalotl. Originating samples and their partials

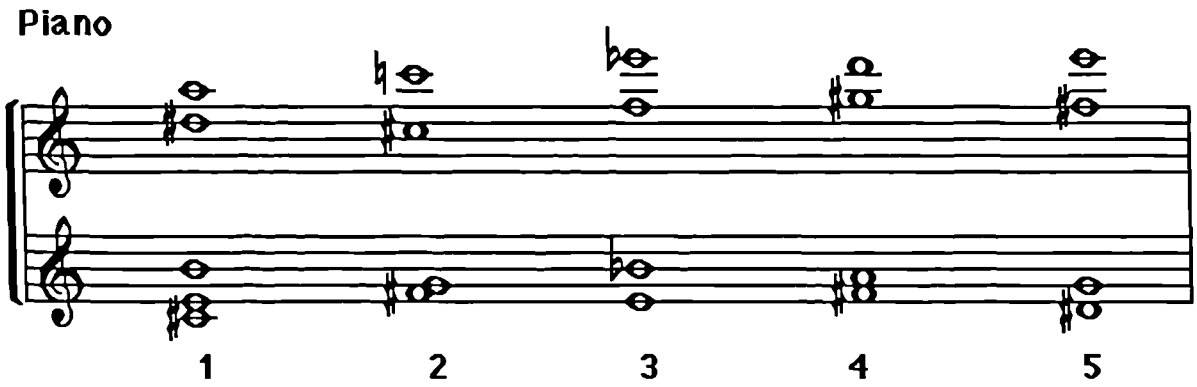
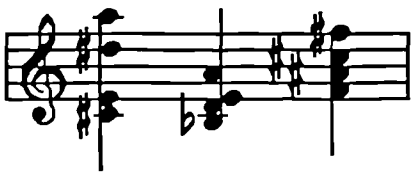


Figure 2-1b: Papalotl. Chord scheme derived from samples partials

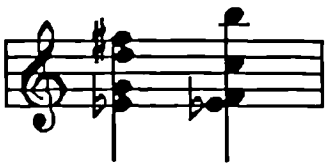
I started to intuitively play around with these chords. I wanted to develop some kind of functionality between these and other chords in such a way that, when made into rhythmic objects, they would become characteristic, not only through rhythmic placement, but by an inherent harmonic sense of progression between them.

Without resorting to root relationships which result from using a fixed scale or mode, harmonic progression between these chords seemed only possible if I assumed *a priori* that their intervallic makeup was the determining aspect of harmonic tension. Using the five basic chords as *schema*, I composed numerous other chords which I classified, according to semitones, into four groups, as follows:

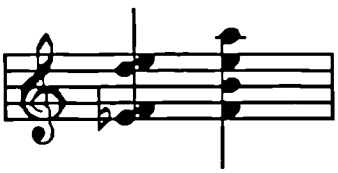
Stable
1) Three - eleven - six
2) Four - two - five
3) Four - four - five



Less Stable
1) Four - seven - four
2) Two - seven - eleven



Neutral
1) Two - eight - two
2) Six - five - five



Unstable
1) One - seven - eleven
2) Six - seven - ten
3) Eleven - two - eight

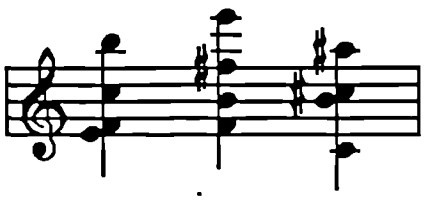


Figure 2-2: Papalotl: Chord schema according to intervallic makeup (expressed in semitones)

This classification provided initially the harmonic material for the piano part. Later on it also served as a model for the electroacoustic material(see below). In order to achieve flexible harmonic progression it was also necessary to systematise the voice-leading between chords. This was done by contrary motion in either of three ways. (Fig. 2-3) .

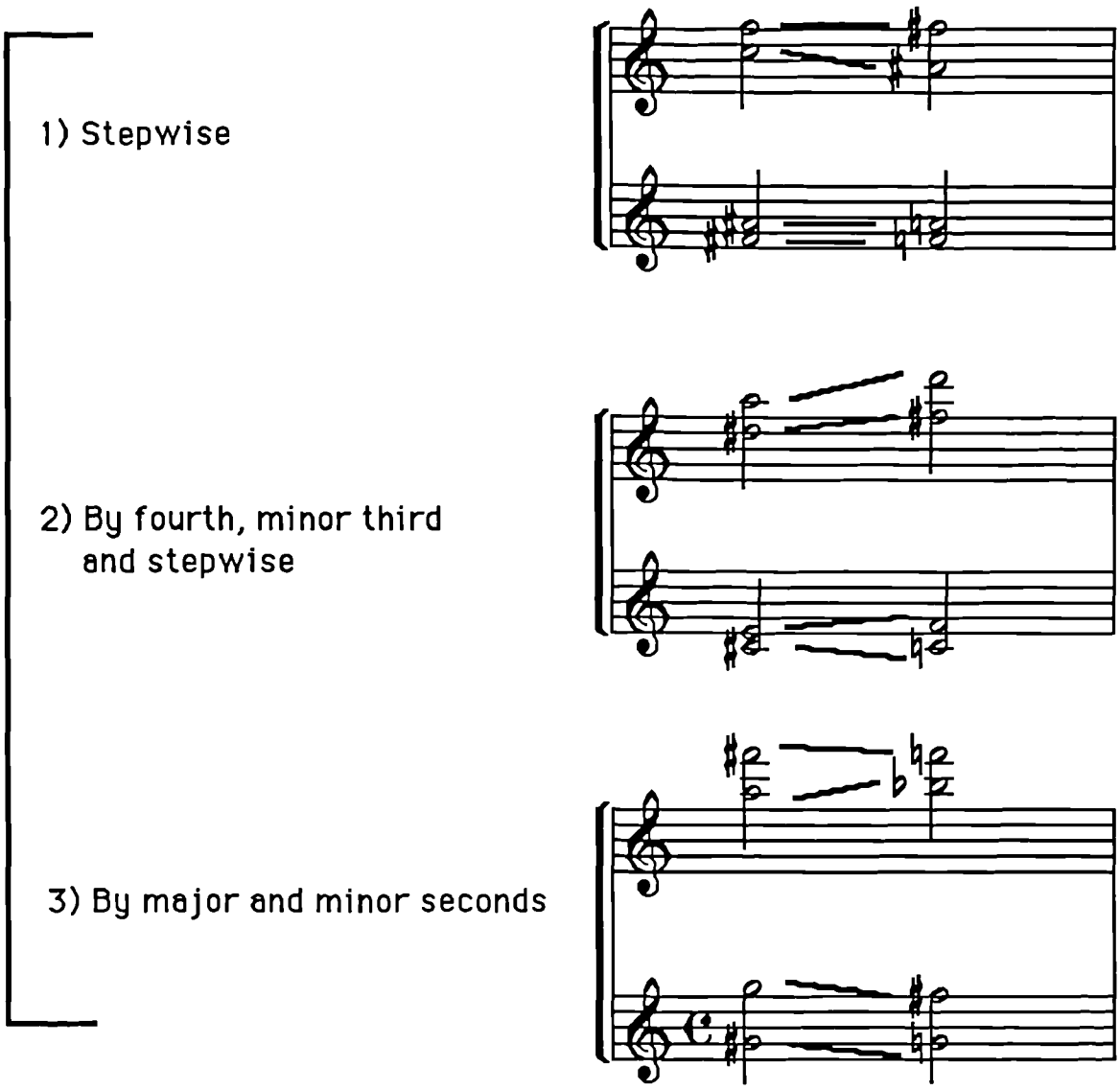


Figure 2-3: Papalotl. Chord schema voice leading

2.3.2 From rhythmic patterns to rhythmic objects

The following step was to develop short rhythmic patterns onto which I could map the chord schema. I started out with a few syncopated patterns of different lengths, where shorter and longer durations were interspersed, such as:

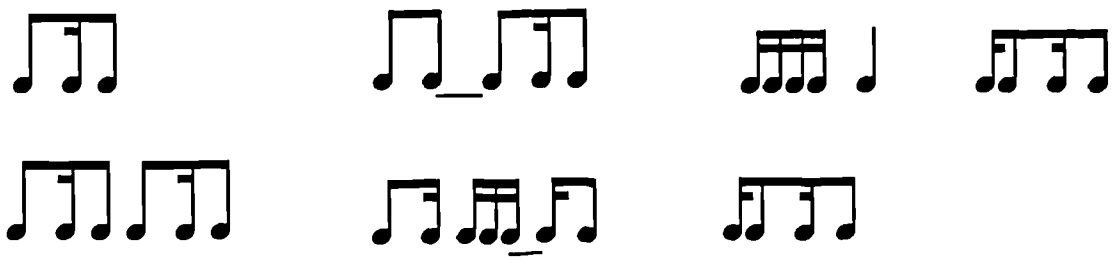
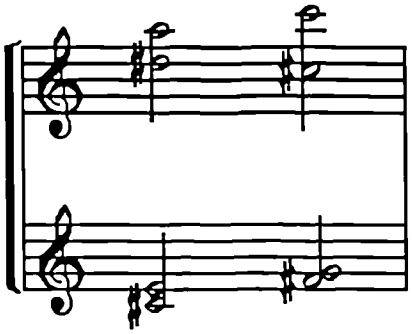


Figure 2-4:Papalotl: Typical rhythmic patterns

A model for an object could then be obtained by combining two of these simple elements. Take, for instance, a short sequence made out of two chords which have a clear *strong-weak* harmonic shape.

a)



Then, mapping the chords onto a rhythmic pattern which opposes its shape, say , a *short- long- short*  with an arsis accent yields the following object and agogic accents:

b)

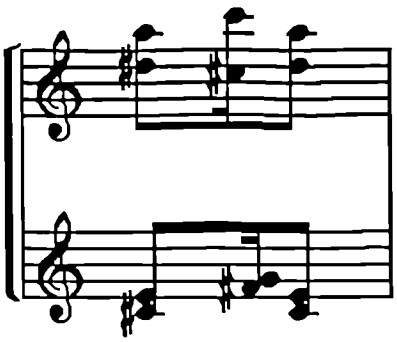


Figure 2-5: Papalotl: A typical rhythmic object for the piano

The above example represents one of the basic "building blocks" used in *Papalotl* , which I shall refer hereafter as *rhythmic object*.. As explained before,

sound objects are in general the synthesis of two global aspects: salient features specified by energy, and a timbral evolution specified by spectral structure. These elements are such that at subsequent hearings, the object is recognised as being the same. The interaction of these two inherent aspects determines the object's overall morphology, that is, its shape and the motions it may imply. If salient, accented[9] features predominate over a continuous spectral evolution, the object will be closer to a what I call a rhythmic object. Conversely, if its spectral trajectory is elongated without any specific protuberance, then it can be regarded as the more familiar sound object well known to electroacoustic music. Instrumental writing such as the one in *Papalotl* is a somewhat extreme case: a short sequence of saliences but little predominance of a timbral evolution. We can talk nevertheless of a rhythmic object because its inner correlations result in an unstable gesture. By "unstable" I mean that the gesture is imbued with an internal force of motion, generated by the tension between the harmonic "downbeat" implied in the first chord and the agogic (length) accent on the less stable chord happening at an "unexpected" place, which challenges its stability[10]. Rhythmic objects in the piano part of *Papalotl* were of that kind, ie. short, single, self-contained unstable gestures. I used a number of additive procedures (see below) to expand the instrumental material as well as repetition as a compositional strategy to generate objects and articulate tape material, beginning of phrases and larger sections and also to generate pulses as a means of further integration between piano and tape. As I sought to define sections by their harmonic progression, repetition of *color* (see Isorhythm below) allowed me to invoke familiar harmonic contours within new rhythmic objects, even when repetition was in itself, not literally present. With regards to the electroacoustic material, I used repetition as a form of granular synthesis, as an iteration of samples at frequencies in the audio range to fuse their harmonic characteristics into one single timbre compound or to generate hybrid gestures somewhere in between.

2.4. Stringing

I then used simple additive operations by which basic rhythmic objects in the piano were strung, augmented and transformed to generate patterns for other transformations such as Isorhythm.

2.4.1 Augmentations by addition

This is illustrated in Figures 2-6a to 2-6e.

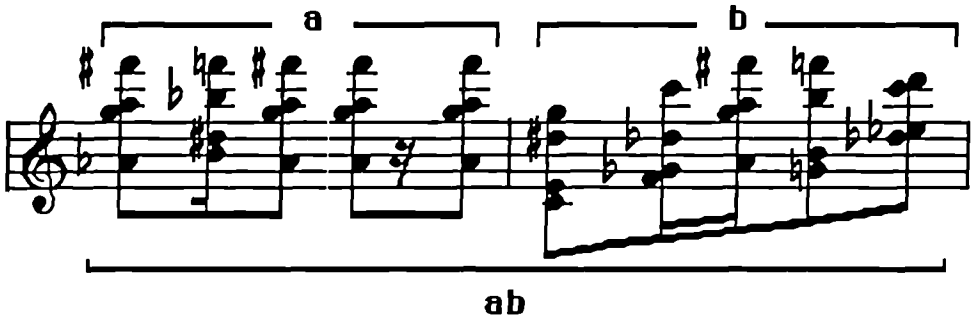


Fig. 2-6a: Papalotl Addition of two rhythmic objects *a* and *b* to form object *ab*.

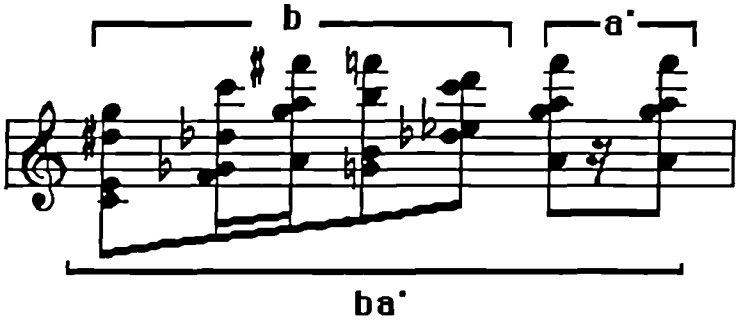


Fig. 2-6b : Papalotl: Addition of second half of object *a (a')* to object *b* to form *ba'*

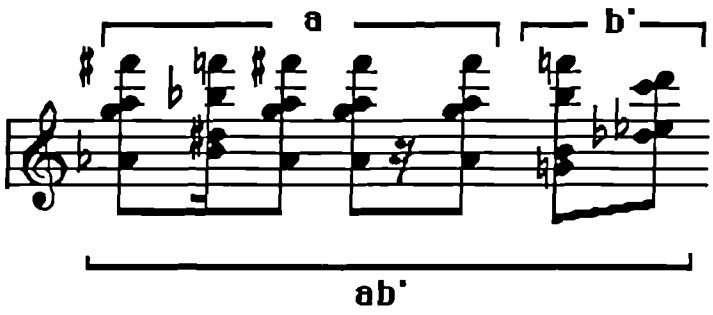


Fig. 2-6c : Papalotl : Addition of second half of object *b (b')* to object *a* to form object *ab'*

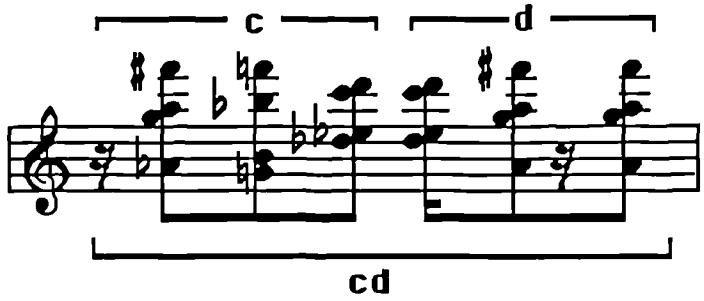


Fig. 2-6d : Papalotl : Addition of *c (half of ab')* to *d (half of ba')* to form *cd.*

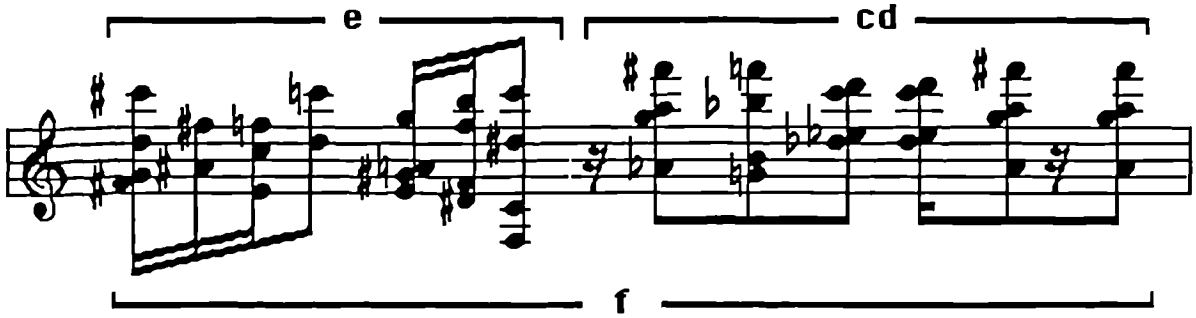


Fig. 2-6e :Papalotl : Addition of new object *e* with *cd* to form object *f.*

2.4.2 Isoperiodicity

Larger transformations were carried out through the use of *isorhythm* . Isoryhthm or isoperiodicity is a technique which was very much in vogue during the 14th century Ars Nova era in France and Italy. It works by systematically combining rhythmic periods or *talea* with *color* or melodic sequences. In the case of *Papalotl* , instead of using *color* made out of melodic phrases, I used chord sequences chosen from my harmonic material and I mapped them onto *talea* made out of short and extended rhythmic patterns. As in the 14th Century, the lengths of *talea* and *color* were not necessarily the same, so, for instance, a chord sequence made out of two chords was mapped onto a pattern of three elements. The ratio between the two establishes a cycle of repetition, hence the periodic nature of the technique. However, the procedure works best when it is not complex; simple ratios such as 2:5 or 2:3 suffice to yield useful and interesting musical

combinations. Let us take a simple case where a ternary *talea* (a three element pattern) is used with a binary *color* (two chords) and then repeated:

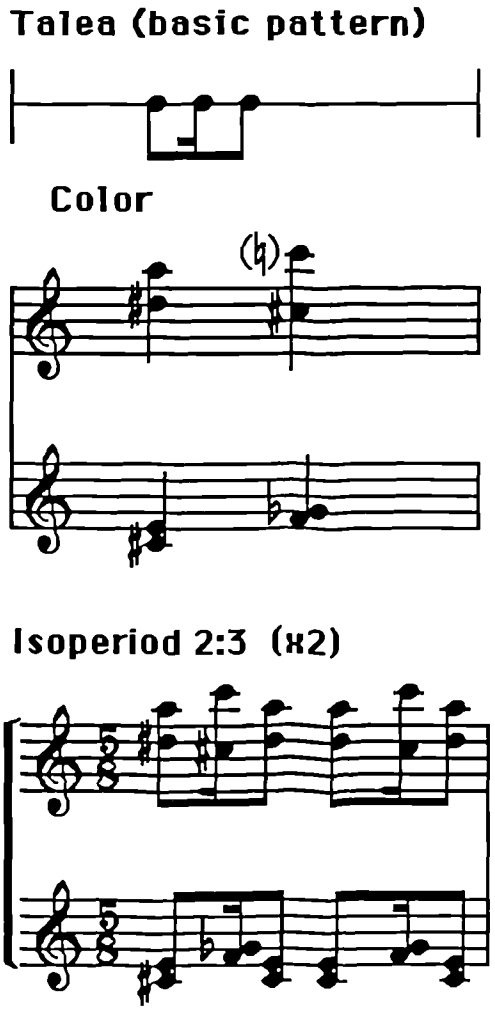
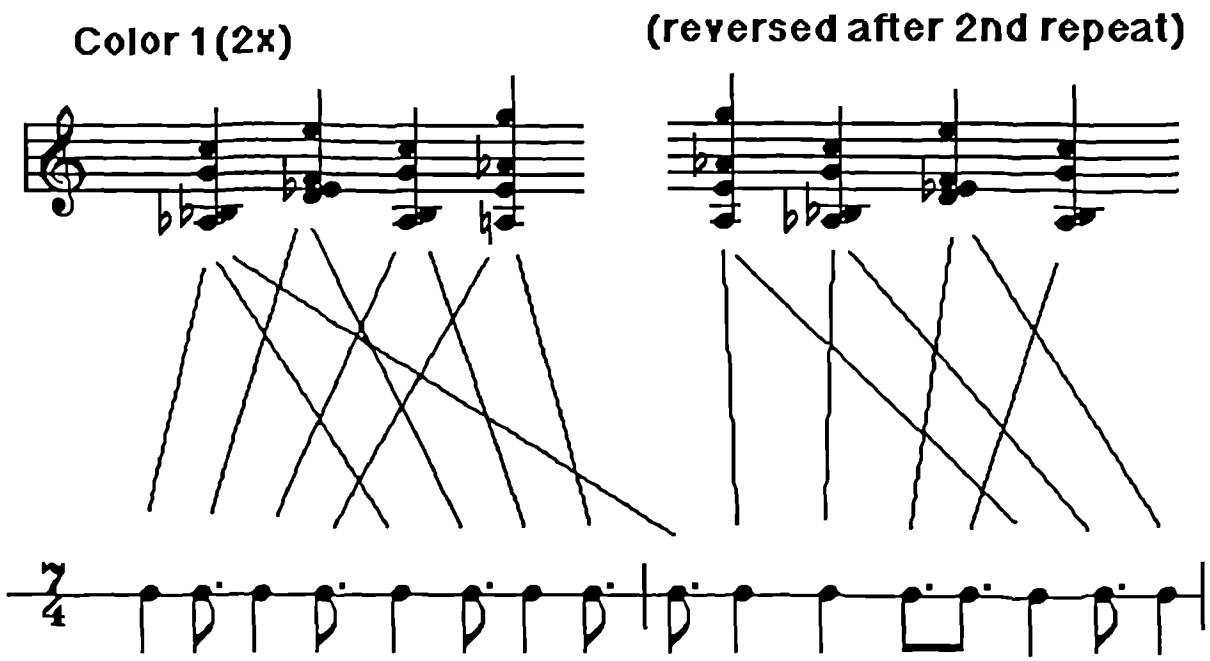
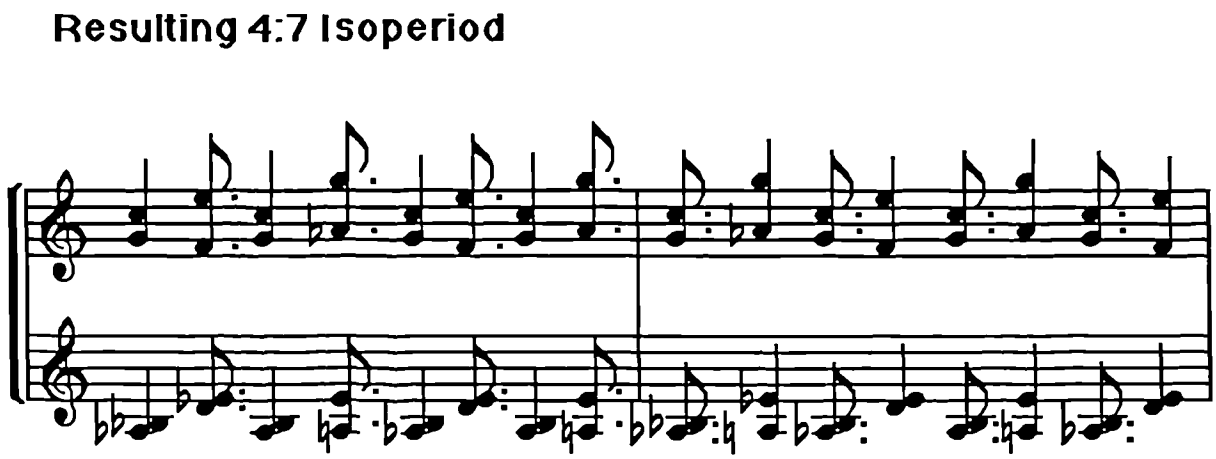


Figure 2-7 : Papalotl: Talea and color: 2:3 Isoperiod object

Another related procedure consists of establishing a *talea* but reversing the *color* after one or two of its repeats. Although this obscures the isorhythmic process itself, it gives an extra dimension to the harmonic progression and the rhythmicity implicit in the pattern. This kind of procedure was used rather intuitively, altering the rule if the particular context so required. (Fig. 2-8).





F igure 2-8 :Papalotl : Reversed talea and resulting isoperiodic 4:7 object

2.5 Pulse and repetition

As pointed out before, all pulses are potentially infinite series[11], so in the context of angular (and of similar attack onset) rhythmic objects as those used in *Papalotl*, I found that the emergence and tempo (or speed) of pulse points could be controlled quite readily through the careful choice of temporal placement of accented events within an object (either by stress in intervallic makeup, harmonic relation or dynamics) or within a succession of objects. In

the first instance I experimented with objects repeated unchanged a few times, a process which yielded two main types of pulses: (i) a *global* pulse, relative to the speed (phase) and length (period) of the repetition and (ii) a *local* pulse manifest in the tempo (phase) and the length (period) of the object itself. See the example below:

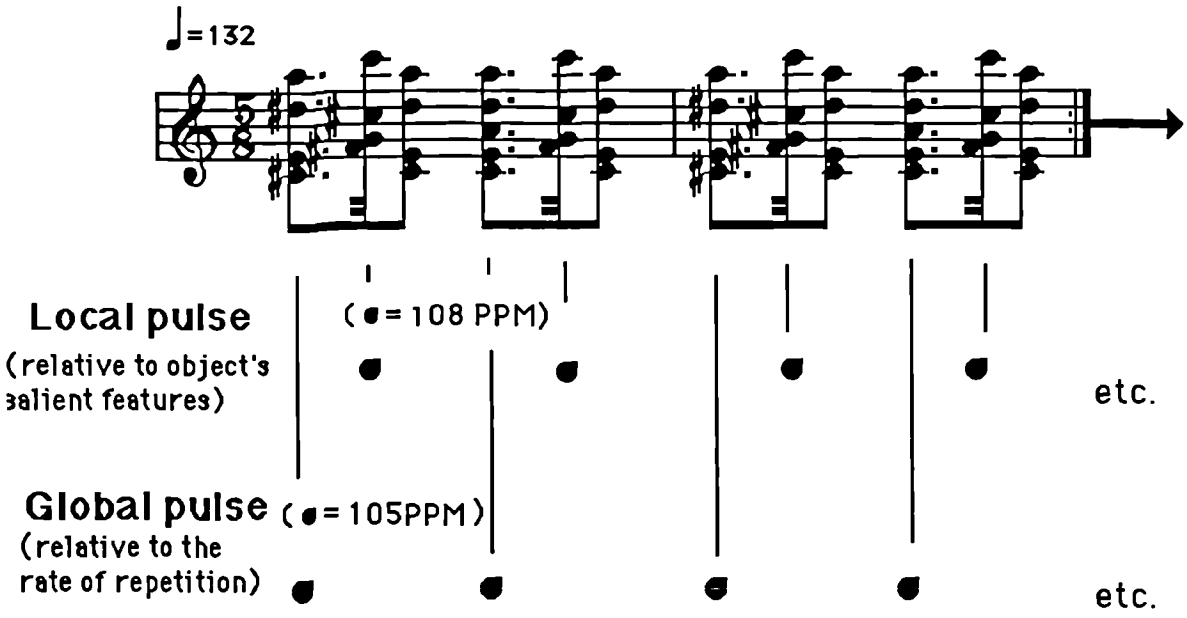


Figure 2-9: Papalotl: Pulses generated by repetition

Local pulse points emerge by iteration of salient features, whilst global pulse points are specified by the tempo and by the "size" of the repeated object. As may be inferred from the example, global pulse is perceived at a lower hierarchical level which corresponds to the length of the repeated object. At this level, the perception of global pulse is related to the perception of accentuation patterns, which some theorists have referred to as a metric "motion"[12]. I shall come back to this. In compositional terms, the perception of pulse period and phase in both levels can be predicted by the temporal placement of accented events.

In addition to the contextualising strength of pulse or of the force of motion that the perception of pulse provides, there is great compositional potential in the information furnished by emerging pulses. Looking at it from another angle, pulse points can be regarded as indicators of tempo or frequency. Let us start by considering local pulse as a tempo reference. As the example above shows, the repetition of that particular object yields 108 and ca. 105 pulse points per minute (PPM)[13] . Based on "first generation" objects, I created a new piano object which was articulated at the tempo of one of the emerging pulses -108 PPM. Because the new tempo was originated from the local pulse of the originating object, the overall phase relation between the two objects was equal to the ratio between tempos, in this case 10:11, which yielded such irrational equivalences as ♩ : ♩ 5 To make things easier to transcribe, and given that at fast tempos the difference would not be so significant, I resorted to simplifying the equivalence to the nearest exact geometric ratio (in this case 8:10) ♩ : ♩ to proportion duration and tempo (sounds played slower result in longer durations), so I could notate the new objects thus generated in terms of semiquavers at ♩ =132 BPM, the tempo marking of the entire work.

Another interesting experiment consisted in juxtaposing repeated objects in the piano against gestures on tape whose global accentuation contour corresponded to the tempo of the emergent local pulse, thus, on one hand reinforcing the salience in the rhythmic object, and on the other, contradicting the object's metrical cycle. As there is normally a delay of the performer's attack with respect to those on the tape part, using close ratios (as above 10:11) tends to accentuate the discrepancy. In my experience, given that the attack onset times are slightly askew, but that the metric flow is being "pulled back" by the pulsing of the gestures on tape, the discrepancy prompts the performer to increase the tempo, imbuing the attacks with a very rhythmic anticipation, helping in turn, to create the illusion that the gestures on tape are

triggered by resonances from the piano. Although this phenomenon is difficult to illustrate, the example below may give an indication as to how the process interlocks. (Fig, 2-10)

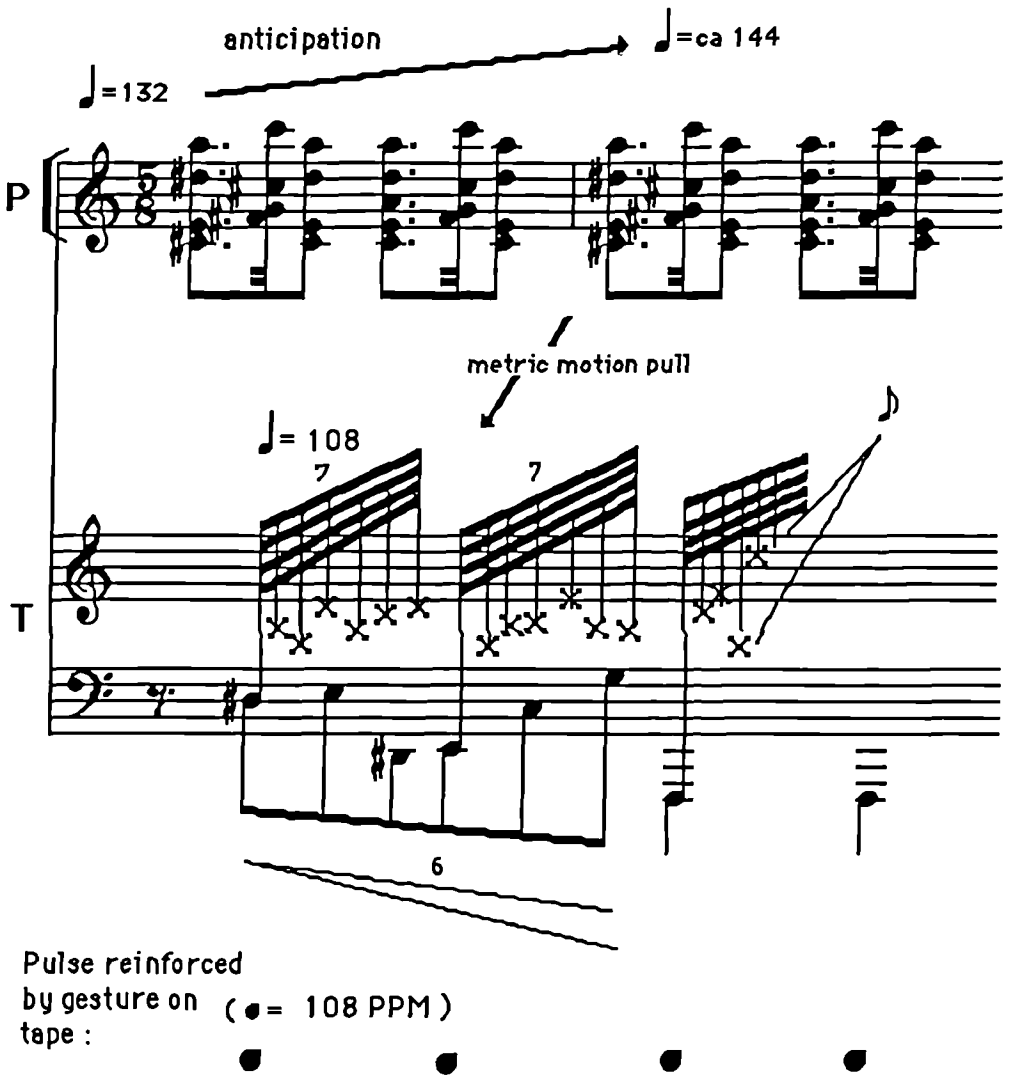


Figure 2-10 : Papalotl: Gesture on tape based on local pulse

On the other hand, I considered pulse speed as an indicator of frequency. The PPM information furnished by emergent pulses was used to derive multiples (for example 1680Hz -from 105 PPM) as the frequency basis for "granular" repetitions. This was useful to create gestures or continuous sounds on tape which could be made to function as partial frequencies to the live piano part or other sounds on tape, thus establishing a harmonic relation at several

structural levels. Examples of this kind of use will be discussed below and in Chapter 5.

2.6 Pulse, metrical flow and variation

In general, a sequence of repeated or strung events favours the perception of short-term memory *schemata*, that is, of patterns and groupings such as pulse. However, the relation is dialectical, because, once pulse is perceived, it tends to continue, acting thereafter as a framework against which the degree of accentuation (whether harmonic, rhythmic or timbral) of saliences can determine the flow of a cyclical pattern which we interpret as metre[14]. An example of the compositional use of this relation can be found in the early works of American composer Steve Reich, where a solo percussion instrument explicitly provides a pulse against which repeated patterns undergo a gradual processes of augmentation and diminution[15]. As the pulse remains constant, shifts or successive changes in duration or structure of the patterns creates tension as it acts against the cyclic tendency of the metrical flow.

In *Papalotl* I wanted to take this principle further so that, by varying the rhythmic objects as well as the underlying pulses, I could generate moments of metric and cyclic ambiguity. This technique required inventing a manner of progression between two pulses, so I started by establishing a metrical cycle by repeating a *color* rather than a rhythmic pattern, supporting the pulse by gestures on tape. By augmentation of the timespan and varying the placement of harmonic accents , I would introduce the seed of a new pulse, which would then be taken over by the tape, thwarting the expectancy of a cycle, and gradually weakening the perception of the original pulse. As the overall tempo was quite fast, the addition of a few semiquavers per *color* cycle resulted in gradual minute expansions which created a glide between one

possible pulse and the other. I was particularly interested in this area "in between" , because - in the contravention of metrical balance between the color and the pulse - there was a sense of "time expectancy" which would only result in fulfilment once the progression to the newer pulse was completely established by the coincidence of metrical accents between piano and tape material.

Other variations of " pulse progression" included stressing the new pulse point "seed" from local pulse points rather than from the global, more metrically bearing ones; or arbitrarily initiating the new pulse with material on tape rather than by the piano. My ulterior idea was to establish a functional correspondence between "darker" harmonic areas and slower pulses, or "clearer" harmonic areas and faster pulses, to delineate the boundaries between sections of different "rhythmic charge", end of phrases or points of repose. (Fig. 2-11)

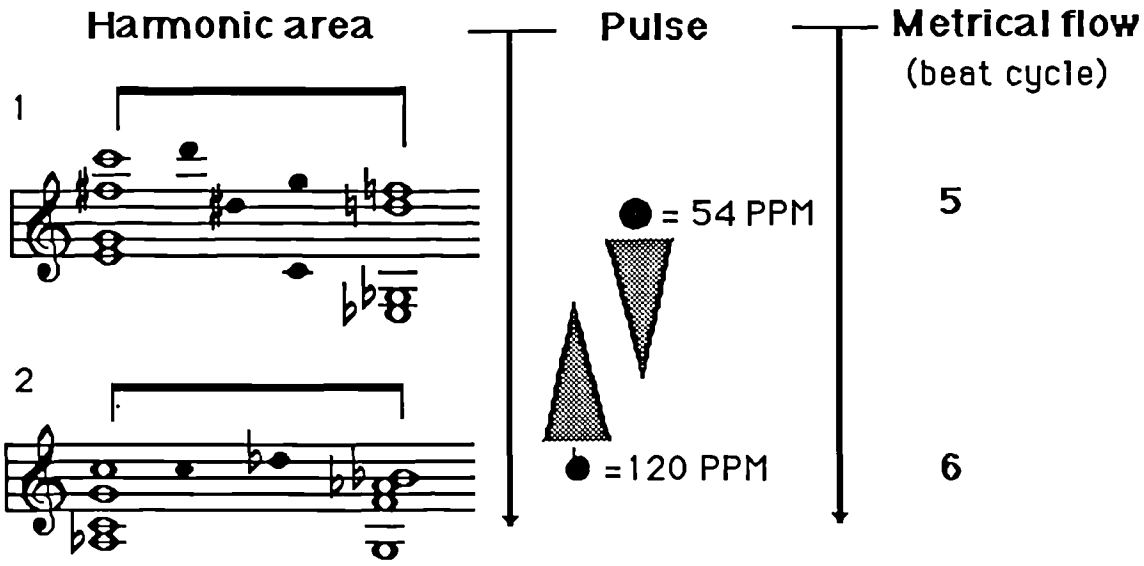


Fig. 2-11 : Papalotl: Harmonic, pulse and metre correlations

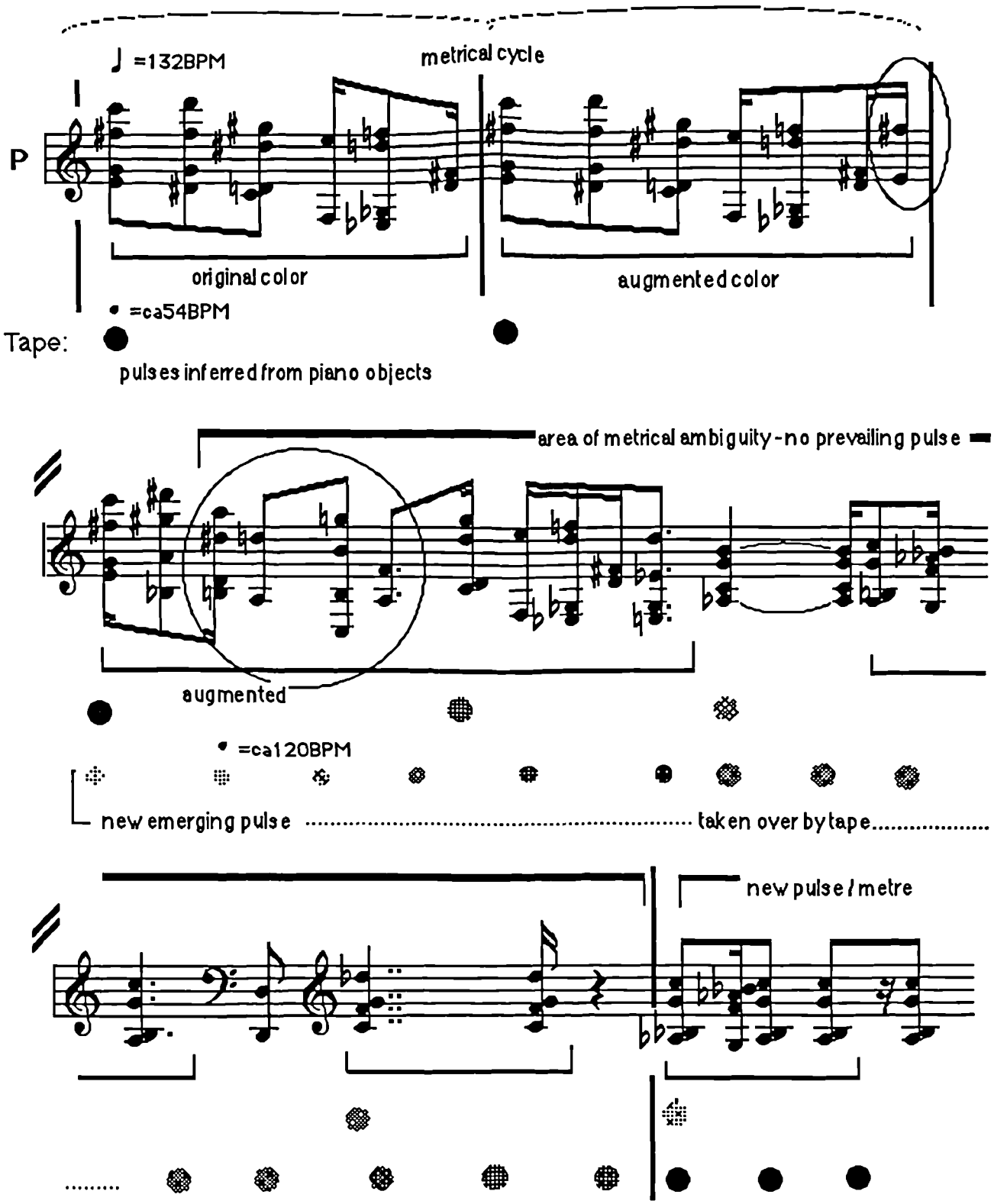


Figure 2-12 : Papalotl: Metrical ambiguity by pulse progression.

In *Papaloti*, this principle was made operative both at the level of single strands and of the ensemble as a whole, inverting the process when necessary that is, creating electroacoustic material and extracting pulses on tape first, then adjusting the piano part. The force of motion of the piece can be regarded as resulting from the polyphony of pulses generated by the harmonic accentuation and the metric flow of the rhythmic objects in the piano.

2.7 Electroacoustic materials

I have described above how the initial piano harmonic material was derived from the partials of five short sound samples. However, the analysis of these low piano string sounds, although extremely useful to inspire the material for the piano part, made it clear that it was not entirely practicable to grant too much importance to the harmonic implications of their inharmonic partial content on their own. As can be deduced, most of their upper partials, when present, did not coincide with the tempered scale, certainly not above what I estimated to be the sixth or seventh partial. This was only a problem in that the resulting "out of tuneness" with the piano was not particularly pleasing. No doubt this had to do with the way in which the sample sounds were struck in the first place. Yet, given the low sampling rate available on the Fairlight CMI, it seemed more adequate to exploit these sounds as "fundamentals", and allow the piano to provide the upper partials of the entire spectral composition of the work. Acoustically, this was well suited to combine with the percussive quality of reiterated chords on the piano, because of their naturally powerful resonance, somewhat "crowded" by clear and distinct upper partials. Whilst the samples remained in their actual registers, the mix with the piano resonance created a characteristic coloration of the piano. This made me conceive the instrumental part to mainly partake in the middle to upper registers of the keyboard. Even at points where the piano and tape parts were juxtaposed, this mirrored registration gave the entire sonority an alluring

quality, which I can only describe as being similar to a kind of giant "disembodied" piano. With its abstracted presence, this quasi-anecdotal instrumental trait provides a clear and aurally perceivable reference to the listener: these sounds remit to the piano.The tape part reinforces this image in two "solo" interventions placed equidistantly in time. The solos enact a kind of self-animated piano which plays rhythmic and harmonic material strongly related to the instrumental part.

2.8 Computer manipulation : morphologies from short sounds

I have so far analysed instrumental materials in *Papalotl* in isolation. However, the process of composition in *Papalotl* involved the simultaneous elaboration of the instrumental and electroacoustic parts. As described above, the techniques employed to create material for the piano involved the use of sampled [piano] sounds as an instrumental model with which the sequencing of rhythmic objects and their elaboration was tried out. With regards to the electroacoustic part, however, the techniques were more varied because of the limitations of the sounds used as sources. As these mainly included short note-type sounds, creating continuous gestures or extending the sounds required working "against" their natural decaying tendency, imposing on them an artificial shape or enriching their spectrum by means of layering, iteration, filtering and control of the particularly dynamic envelope parameters in the Fairlight CMI. Longer sounds (the scraping of a low piano string, for instance) were used more in isolation, especially in the tape solos. Other less conventional techniques, such as alternating the outputs and controlling loop length to create changing resonance also played an important role, as well as those by which I related the harmonic implications of chords in the piano to the value and range of controllers, such as the filter frequency or envelope release. Whilst these techniques were often used interrelatedly in the composition of the work, for the sake of clarity I shall examine them separately.

2.8.1 Layered repetition

This canonic technique was particularly idiomatic to the Fairlight CMI and consisted of assigning the same sound to *n* channels[16]. The same short identical sequence was created and assigned to the these channels, each sequence being staggered by a short delay at the beginning, usually 1/n of the sample length. It resulted in the same sound being articulated *n* times with a very short delay between each re-articulation. Accurate flanging and phasing could be governed in this way, and it was especially effective in creating a continuous layer if the sound source was given a slow attack and a long decay. These parameters, together with filter cut-off, loop points and start points could also be designed within a separate control sequence to vary dynamically and independently from the other sequences. (Fig. 2-13)

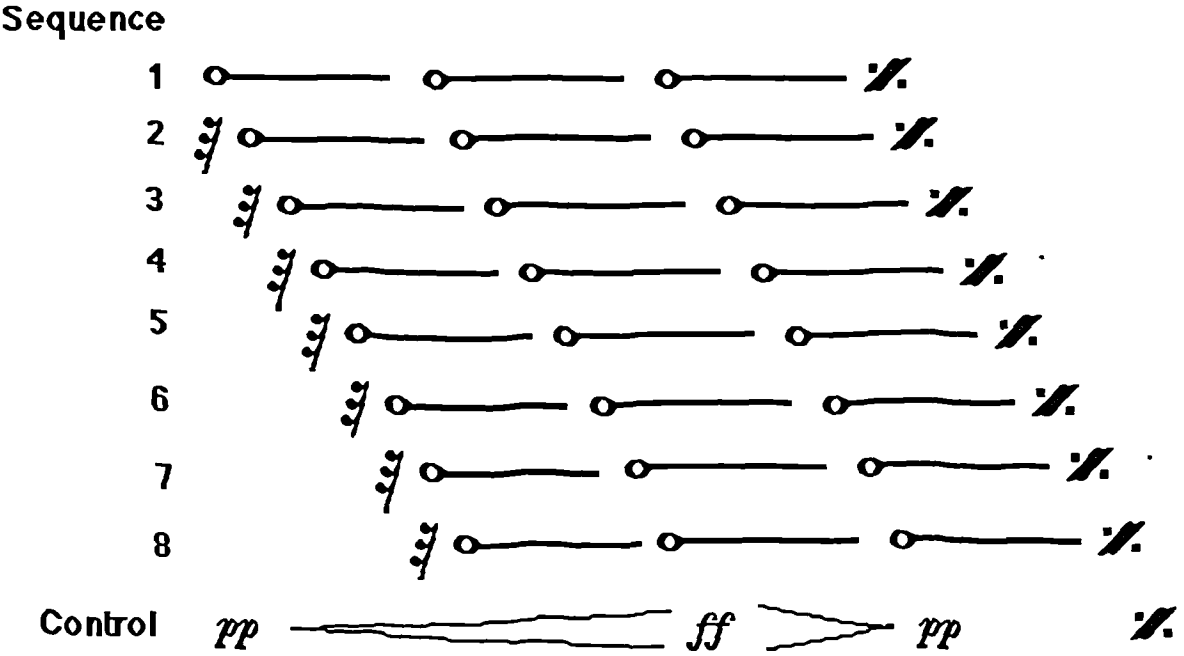


Figure 2-13 : Papalotl : Layered repetition

Using this technique as a model, I took a short sound and had it play at the pitches of one of my rhythmic objects. On the other hand, the sequence was staggered by silences corresponding to a simple rhythmic pattern. This

resulted in a layered grainy texture which followed the contour of the original rhythmic object. As the spectrum of the sound source was quite complex in itself , the resulting sonority is a rich cascading inharmonic gesture. (Fig. 2-14)

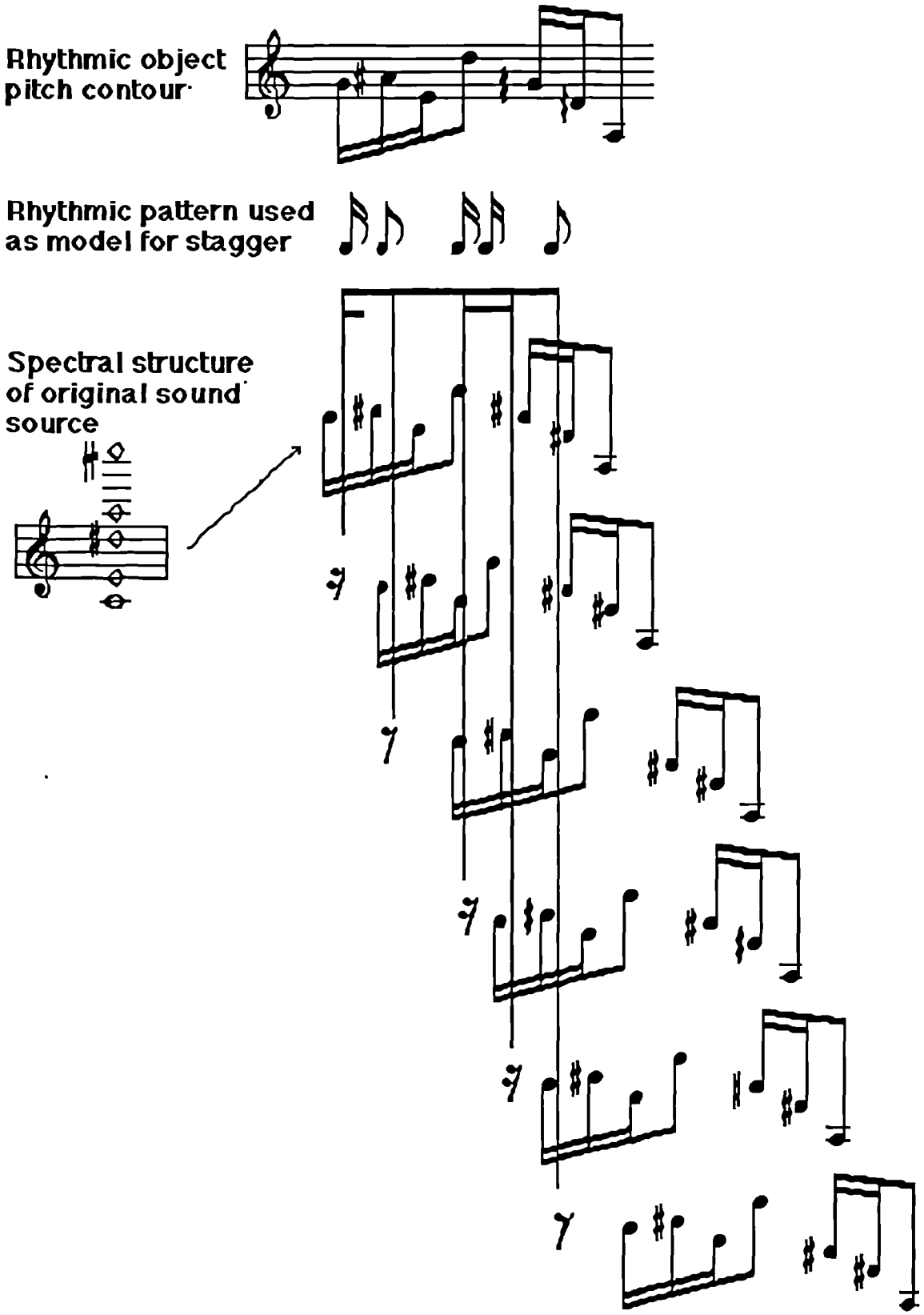


Figure 2-14: Papalotl: Staggered sequence using a rhythmic object's contour

To add resonance to the sonority, I often looped the sound so as to get a repetition of the attack very shortly after the initial articulation. By careful adjustment of the loop portion, its length and the decay time I obtained shimmering conglomerates of sound, as in the opening of the piece and the tape solos..

2.8.2 Resonance by iteration

As mentioned before, it was often necessary to add an artificial resonance to short sounds in order to create short sweeping gestures. One way of generating the material was by straightforward iteration of a sound at a frequency related to one of its most significant partials. The technique became particularly interesting when, in addition to the iteration of the sound itself (the actual speed of the sequence) , its loop length (in sample windows) was also related to the spectral structure of the sound. Careful tuning of the parameter controls would yield "grain", a lower frequency (the iteration itself) as well as a partial (looped portion) not present in the original sound source. A volume envelope would then be imposed on the resulting texture. (Fig. 2-15)

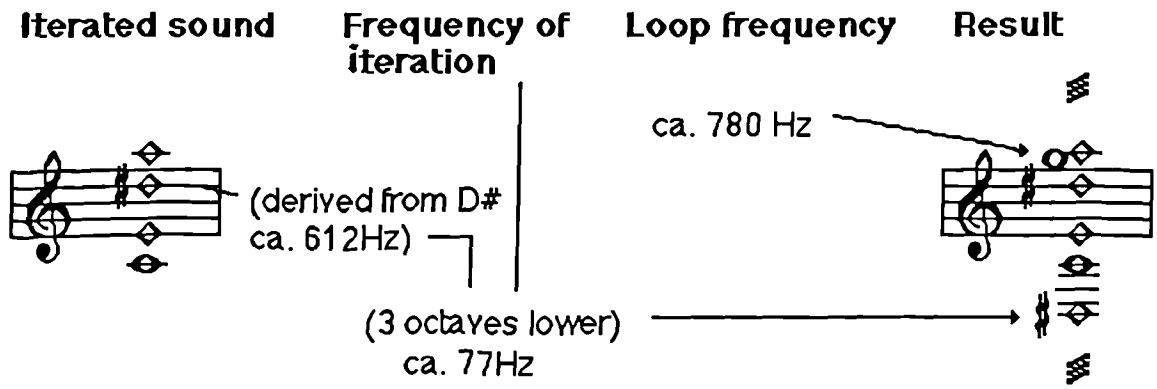


Figure 2-15 : Papalotl: Adding resonance by iteration.

A further approach was to take a frequency reference from the emergent pulse of a rhythmic object or a particular pitch played on the piano as the basis for the frequency of the iteration and/or the loop lengths.

2.8.3 Alternate outputs

This technique was the result of chance. By loading a number of samples into more than one memory register in the CMI , and then unloading one of the samples from a particular register, the whole memory map of the system would be mismatched. In simple terms, when the affected register's sample was articulated from the keyboard, the computer would first address the currently loaded sample and then, on the next articulation, it would mistakenly address the next register's sample. By repeating the loading-unloading procedure one could recreate this condition on two memory registers. Then, by simply routing each register to different audio outputs on the mixer, it was possible to play alternate samples coming out of alternate sides of the stereo image. This meant, for instance, that iterations as the ones described above, could include more than one sample, which could be susceptible of different control settings. Also by the number of iterations, I could "write in" from which side of the image a given sound would come out.

2.8.4 Control parameters activated at harmonic frequencies to the piano

In the computer part, many of the control parameters were programmed maintaining the shapes of my rhythmic objects (just as with the staggering of sequences) but activated at frequencies related to what I intuitively deemed to be the main harmonic centre of the piano part at a particular moment. So for instance, when the piano part was centred at around a c# region (i.e. the section before the first piano solo), control parameters such as filter cut-off,

loop lengths, etc. were activated in repeating cycles at harmonic frequencies of ca. 17.32 Hz (c#0), 25.96 Hz (g#0); 30.87 Hz (b0) or 34.65 Hz (c#1), etc. In spite of the fact that the piano and computer parts were often juxtaposed, this pairing up created a hybrid "piano-like" resonance, and shapes the sense of movement in both parts in a very characteristic way. Also, by this means, the piano provided the upper partials of the entire spectral composition of the work, while the tape part constantly touched upon fundamentals.

2.9 Final considerations

In *Papalotl*, my most important goal was to compose a work where motion could become structure, where movement became form. As a composer, it seemed to me that a way to convey a *motion form* was to allow the listener temporal landmarks to be able to zoom in and out of the immediacy of the surface and accede to an imaginary temporal landscape, an ontological space resulting from a personal process of magnification of all the minute processes which retain his attention. Formally, I see *Papalotl* as a large "rhythmic object", where the tape solos act as unaccented "beats" and which help to create this transition of scale. In this sense this work shares with the works described below the idea of recreating a 'giant' instrument inside of which the performer and listener alike experience the *poesis* of the motion within.

Footnotes on Chapter 2

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[1]The Park Lane Group is a London-based organisation which promotes young professional instrumentalists interested in performing new and contemporary music. Chosen annually by audition, the selected players are promoted through a recital series at the Purcell Room, South Bank Centre in London. The commissioning of new works, including those with electroacoustics, forms part of the programming policy of the PLG.

[2] A click track is a term that comes from multitrack recording practices. It consists of a pre-recorded metronome which is relayed to a player via headphones in order for him/her to keep in complete synchronization with other instrumental or electronically generated material on tape.

[3] Simon Emmerson : *Piano Piece IV* for amplified piano and tape. Published by the composer. London 1985.

[4] Alejandro Viñao: *Triple Concerto* for flute, cello, piano and computer 1983-84. Published by the composer. London 1984.

[5] Refer to Fairlight CMI manual.

[6] A form of granular synthesis

[7] See Alejandro Viñao's notes on *Triple Concerto* in the cover sleeve of Wergo LC 0846, Mainz, Germany 1990.

[8] A short explanation is needed here. I use the word "shape" in preference to the less abstract concept of "meter" although my understanding of shape can in some instances be imbued with a metrical identity: Shape has a more encompassing meaning to do with the actual flow and morphology of a sound object, for example thesis patterns (on the beginning) or arsis (on the end). The problem with traditional concepts of "meter" is that it is only explained in terms of notation and only indistinctly to rhythm and timbre. One must bear in mind that notation hardly ever represents unsounded or implied accents and offers, if at all, an inaccurate representation of accentuation patterns by comparison to what is actually perceived.

[9]'Accent' here has not a speculative meaning: accent takes many forms and is in itself an objective phenomenon which has an organising function, aurally verifiable through differentiation in timbre, length or dynamics.

[10]This inner tension is what Jonathan Kramer has referred to as metric "resistance" (Kramer, 1988:81).

[11]As suggested before pulse can be thought of as a succession of "points" that are perceived as being equally spaced in (musical) time. The features of pulse are its *period,* or the perceived interval between the events and *phase*, or the actual time at which any particular event is perceived relative to some reference time, frequency or beats per minute.

[12]See for example Jonathan Kramer's discussion of meter and rhythm (Kramer 1988) and Victor Zuckerkandl's concept of metric "wave" (Zuckerkandl 1956).

[13] I shall hereafter refer to Pulse points per minute as PPM and to *Beats* per minute as BPM.

[14]See for example Richard Parncutt's theory for the prediction of metre percepts. (Parncutt 1987)

[15]See *Four Organs, Drumming Part One,* etc.

[16]Refer to the Fairlight CMI manual for a more detailed explanation of terms.

Chapter 3 On going on
Composing by unrepeatable routes

3.1 Genesis and Background

There were several important technical and æsthetic considerations in the conception and composition of *On going on* for baritone saxophone and electroacoustic sounds. Given the experience with previous works, I had become more aware of the production and musical constraints imposed by the use of a tape as the medium to diffuse the electroacoustic sounds. On the one hand I was confronted by the problems and limitations of notation to express gestural or non-punctual sounds accurately in a metered score, and on the other, by the necessity of a click track to keep player and electroacoustic sounds together in performance. Hence I wanted to arrive at an intermediate solution, where the player could follow a score, keeping in close synchronisation with the electroacoustic part and yet being able to feel and project an undisputed freedom of action with regards to the electroacoustic sounds. This particular aspect made me incline towards a different approach both from the angle of composition and of performance.

Above all, I felt I needed to experiment with the way I approached composing in general. I determined that, from the point of view of performance style, I wanted this piece to have an improvisatory character. In my early student days, I had been a performer of the saxophone in the context of jazz, so - conceptually at least - it felt quite natural to incline towards this strong influence and its instrumental connotations. The raucous, deep-throated articulations of which the baritone saxophone is capable seemed ideally suited to satisfy this aspiration. Equally considerable was that using improvisation in a new context could also become a musically challenging compositional strategy. At any rate it suggested a refreshing manner to

generate and develop a relation between performed and electroacoustic elements.

3.2 Improvisation in general and computers in particular

Before discussing the composition of *On going on* , it might be helpful to examine some of the general questions surrounding improvisation in the context of computer technology.

'Improvisation' was defined in the 1960s as the "art of thinking and performing music simultaneously[1]". To a great degree, the concept of 'improvisation' in the realm of Western concert music has carried a somewhat pejorative burden. This is due to the assumption that improvisation is a purely spontaneous activity which usually takes place without a preconceived formulation or context. Fortunately more open attitudes towards music making of all types (including improvisation) have developed during the course of this century. Aesthetically, this has also been influenced by literature, musical criticism, and other areas of artistic thought. The arrival of computers has possibly played one of the most significant roles in this change of attitude.

Generally speaking, the computer user is confronted with *information* and *choices*. In the hands of the user, information that is stored, calculated, created or retrieved gets transformed, ordered and re-arranged to provide a finished product or a new piece of information for further use or modification. The choices themselves are dictated by a myriad of needs and aims. A general discussion of this process of decision is beyond the scope of this writing. However, as musicians and composers, this scenario is very familiar because - historically at least - the art of music making and of composition has always involved a process of evaluation and choice between what we could call types of *musical information*. The introduction of computers into music during the

last few decades has made such information readily available, blurring the dividing line between the separate positions of the composer 'versus' the improviser[3]. Let us briefly examine how this distinction has become less pertinent and what it implies in the creative process itself.

In making information accessible, probably the most important aspect that computers in music have brought to the fore is that of *control*. This is true in many areas of music, an immediate example being that of timbre, not available before to the composer other than as a prescriptive annotation on the musical score, or through the interpretation of an instrumentalist in the act of performance. Arguably, in the early 1950's sound recording had already made it possible for the composer to manipulate timbre through tape editing, simple analogue signal processing and mixing, but systematic control of timbre and spectrum for accurate, repeatable analysis and resynthesis only became a likelihood through computer techniques in the 1980s. Other aspects such as the structuring potentialities of timbre, pre-compositional and analytical methodologies have also been deeply touched by the enhancement of control possibilities.

What does computer *control* specifically involve? There are two options. As suggested above, control involves the handling of information which can be relayed in *real-time*. This includes the recording of sound waves as well as the capture of performance events, instrumental or gestural. Both of these involve some type of *conversion* by their encoding into a retrievable digitised format. Performance events comprise conventional musical aspects such as articulation, dynamics, and manipulation of timbre of the specific digital instrument being controlled. Parameters such as modulation, pitch shift or glissandos - to name a few - have become "performable" through hardware incorporated into digital instruments and analogous controlling devices in the shape of keyboard, wind, percussion or hybrid instruments and interfaces[4].

Secondly, computer control involves the handling of data - captured or pre-programmed - which takes place in *deferred-time*. This includes innumerable procedures which range from straightforward editing, through sequencing to complex (signal) processing and modelling. The manipulative choices open to the musician are virtually endless and often involve a combination of more than one possibility. Paradoxically, at this stage, the user is confronted with the possibility of being as methodical or intuitive without relinquishing the accuracy of control. The significant point is that the combined power of real - and deferred- time control - permits the musician to exercise perhaps more than ever before boundless experimentation (through trial and error) while still developing *systematic* decisions over composition and performance materials.

To summarise, the transition to real-time control of sound via modular software and hardware interfaces[5] has made of the computer a kind of "meta-instrument" available not only to musicians but to anybody capable of operating a computer. It may be too early to evaluate the musico-sociological impact of such a leap. But to the present day musician, computer control and the immediacy of feedback allows omnidirectional routes between performance, gesture and compositional or analytical practice. In this sense, the composer-programmer and the composer-performer are closer than ever before, a unique position where techniques, thought and materials are constantly reformulated as a result of what is bounced off the "instrument". In the creative world of composers, this may have a far-reaching consequences. It has not only the effect of subjecting technique to immediate judgement, but at a deeper level, of questioning our listening modes, creative capabilities and preconceptions as they converge and impinge on the perception of our work. Perceptual awareness is broadened as a result of such multifarious information, a relentless feature which undoubtedly reflects on the nature of

musical invention and the rigour with which composers choose and organise musical occurrence.

3.3. Improvisation as the composition process

The original brief for *On going on* required the use of equipment available "off the shelf", which could be obtainable anywhere. The work was to be composed for the saxophonist Stephen Cottrell[6], who wanted a piece which would exploit the saxophone as a sound source for signal processing. Initially, we envisaged the possibility of using live electronics[7] as a important feature. However, as the piece needed to be transportable for touring, hauling an additional electronic set-up under those conditions made it too demanding for the performer. I therefore decided to use the computer as the "performer" of the electroacoustic element, so that eventually the piece could have two alternative formats for performance: the first one, using a transportable "pre-realised" version on tape and the second, using the computer to control electronic instruments "live". Hence, in order to compose the piece, I had to recreate in the studio an identical rig to the one used in performance, which would allow me to structure the piece as a "performance" and try out different possibilities before committing anything to computer files or tape. (I shall hereafter refer to them indistinctly). Not having a saxophone available, I employed a Yamaha WX7 Midi wind controller[8], which served both as a performing instrument in the conventional sense and as a gestural input device for the elaboration of the electroacoustic material. The WX7 was later incorporated in another possible version of the work. The diagrams below show the alternative touring and live computer control systems, the latter being the one used in the process which I shall presently discuss.

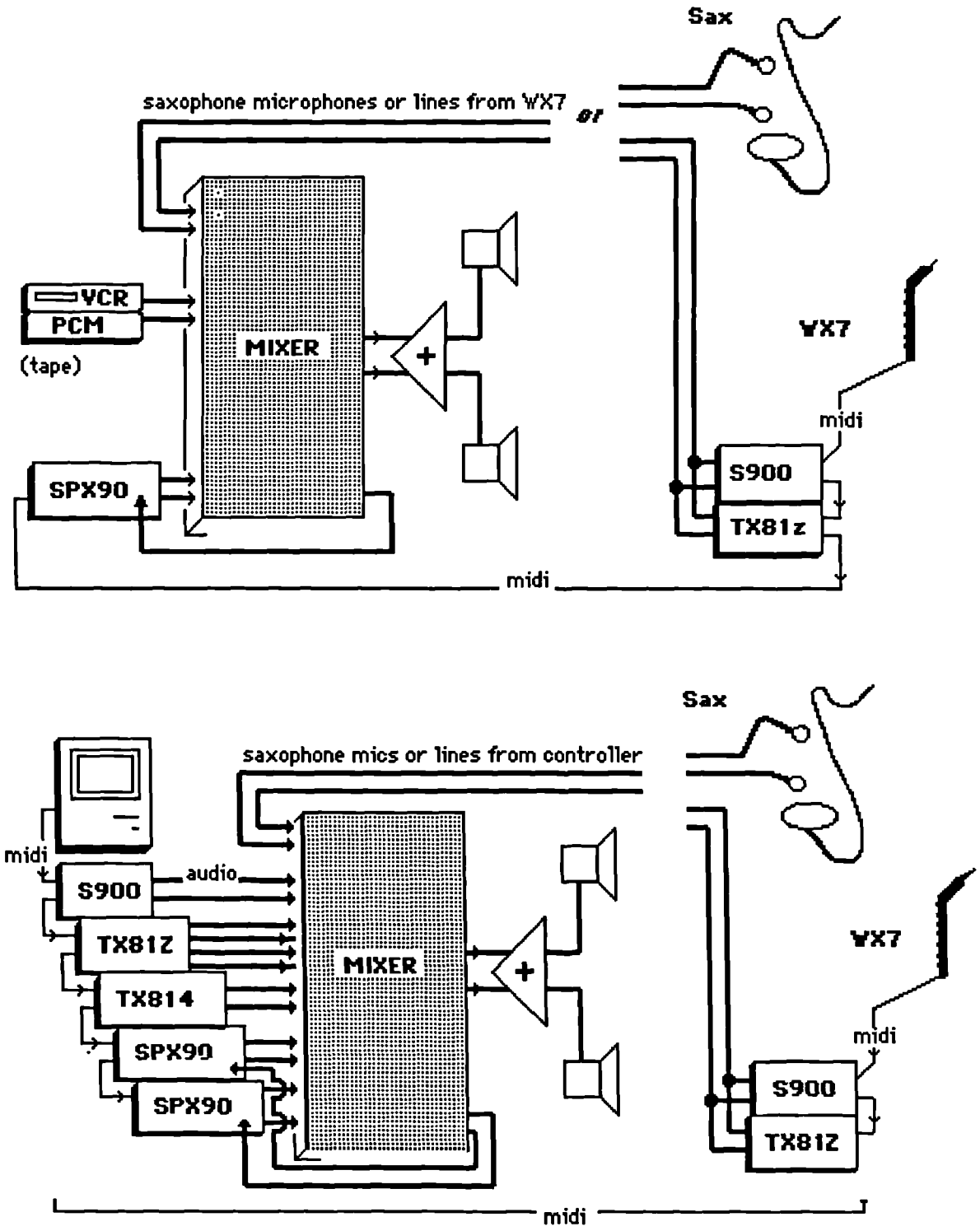


Figure 3-1: On Going On: Performance systems: Touring (top) and Composition (bottom).

After an initial recording session with the instrumentalist, a whole sound catalogue on tape was assembled out of conventional and extended saxophone performance techniques as the basic sounds for experimentation.

These sources included multiphonics, long sounds with different attacks, percussive sounds produced by key clicking, flutter and slap tonguing, etc. In the studio, I put the longer sounds through one of the most widely available sound processors at the time, the Yamaha SPX90[9]. I was particularly interested in the pitch shift[10] facility available on the processor given the rich overtone makeup of lower sounds produced on the baritone saxophone. I hoped to obtain thick layers of sound, chord-like objects which I could string together by either resampling or by means of delays to create a continuous texture onto which a saxophone line would be superimposed in performance. Through subsequent experimentation I came to realise that the processor had not enough definition to generate sufficiently smooth transitions between the original input signal and the pitch-shifted one, specially when there was a delay. This, however made me question how I could achieve a similar idea. I was interested in the moment when the difference between the original and the processed signal was noticeable as a change of pitch, rather than as flanging. Leaving the signal processor aside, I sampled fairly long straight saxophone sounds and programmed short sequences against which I started improvising with similar sounds on the WX7. I became more interested in the tension that arose from playing similar sounds, slightly detuned, which I could control fairly accurately in time with the controller. I then thought that I could use that idea with a more defined compositional structure, so at that point I decided that a better way of approaching the composition would be to create a kind of global "block structure" - an imaginary silent backbone onto which I could attach material by direct improvisatory input. Using the WX7 as an interface meant that, once having approximately defined the outside boundaries of the different sections, I could try out at any stage a performance of material intended for the performer responding to that of the computer or vice-versa, without any further *a priori* compositional ordering. Therefore, once I had a plan for the backbone, my generating strategy revolved between two general organising procedures:

(1) Improvise and record (sequence) material for the computer- select the best portions and re-improvise with these - respond with material for the instrumentalist.
(2) Improvise and record material for the instrumentalist -select the best portions and re-improvise with this- respond with material for the computer.

Of course, the order of any of the above could be subverted at any stage, something which allowed me great liberty to reformulate, choose, and re-work material by performance or by programming at the computer without further improvisatory input. Nevertheless, as the originating method was the same for all the material, there always seemed to be a coherence in the results. I shall therefore refer here to any of these compositional processes as they arrive.

3.4 The backbone scheme

During the initial period of experimentation with sound sources, I was struck by the different ways in which I would respond to a number of different types of sound. I became fascinated by the idea of stimulating the performer to listen to opposing qualities in the sound and the gestures and invent ways to respond with adequate material. I therefore thought of three kinds of situations that my backbone should recreate in order to prompt the player to:

(i) respond to timbre by "re-tuning " long sounds against continuous sounds on tape; (ii) respond rhythmically to an active texture made of short, impulsion sounds and ; (iii) respond by any combination of the above- a "textural" response.

I decided to translate this ordering to my scheme by establishing clearly defined areas in time or "block" against which I could experiment. Having determined the dramatic potential of the friction produced between detuned

continuous saxophone sounds - sampled and performed - I established this as my first kind of block, and one which would happen at several points in the piece as a recurrent formal landmark. As a contrast to this, I imagined longer blocks for sections of greater rhythmic activity and motion, where the player could retort in a more "horizontal" manner[11]. These would be placed at each side of my first type of block. Finally I thought of a central section, where I would have longer sounds and grainy textures, giving the player the chance to decide freely between a "vertical" or "horizontal "response. The backbone scheme I envisaged thus looked like this:

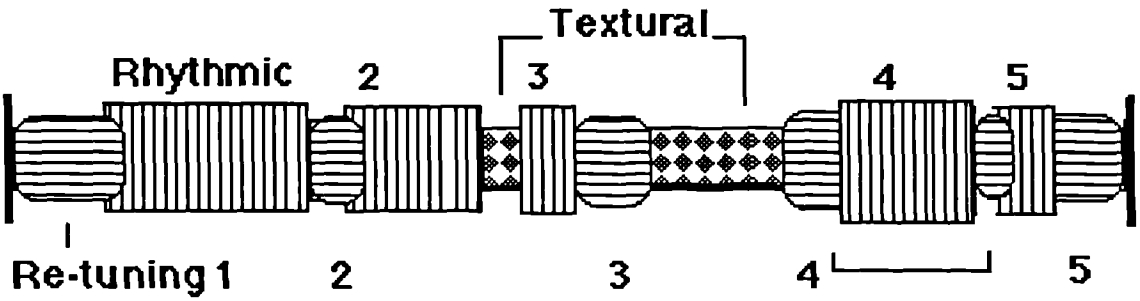


Figure 3-2: On Going on : Formal backbone

3.4.1 Re-tuning blocks

As mentioned before, the re-tuning sections were thought of as blocks that would happen several times throughout the piece. As I wanted them to function as formal arrival/departure points, they needed to be very well defined in terms of timbre and shape. I had previously been improvising against long saxophone sounds, changing the pitch of my own performance by inflecting a gradual glissando on a long sound towards the end of my breath, in an attempt to imprint the gesture with a sense of unresolved cadentiality.

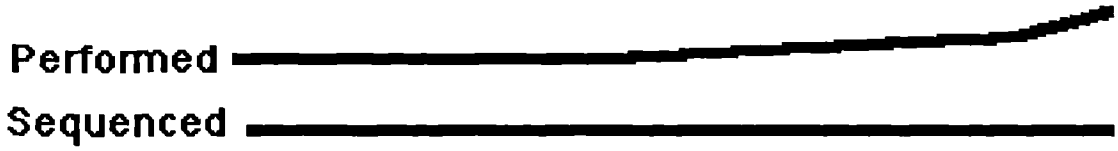


Figure 3-3: On Going on : Cadential gesture

Given that the gestures were extended (ca. 10- 20 secs.) I felt I needed to constrain their size, partly to get more air into the instrument, but also, so the "rising" movement could become easily recognised as a gestural motif. The most successful improvisations were deemed to be those where I had used shorter sounds because- regardless of small time differences in performance - the shape of gesture would nearly always seem self-contained. I eventually decided on "modules" made of sounds of ca. 3 to 5 seconds long, which would repeat a number of times according to the eventual length requirements of each appearance of the section. Against sustained sounds on tape , I would have the saxophone playing a repeated rising-reprise shape as in a pendular motion subtly varying at each re articulation the dynamics and the graduation of the pitch bend. In order to give a further prompt to the performer, I programmed the computer to play a shorter rising or falling pointillistic gesture at the front of each re-occurrence. See for instance the opening gesture of the piece (baritone saxophone in C). (Fig. 4.5)

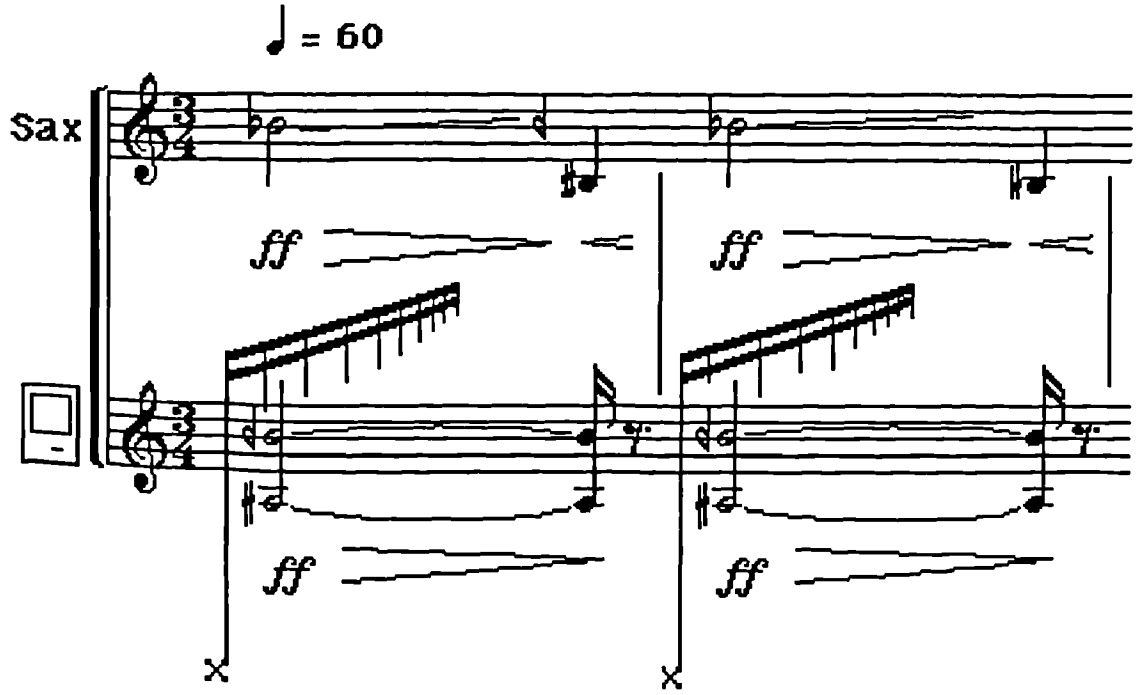


Figure 3- 4 : On going on : Opening gesture.

This kind of gesture and relation between saxophone and computer was kept essentially the same at every appearance of the block (see for instance rehearsal # 2, 3, 5 in the score). But, as these gestures were also meant to serve as pivots, they sometimes underwent two types of variation which consisted in (i) extending the durations of the lower pitches , or (ii) extending the range between the pitches. These augmentations allowed the gestures to become more connective and bridge through a more organic transition into other kinds of material (see below), as in a kind of rhythmic/timbral pendulum.

With regards to pitch, the choices were completely intuitive, but I gave preference to those sounds against which the live saxophone would generate more difference tones[12]. Globally, the sequence embraced a rising low register progression as the piece developed (given that difference tones are subjectively easier to be perceived at lower frequencies). For the actual electroacoustic pitch-conglomerates, I chose intervals of an octave diminished by a 1/4 tone, diminished octaves, or 3/4 tones, because of the small steps required by the live saxophone to match one of the frequencies at either side of the starting pitch. Whenever this match happened, there would be a momentary sense of resolution and tonicity, as the difference tones shifted or became fainter. See Figure 3-5.

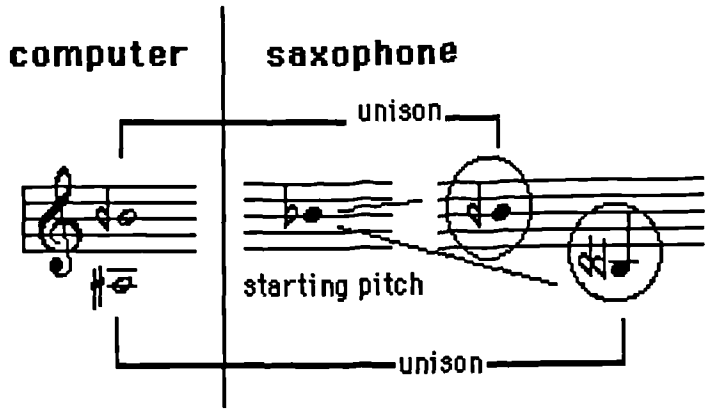


Figure. 3-5 : On Going on : Saxophone pitch trajectory with computer 1/4 tone diminished octave

3.4.2 The rhythmic blocks

I approached the elaboration of this type of section from a completely different perspective. In the first place, I was interested, as mentioned before, in prompting a "horizontal" listening mode in the performer. On the other hand, I wanted to create a strong contrast with the "re-tuning" sections by timbral and rhythmic differentiation.

Firstly, with respect to timbre, I constructed these sections with sounds generated synthetically. Based on the spectral analysis of two low register saxophone sounds, I synthesised a basic sound source by means of a frequency modulation synthesiser. The sound was designed to be responsive to WX7 parameters and had great white-noise content at the attack portion, with stronger and faster transients at high velocities. Its spectral trajectory was dependant on the velocity and wind pressure values from the controller, increasing in higher inharmonic frequencies as a result of greater modulation during the sustain portion. At low velocity/pressure, the sound remained quite stable with a high content of lower odd-number harmonic partials (I had used square waves to generate the sound), slightly detuning downwards during decay. The overall result of sounds played at a low-to-middle register (C1-C4) generally resembled the sound of a metallic pipe being overblown through a reed-like mouthpiece.

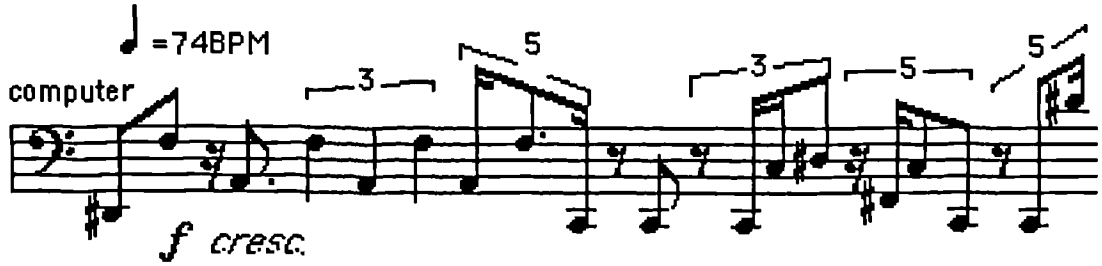
In terms of articulation, I sought to create a pointillistic texture made of resonant impulsions of a breathy attack quality which could mix well with short sounds on the live saxophone, especially at low registers. Through this type of articulation I wanted to generate a continuous web of rhythmic gestures of strong forward momentum. I shall now describe the generation and organising strategies employed to construct these materials.

In the first place, having obtained a satisfactorily responsive sound on the synthesiser to be played on the WX7, I started by improvising and recording a number of short sequences on the computer. Once I had a good number of these improvisations, I selected those passages, or those gestures which I found to be more interesting in rhythmic terms. I then strung together these selections and used them as a new framework for further improvisation. I experimented with the newer materials under two broad criteria, either considering them as

(i) harmonic "platforms" from which I could intuitively extract pitch patterns or,

(ii) as gestural models which I could imitate again or vary in the same manner.

At each successive stage, I re-elected the most effective material in the pass and regrouped it under a new name, gradually arriving - at the twentieth or so improvisatory generation - at strongly homogeneous performances, from which I finally selected the versions for the electroacoustic part. I then proceeded to refine where necessary the strands, colouring and enhancing the gestures by minute and careful editing of single velocities and attacks. I also worked on the overall progression of dynamics, harmonic coherence and timbral shading of the sections. The following example, although an extremely approximate transcription in all respects, may furnish an illustration of the type of rhythmic sequence of events I arrived to.



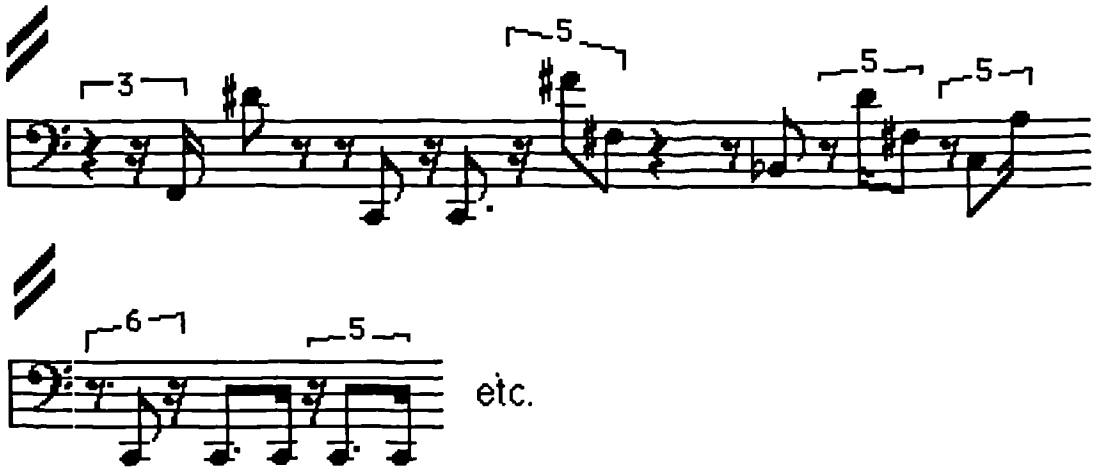


Figure 3-6: On Going on: Example of rhythmic section.

Having arrived at this stage, I then proceeded to compose the saxophone part. As I had generated an enormous amount of useful material for the computer part, I was able to go back and refer to some of it as a source of gestural models. I tried these out against the computer part and soon realised that, because of the rhythmic intricacy of the strands, any material played against it risked completely obscuring its timbral nuances and rhythmicity. I therefore attacked the problem by devising less complex material. It was important to make sure that the saxophone material remained less complex in order for the texture of the computer strands to be perceived at a comparable ground level. Indeed, below a certain level of density, hocketing patterns could start to emerge, the synthetic sounds truly acting as resonances to the saxophone sounds. I therefore started to improvise more sparsely to generate material that would work with the synthesiser in that manner. The final and most effective approach was to extract shorter rhythmic passages from these recordings and only then audit them separately against the computer part. When played at the approximate perceived pulse of the computer material, their profile would invariably yield a rhythmic foreground against which the combined texture acquired an efflorescent quality (something analogous to

watching the light through the spokes of two superimposed wheels turning at slightly different speeds).

Sequences were then assembled out of these phrases, ordering them according to what I felt to be an increasing harmonic tension. A progression was established by placing first those of less complex contours and only then moving, through the most neutral ones, towards those of rich harmonic implications, so as to match the harmonic progression of the sequences created beforehand. I then juxtaposed these new strands against the computer layer only to find out that -although the texture still remained transparent - there was a contradictory rhythmic feel with respect to the motion implied by the electroacoustic sounds on tape.. This discrepancy appeared because the phrases did behave as what they were, continuous melodic lines, instead of what I envisaged they would generate: a more localised , or rather, cyclic motion. Going back one step , I dismembered the sequences and re-selected a number of separate rhythmic objects. These cells were then superposed to the synthetic strands, but this time they were allowed to repeat two or three times before introducing a new object and so on, until the section finished at a re-tuning or textural block. When I played the objects myself with the computer, I found out that treating the objects as repeatable "melodic mobiles" would also allow the player to stretch or contract the music and adapt it to the durations on tape. In addition to generating a sense of forward momentum, this new and final approach favoured greater instrumental freedom in the phrasing, accentuation and overall rhythmic pacing in performance See Fig. 3-7.

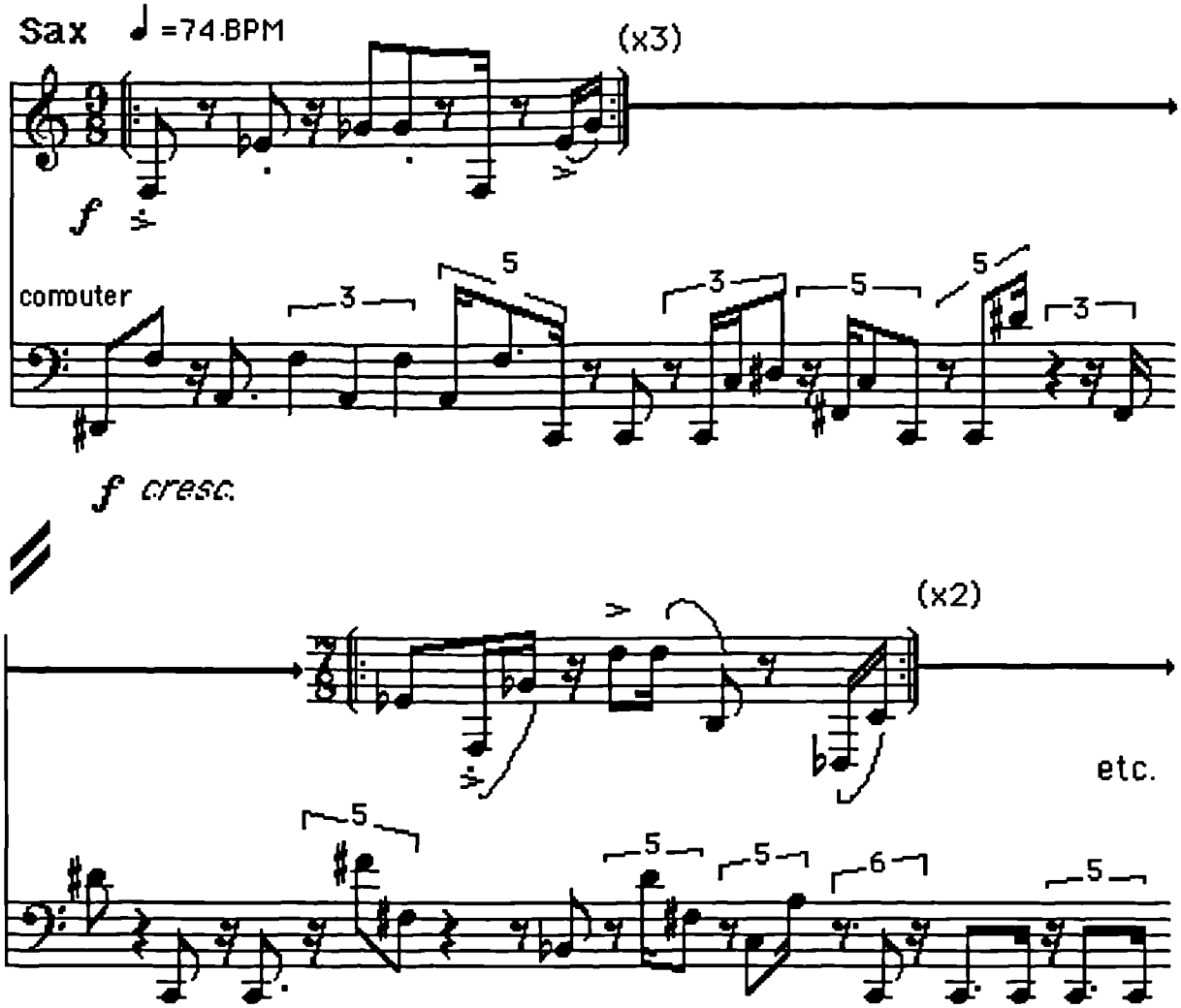


Figure 3-7: On Going on:. Rhythmic objects juxtaposed to computer.

3.4.3 Textural blocks and other materials.

I have termed these sections "textural" for a lack of a simpler description. In these sections, I wanted to create a somewhat ambivalent area in formal terms, sections where the player could integrate freely with the electroacoustic sounds on tape either via responding to rhythmic motion or to timbral contouring. Hence, just as the re-tuning section had been paired-up with sampled saxophone sounds and the rhythmic sections with synthetic sounds, I decided to construct these so called textural sections by a combination of sampled and synthetic sounds.

As may be seen from the backbone scheme above, these sections were meant to occupy a relatively central position in the piece. Therefore I felt they were required to act as a kind of pivotal formal *plateaux* to the outside sections. The sound sources used for the sections included recordings of sampled "extended" saxophone sounds, such as hits and key clicks on the body of the instrument, slap-tongue attacks and a number of longer sounds made out of looped multiphonics samples. Drone-like sounds were produced synthetically with four FM synthesiser modules, slightly detuned between them. The basic sound was generated by modulating sinusoidal waves arranged in slightly phased harmonic frequency intervals, with little feedback modulation and thus hardly any noise content after the sustain portion. The attacks were slow rising and the sounds finished with a long de-tuning decay. The resulting sound layer produced by the four FM modules could be described as resembling a giant rubbed crystal glass. Other synthetic sounds consisted of short percussive gestures produced on a smaller synthesiser.

The organisation of these sections was fairly uncomplicated. Firstly, the WX7 was programmed to simultaneously trigger looped (slow attack-long decay) multiphonics as well as the aforementioned FM drones. The objective was to arrive at to two related types of texture, one which would be mainly sustained with granular colorations, the second being mainly granular with underlying drone.

The starting point was to improvise long stretches of sound which would function as a basic "floating" texture for the computer part, leaving small gaps of silence between the sounds to create a subtle illusion of undulating waves. I chose the pitches intuitively, moving very slowly towards higher pitches, but keeping in general to a fairly restricted range so the short term harmonic implications would be minimal. For each final version I mixed two similar layers together, with slightly differing tunings (from ca. 10 to a maximum of 50

cents apart). Once I had convincing versions of these static streams, I returned to my "performer" mode and improvised over them in an equally gentle manner, experimenting at first with distant pitch areas to those suggested by the underlying drones. Through careful and intent listening , I determined that the most dynamic pitch relations could be created by commencing in unison to the computer and then gradually rising to the end; in a way, paraphrasing the small scale gesture of my "re-tuning" sections. The idea of having gaps of silence - so as to have the computer and saxophone slowly crossfading - did work well with long quiet sounds on the saxophone. Nevertheless, these lengths had to be adjusted with the saxophonist in order to determine their ideal durations in relation to the player's breathing capabilities (which obviously depended on the register played). (Fig. 3.8).

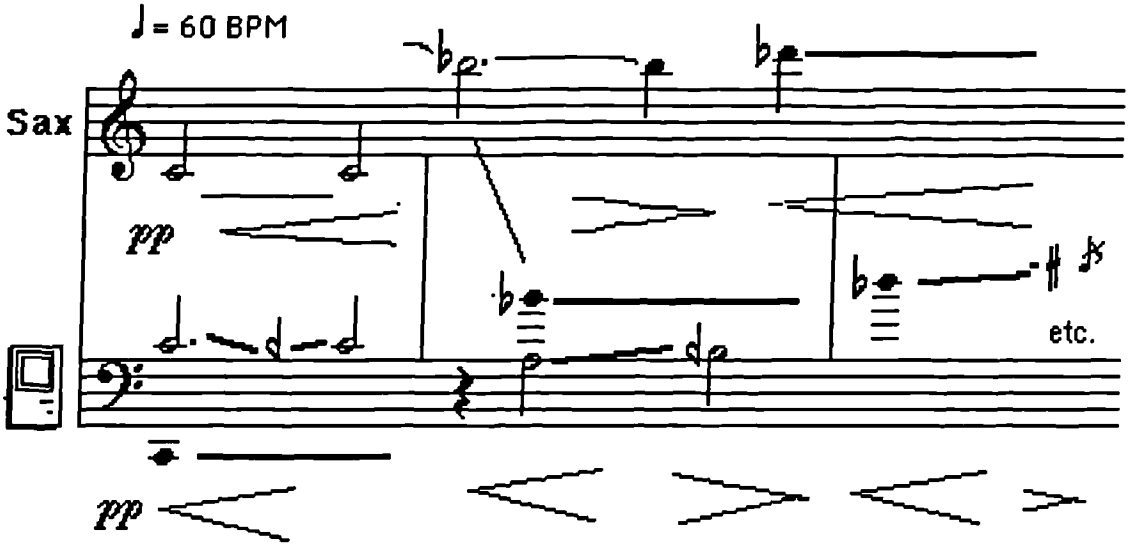


Figure 3-8: On Going on: Textural section, saxophone and electroacoustic sound crossfades.

Having established that first kind of texture, I continued to develop a version that would integrate granular flurrying gestures obtained with percussive sounds sampled from key clicks and slap-tonguing attacks. This required creating short and very concise objects which could be used simply on their own or as colorations to the sustained sections I had already composed. This material was generated completely intuitively, re-improvising on the basis of the successive generations of gestures I preferred. I also experimented

constantly with different "instrument" configurations[13] either by performing them myself or by having the computer play the events on other sounds (ie. percussive sounds from the smaller synthesiser) than those used to generate them.

A number of these objects was finally selected for their engaging shapes or colour, and were sequenced quite sparsely over a span of silence. I then started to reintroduce the drones from my first texture and place them in the silent gaps or where they would seem to connect more naturally with the fast moving gestures. To allow room for the saxophone part, I freely edited out some of the gestures or drones whenever I felt that the live player would not have enough time to react to the sounds. The result was an alternating texture, quite granular in the foreground and held like that for most of the time while increasingly longer drones fizzled in and out at the background level. The latter were found to be very useful as pitch anchors in performance. The passage was then refined in further detail , the edit points tidied and the dynamic shapes carefully balanced. As for the saxophone part, it was built using a similar kind of method, but I purposefully left much of it out, so the player could improvise further during the passage (See for example Rehearsal # 6).

There was other material which was designed to bridge between the rhythmic and textural sections. These were passages which were entirely programmed at the computer and consisted of repeating short saxophone sounds which emerged from the rhythmic sections into a straight pulsing crescendo. They were in turn pitted against a sequence of rising synthetic (metallic-pipe) impulsions in the background. The live saxophone played in rhythmic unison with the saxophone sounds on tape:

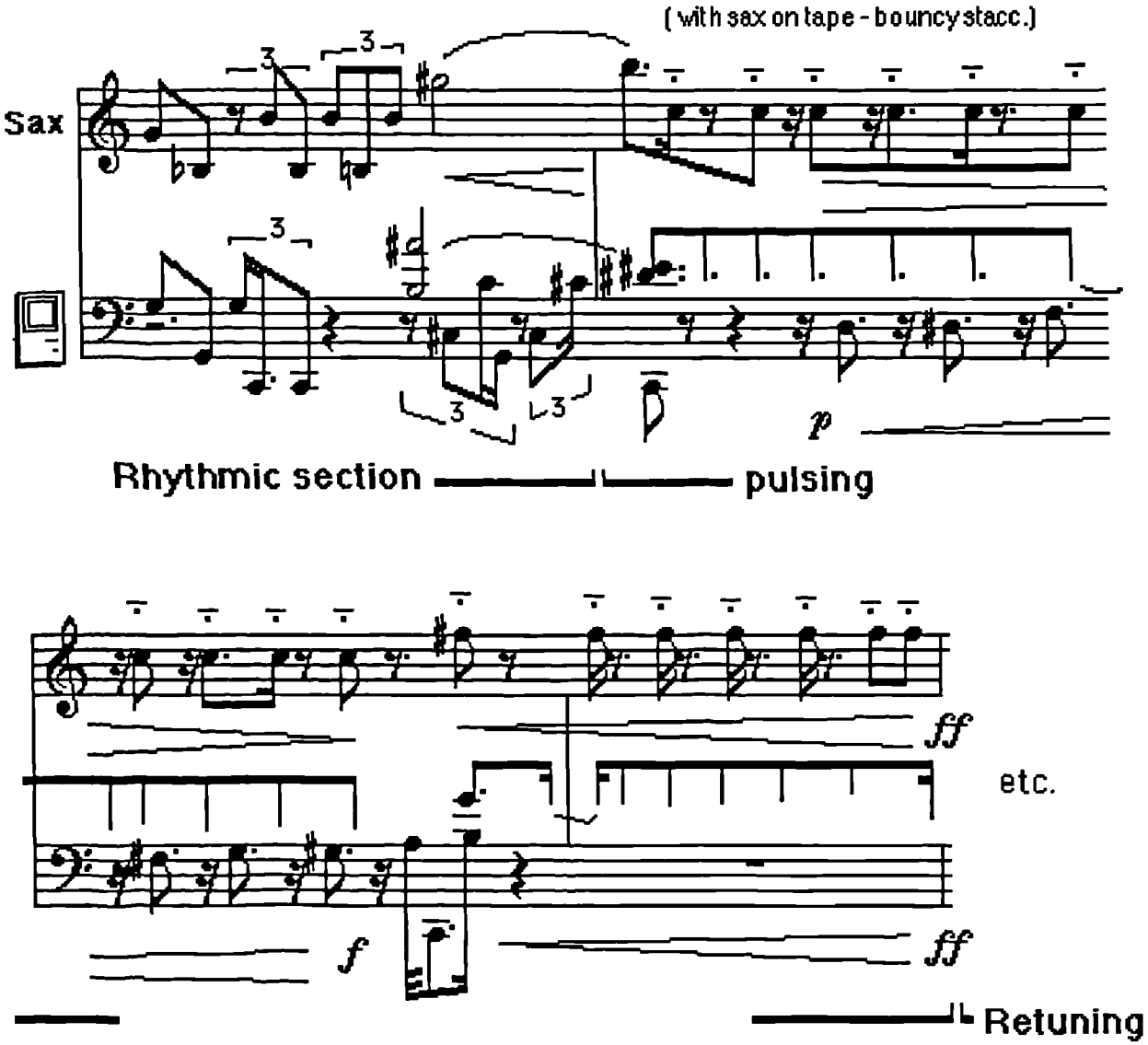


Figure 3-9 : On Going on : Bridge pulsing material

3.5 Signal Processing

I have discussed so far the various ways in which the material for *On going on* was created and put together. There was, however, the aspect of signal processing which was present all along in the evolution of the composition. As I said before, I had begun the work by processing my sound sources, so when I landed on the idea of creating a backbone plan, I was already well aware of the kind of transformations that could suit the material envisaged. Hence, many of the improvisatory avenues described above also involved the use of

the SPX90, particularly as it was susceptible of being controlled by the WX7. I shall not discuss in detail all the signal processes employed, but I will describe a couple of distinctive examples which may illustrate the way they integrated with the realisation and eventually to the performance of the work.

(i) **Delays** were used on the saxophone and/ or the computer during the rhythmic blocks as a means to generate an increase in the pulsating "aura" helping the performer perceive and convey a sense of motion. During the composition stages, I used delays to give myself an idea of the potential of a given gesture, which I would then realise by performing or programming. For their use in performance, I designed a number of patches which could be recalled at the appropriate times. In general these varied in terms of the delay times and the direction between the left and right sides, but kept to ratios related to the durations and tempo in the computer part. See for instance Figure 3-10 below, which I used as a reference in the rhythmic sections:

Durations in milliseconds for ♩ = 74 BPM

Ratio	𝅗𝅥	♩	♪	𝅘𝅥𝅯
1:1	1620	810	405	202
3:2	1080	540	270	135
5:4	1296	648	324	162

Figure 3-10 : On going on : Delay durations (in milliseconds)

By switching between patches where, for instance, the first one had a left delay of 1080ms and a right delay of 648ms, and the second, a left delay of 540ms and a right delay of 1620, I could create a rotation between the sides

and keep a relation with the pulses implied by the original source material. The patch changes were performed intuitively by the person at the mixer.

(ii) **Flanging and phasing** were mainly used on the computer during the textural sections as a means of coloration. Again, they were programmed in patches with low modulation depths and with varying modulating frequencies related to those of the pitches played by the computer or the saxophone. As with the delay patches, the switching was done freely by the balancer. However, because there was a noticeable glitch between patch changes, these were usually kept at a minimum, and only changed at moments where it could be masked by something else happening on the computer.

In the version using the wind controller (see below) the switching between signal processing patches was left to the player himself.

3.6 Notes on the WX7 version

As mentioned at the beginning of this chapter, another version for the piece employed the WX7 wind controller as a substitute instrument for the saxophone. This was originally designed in response to an opportunity to perform the piece myself; at a later stage other wind players took up this as their preferred version[14]. Obviously, the difficulties of performing the work with a controller are quite different to those faced with a saxophone, and - whilst I do not wish here to make a comparison between the two - it may be interesting to comment on a few of those problems.

Possibly the single most significant obstacle in using a controller is that of establishing a coherent sonic identity with which the performer can develop instrumental dexterity. The controller is indeed a sophisticated instrument capable of transmitting a vast amount of (pre-assignable) data, but since it itself does not produce sounds, there is a lack of direct resonance and close

sound-radiation which in general presents problems of a psychomotoric and psychoacoustical nature. In this respect the controller may best be understood as a musical interface rather than as an instrument in the conventional sense. This, however does not entirely solve the dilemma for the performer and leaves open the additional question of how the sonic identity, once mastered by the player, may be conveyed to an audience. The predicament is that, in my experience, the audience invariably seeks to establish a connection between the performer's gestures and sounds which may or may not come from elsewhere in the room (loudspeakers, for instance). Admittedly this is not only a question which concerns the peculiarities of the instrument itself, but also one which touches upon the efficacy of prevailing modes of listening , the hindrance of æsthetic prejudices or simply the preconceived auditory images which listeners may associate to specific instrumental gestures, in this case, to those involved in blowing air into an instrument.

Another perplexing point is the question of articulation. Whilst the WX7 can be tuned to be extremely sensitive to lip and wind pressure, the possible repertoire of articulations is dependant on the actual sounds being articulated, their response, amplitude envelope and inner characteristics. Again, the question can only be partially addressed in terms of what sound may efficiently convey articulations that are coherent with the compositional material chosen by the composer and discerned in performance by the listener. Obviously, if this is examined from a narrow perspective, anything which may constitute positive capabilities on a given wind controller will to date still pale by comparison to the subtleties possible on a baritone saxophone.

In view of these considerations, in this version of *On going on* I took the stance that the controller should avoid being taken for an specific wind instrument and deliberately play on the ambiguity of the concrete and abstract character

of the sounds I intended to use. It seemed more akin to the genesis of the work to , on one hand, experiment with a number of sounds which could still convey a coherent gestural reference, but, on the other, to retain the possibility of veering away from the fixed sonic *landscape* and register associated with a "saxophone"- to borrow Trevor Wishart's terminology[15]. Specifically, as my main "instrumental" sound, I created a hybrid made up of a combination of sampled and synthetic sounds, all of which were programmed to articulate in a predictable "wind like" manner through very precise response to volume, lip and wind pressure on the WX7. This sound was to be used in all the sections that required a more instrumental character, namely the re-tuning and some of the textural sections. For the rhythmic sections I also created hybrids, but ones which were imaginary, made-up of 4 combinations ranging from sampled and/ or synthetic percussive or granular sounds through to complete mixed textures in themselves. All this sound material was organised in a total of five patches, which I could recall via Midi patch changes from the controller as and when required. With respect to signal processing, I designed the system in such a way that patch change could be effected independently on the SPX90, thus controlling the sequence of processes as a further "performable" layer.

In my view, this version was a very auspicious experience in that it reassured me what an extraordinarily powerful instrument a wind controller can be. Whilst it is not comparable to an acoustic instrument in conventional respects, a controller such as this is nevertheless capable of being used to produce unique gestures and extremely expressive nuances, move between vastly distant registers and originate massive sonorities, all unimaginable otherwise.

3.7.Final considerations

Throughout this chapter I have reflected upon *On going on* from the perspective of the composer as an improviser. But in a way I also regard this process as the "stopping" in time of *one* improvisation amongst many. This

work is, in other words, the *composition* of an improvisation. Whilst this may seem a play of words, in my view, the ambivalence and interchangeability of these two concepts throws light on the subject of method, that is, on the manner in which - as a creative individual - the composer *performs*. Yet, as a performer, improvisation strongly remits me to dance, where there is no repeated gesture entirely alike, just motionful gestures that balance forward in the arrow of time. *On going on* was for me, in its *poietic* roots, an experiment in reuniting musical gestures to create a sense of time always moving forward, in a dance-like manner of performance. In the words of poet Brian Patten (1979: 49):

Just now begun! To think on this half-way through what time is left!
Among the dead and glittering brambles on the path
The miracle is obstinate
There is no 'going back', no wholly repeatable route
No rearranging time or relationships; no stopping
Skin from flaking like salmons' flesh.
Yet no end of celebration need come about,
No need to say,
'Such and such a thing is done and gone'-
The mistake is in the words, and going back
Is just a way of going on.

Footnotes on Chapter 3

[1] In *Grove's Dictionary of Music* (Ed. E. Blom) 5th Edition. Macmillan, London 1961.

[2] In my view, a distinction which gradually evolved as a result of the industrialisation of society. The bourgeois audience of the late 1800's became by the 1900's a mass audience which moved slowly. The discrepancy between its growth and comprehension of the composer's growth became so severe as to disrupt completely its interplay with music genres not associated with the more familiar composer-performer of the European musical soirée or the music hall concert. Internationalisation of the artistic communities in the early 1900's and continued specialisation of musical thought and of the Western capitalist societies as a whole contributed to disintegrating the relationship between the composer-performer and the mass audience, itself now split into a number of class-conscious specialised audiences. As performers and soloist veered towards the security of the symphony orchestra and operatic companies, composers became free-lancers in search of private or institutionalised patronage, a situation which has prevailed to our days.

[3] I am referring to unconventional "instruments" such as midi "sticks", or prototypes such as those developed at STEIM in Holland for composer-performer Michael Waiswicz. Also, variations of a similar principle can be found on other non-instrumental equipment, such as computerised mixing consoles, which allow, for instance, the transmission and capture of events which in turn command the minutest parametric change of timbre via on board potentiometers, signal processors and the like, through to the complete reassignment of functions on the controlling devices themselves.

[4] I am of course referring to the Midi communication standard and the proliferation of media-dedicated programs, small computers and modular synthesising devices, all of which can be interconnected into a control network for a number of different applications.

[5] The work was commissioned by Stephen Cottrell in early 1987 with funds provided by the Eastern Arts Association to be premiered at the University of East Anglia in October of that year and as part of the (Arts Council Of Great Britain) Contemporary Music Regional Tour.

[6] "Live electronics" is a term commonly used in electroacoustic jargon to designate a genre where signal processing devices are used in performance to transform the sound of a vocalist or an instrument, as opposed to transformations produced and pre-recorded in the studio environment.

[7] The WX7 Midi wind controller was introduced to the market in 1986. Its designed is based on the Boehm fingering mechanism as found in conventional wind instruments. The instrument is equipped with an 8 bit chip which handles information relayed by two wind and lip pressure sensors, fingering keys and on-board controllers (pitch-bend wheel, hold key (sustain), program change and octave transposition keys). In addition it allows the extension of the range to 7 1/2 octaves, as well as the individual selection of 3 overall key transpositions (C, Bb and Eb) and the capability of sending data over two Midi channels.

[8] The Yamaha SPX90 was one of the first 12 bit signal processors designed with the medium to low budget market in mind. Its software architecture included a number of memory registers where altered "patches" or configurations of in-built factory presets could be stored. The types of processes available to the user included variations of four main types of processes: reverberation, delays, modulation and pitch-shifting.

[9] Pitch shift designates a signal processing algorithm by which an input signal is sampled and then multiplied / divided by a number in real-time before being relayed back to the output path.

[10] By "horizontal" I mean a mode of listening which focuses on the elapsing of perceived timepoints as opposed to "vertical" listening, which I deem to be more concentrated on the perception of instantaneous relations of timbre or dynamics. Of course, both kinds of listening are interrelated and inseparable because all events in music are perceived as time goes by. Therefore my distinctions are distinctions of emphasis.

[11]Difference tones refer to the phenomenon which takes place when two periodic vibrations are generated simultaneously. Besides the perception of the separate vibrations, the ear may hear additional fainter sounds called *combination tones.* The most important of these sounds is termed *difference tone* because it corresponds in frequency to the difference in frequency between the fundamentals of the two vibrations. When the vibrations are complex in themselves (ie. containing several partials) the effect may also occur between the upper partials.

[12]By "instrument configuration", I mean here a different combination of Midi controllable sounds.

[13]The Canadian composer and recorder player Peter Hannan and the Venezuelan flautist Luis Julio Toro have performed this version extensively since 1988.

[14] Trevor Wishart proposes the general term of "Landscape" to designate the various characteristics of a sound experience which relate to our perception of the source of the sound (Wishart 1985).

Chapter 4 Acuerdos por diferencia
Composing a rhythm of rhythms

4.1 Background

Acuerdos por diferencia for harp and tape was written on a commission from the Park Lane Group[1] for harpist Hugh Webb, who gave its first performance at the Purcell Room, London in January 1988. The original brief for this work was to employ the Salvi electric harp[2], which was in fact used for the first performance of the work. However having had a demonstration of the instrument it soon became clear that I should keep the standard concert harp in mind rather than to limit the future of my piece to the unsatisfactory peculiarities of this prototype model.

Having enjoyed music which features the harp from early childhood writing for it was a very exciting prospect. Folk music in Mexico inherited the harp from baroque Spanish music in the late16th and early 17th centuries. Nowadays, although the performance style and the instrument itself vary enormously from region to region, its presence is strongly felt in most folk musics still alive around the country [3]. Particularly remarkable amongst these is the music from the east coast and highlands of Mexico, in the states of Veracruz and Tamaulipas. The music of this region, commonly known as *música jarocha* includes the harp within ensembles made out of *jaranas* (small baroque guitars) and a tambourine player[4]. The harp is often used both as a solo and as an accompanimental instrument, usually providing a syncopated bass line against fast moving virtuoso chord sequences and melodic lines in the upper registers. There is a substantial element of improvisation in this music, both from the vocal and the instrumental point of view. The music as a whole is full of repeated motifs which are constantly shifted in time to such great extent that the pulse and metrical interaction between strumming patterns on the guitars against the bass line and plucked chords of the harp often suggest virtual polyrhythms.

It was that aspect of this music which provided me with a pre-compositional model for both the relation between instrument and tape and the experience of form in *Acuerdos por Diferencia* . On the one hand I sought to create a polyrhythmic feel to the music by being very precise in the exchange of roles between harp and tape. It seemed to me though, that in order to give a primary structural importance to this aspect, I would have to create clear-cut points of reference, "landmarks" from which the causal - kinetic relations between instrument and tape could be forward and retrospectively inferred. On the other hand, at a deeper structural level, I wanted to stimulate the perception of motion in its "becoming".

I would like to use a metaphor to illustrate this point. Picture yourself travelling at ease on a train. As you look through the window, you notice the cables which run parallel to the tracks, hanging between regularly spaced pylons. As your eyes follow the cables, they seem to turn giving the impression of a volume that gently and continuously rotates as it changes shape. This flow seems to accelerate before being momentarily interrupted by the pylons; this is immediately followed by the previous gentle movement as you recapture the perspective of the hanging cables. Of course, one can easily deduce how the illusion works. This is what I would refer to as movement "being". But imagine you were in a position to determine a number of things on the spot, say the distance between posts, or the speed of the train instantaneously at will. You would then be able to effect changes in the evolving pattern of the cables and on the rate of the change itself, thus giving the whole illusion a direction and a life of its own in front of your eyes. This is what I would call the movement "becoming".

In *Acuerdos por Diferencia* I wanted to draw a musical parallel to this speculation. The metaphor is apt because in my piece I wanted the gestures and rhythmic objects in the music to be understood not only in their "being". By having them commence or finish on a figurative "pylon" or a point of accord (*Acuerdo*), I sought to bring the flow of motion to the background, rather than emphasise the

causal function of the points from which music would be triggered or continued . Variation, differentiation, juxtaposition and superimposition (*Diferencia*) between computer and harp could then take formal predominance, their appearances being inferred as large-form "edits" and variations in the speed and momentum of musical time. Thus my title can be freely translated as "according to differences" [5].

From the point of view of the composition of timbre in *Acuerdos por Diferencia,* another important inspiration was the baroque [6] sound-world that this highland music inhabits, full of complex strumming flourishes and ornamentation. In order to invoke the image of grain and colour which I had in mind, I considered creating the overall timbre aura of the work basing my experiments on the behaviour and sonority of plucked strings. Hence, the main sound production devices employed to create sources for the tape were taken from a *jarana*, a lute and the harp itself. I shall presently examine how these compositional strategies were used in the elaboration of instrumental and electroacoustic materials, as well as discuss the relations between the compositional aims and technical realisation.

4.2 Sound sources

4.2.1 Principal electroacoustic material

As mentioned before, the main sound source in *Acuerdos por Diferencia* was the harp itself. I sought to re-create the characteristics of strings being plucked as the idea of the entire sound environment. This focused on the noise and resonance elements of this type of sound, to act as a kind of magnified harp for the live harp to inhabit in performance. I worked in the recording studio with the harp player to produce many types of unusual articulations which would give me this quality, and from which I could choose adequate material for the electroacoustic part. For example, during the recording session, the harpist was asked to pluck the strings with all sorts of plectrums (paper, metal, fingernails, etc.). One of my favourite articulations was a guitar-like "strum", which I asked him to elaborate by running his hands across the strings upwards and downwards "starts and stops" in freely im-

provised rhythmic patterns. As I had the idea of eventually relating rhythmic objects with rational patterns, I asked him to produce these strumming gestures at tempos related to ♩ =98, so I would be able, when sampling, to generate rhythmic objects that had related shapes and inner speeds to any of its reciprocals (see below). Amongst other tunings, the harp was tuned for part of the session to a C (major- augmented third) aeolian mode[7] with the A and B strings flattened. This preference was not haphazard: I wanted the aeolian flavor to provide a structural tone colour for several sections, as will be explained below. Many types of strum were tried out; I finally chose one played close to the soundboard or PDLT[8] which was rich in upper partials. As can be heard from the recording of the work, most of the sounds on tape are characterised by the quasi-metallic timbre which results from this type of articulation. To construct the object which would become one of my main building blocks, I chose an excerpt from an entire passage performed in this manner and selected a downward- moving gesture which I deemed to have an interesting shape. In fact, the object was made of a number of downward strums, out of which the top pitch of each strum predominates. Thus, for the sake of clarity in transcription I shall represent it here in terms of those pitches even when the entire object is coloured by the æolian flavour of the resonant strings. (Fig. 4-1)

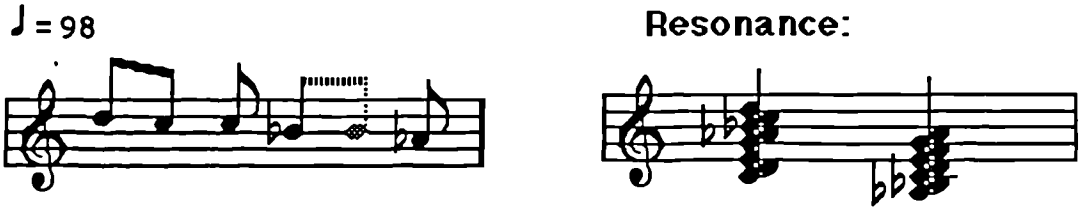


Figure 4-1 : Acuerdos por Diferencia : Principal rhythmic object and its resonance

4.2.2 Secondary electroacoustic material

1. Pre-recorded sounds.

a) Sounds which acted as extensions to the resonance of the live instrument. These included some low "buzzing" harp string sounds which were produced by

touching the vibrating string with a plectrum. These sounds were programmed to alternate between left and right channels in the stereo field. Other sounds included short strums and single "note type" sounds which came from the lute and a *jarana.* They were seldom articulated on their own. Rather, they were repeated at fast speeds so as to create *crescendos* out of the texture. In general these samples were programmed so that the frequency of a low-pass filter would change according to key velocity. The higher the key velocity, the higher the filter frequency. The iteration of the sound itself was done at a frequency related to either the modal centre of the section or to a metric subdivision of the strumming rhythmic object against which they were heard.

b) *Bisbigliando* and *Glissando* sounds, characteristic of the harp. These tremoli and gestures, directly taken from recordings of the harp, were used to fuse the resonance and encourage a mimesis with similar gestures on the live instrument.

2. Synthetic sounds

String-like sounds used to punctuate and reinforce the less resonant low strings of the live harp. These were generated on a Yamaha TX802 FM synthesiser and designed to resonate at the 7th, 10th and 15th partials when played at maximum velocity[9]. Due to their harp-like overtone make-up [10] they mixed well with most of the harp pre-recorded material . When triggered at the same fundamental as the live harp string they were doubling, these string-like sounds act as a catalyzer to the live harp and the sampled sounds. They were mostly used on the first and last sections.

4.3 The structuring of rhythmic objects: a general strategy

Available by the time of composition was the third generation of Midi sequencers on the Apple Macintosh and the second generation of samplers (12 bit). Besides the very significant improvement in recording quality and memory capacity of the

samplers as compared with the Fairlight CMI, the Midi implementation and polyphonic capabilities were far superior than in any other device then on the market. The Akai S900 could record sounds at any frequency ranging between 3Khz and 16Khz. From about 10Khz it was possible to record sounds appropriately without presenting an insurmountable problem for looping (as in the previous 8 bit samplers). This meant greater flexibility in the choice of adequate sampling rates relative to the frequency and timbral characteristics of a given sound, which in turn made for precise editing without compromising more memory space than required. The fact that more sounds could be used in more versatile manners presented a direct compositional advantage, which influenced the choice and structuring of rhythmic objects in *Acuerdos por Diferencia.*

Having experimented with similar hardware in the context of *Papalotl* , I had given considerable thought to the possibilities of sampling instrumental gestures, and in particular to the sampling of instrumental rhythmic gestures as a means of creating electroacoustic material. With respect to the design of rhythmic objects[11] a higher sampling rate allowed me to draw a systematic relation between the actual length (rather than only the frequency) of the sound and the sampling frequency. Rhythmic contours could then be thought of or designed beforehand with a specific shapes and inner tempos , relative to a specific length in seconds corresponding to a higher number of samples. This meant that sampled instrumental gestures could then be edited with complete precision according to any of three criteria: (i) inner salience; (ii) inner speed or tempo relative to those saliences and (iii) sample windows. Let us examine how this could apply to a instrumental gesture such as the one below :

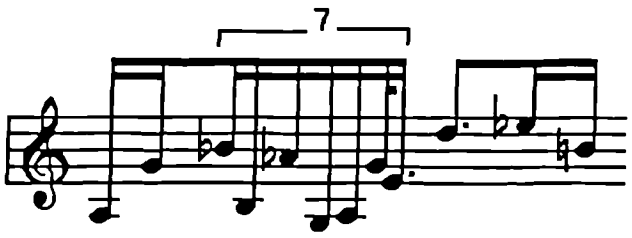


Figure 4-2 : Acuerdos por Diferencia : An instrumental gesture

To illustrate let us assign this object a metronome mark of ♩ = 96 bpm. As the gesture is equivalent to a duration of 11 semiquavers, and each quaver is ca. 156ms long, the object's total duration in seconds at the above tempo marking is ca 1.716 seconds. (Further implications of the object's tempo will become apparent later). Let us assume, in the first place, that the object was played completely accurately. Now, if we record it at a sampling frequency of 16Khz we can determine that the entire object will take 27456 sample windows to be recorded. Once this is known, manipulations of the sampled object become fairly straightforward under any of the criteria outlined above. Let us regard it first from the point of view of its metrical durations. Say we wish to generate another irrational rhythmic object using the dotted quaver and the first four septuplet semiquavers. We would only need to shorten the sound by pulling in the start point at sample window 6769 and making sample window 22463 the end point, for a total of 18192 sample windows (ca.14.5 semidemi-quavers at ♩ =96) [12] :

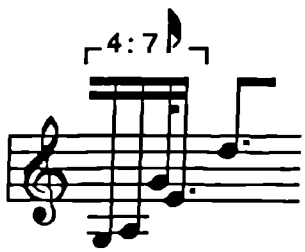


Figure 4-3: Acuerdos por Diferencia: An irrational rhythmic object

By the same principle, determining required loop points also becomes straight forward. Let us use Figure 4-2 again, this time setting a loop length (measured backwards from the endpoint) of 13184 sample windows which will repeat - for as long as a key is held down - the subgroup made of the last 4 septuplet semiquavers, the dotted quaver and the last two semiquavers. (Fig. 4-4)

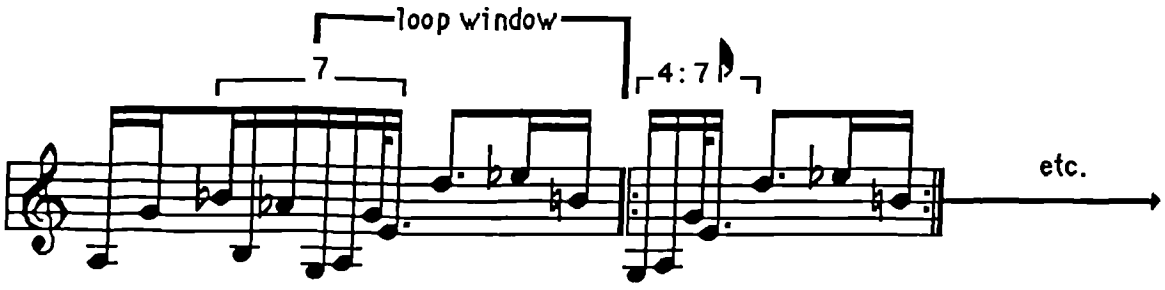


Figure 4-4 : Acuerdos por Diferencia : Repeating loop of a segment of the object.

Setting loop lengths equivalent to the object's total duration obviously repeats the sound in its entirety. However, another interesting possibility is to set a complete "reverse alternating loop" by which the loop window is alternately read forwards and backwards for as long as the sound is held. Using Figure 4-3 as the looped sound :

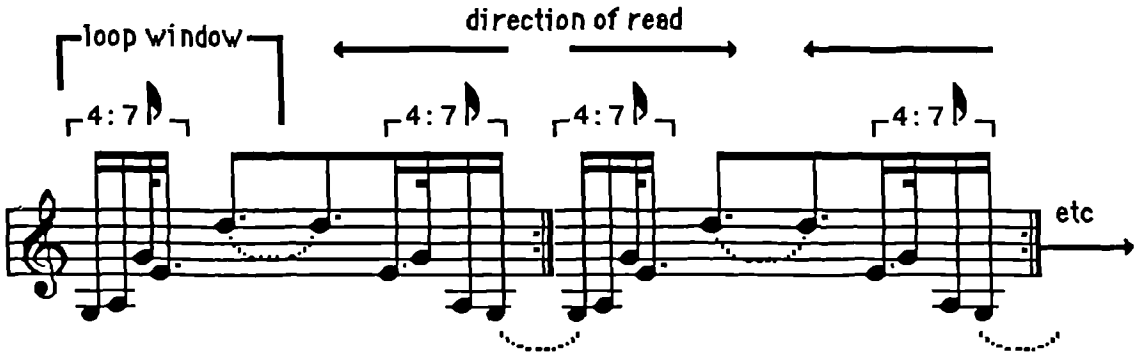


Figure 4-5 : Acuerdos por Diferencia : Alternating loop of the entire object.

As may be gleaned from the above example, the transparency of this technique largely depends on the characteristics of the sound in question. Sounds with hard attacks and little decay will do little to mask the actual process. But in the case of plucked string sounds with longer decays it works well because the joint between forward and backward decays was largely seamless, as the dotted ligatures in Figure 4-5 above suggest.

4.4 Integrating rhythmic objects and computer control

The examples above aim to show basic structuring techniques of rhythmic objects based on pre-recorded instrumental gestures. Of course, the strategy could have been applied to non-rhythmic gestures or non-instrumental material to a similar degree of precision, and would probably work interestingly in the right context as long as the process remained transparent. However, the aim of structuring rhythmic objects in that way in *Acuerdos por Diferencia* was specifically geared towards the integration of computer and live instrument parts. I was interested in the sampler as a technical means to establish coherent structural rhythmic hierarchies based on the correlation between duration, tempo, metrical and

pulse flow and repetition of rhythmic objects, a strategy which Midi control and sequencing could make possible. I shall presently examine this integration.

Once a sound is in the sampler's memory, it is by necessity assigned to a Midi note number (usually middle C), an arbitrary location which when triggered will correspond and play the sound exactly as sampled. If we take middle C as our reference, moving up and down note numbers on a Midi keyboard controlling the sampler, will give us the sound played (or "read-out" in digital to analogue conversion terms) at a speed (as in analogue tape playback) corresponding to the tuning ratio between the middle C and the note number currently triggered. In other words, if we trigger the sound at an interval of a fifth above middle C, it will be read at a ratio of 3:2 in relation to middle C. In more musical terms, this simply means that we will hear the sound played in a quaver triplet -to -quaver ratio and transposed a fifth above. But let us take the slightly more complex ratio of 8:5 (minor sixth) and see what it may yield rhythmically relative to a middle C by triggering and holding both simultaneously. Using a simple looped rhythmic object :

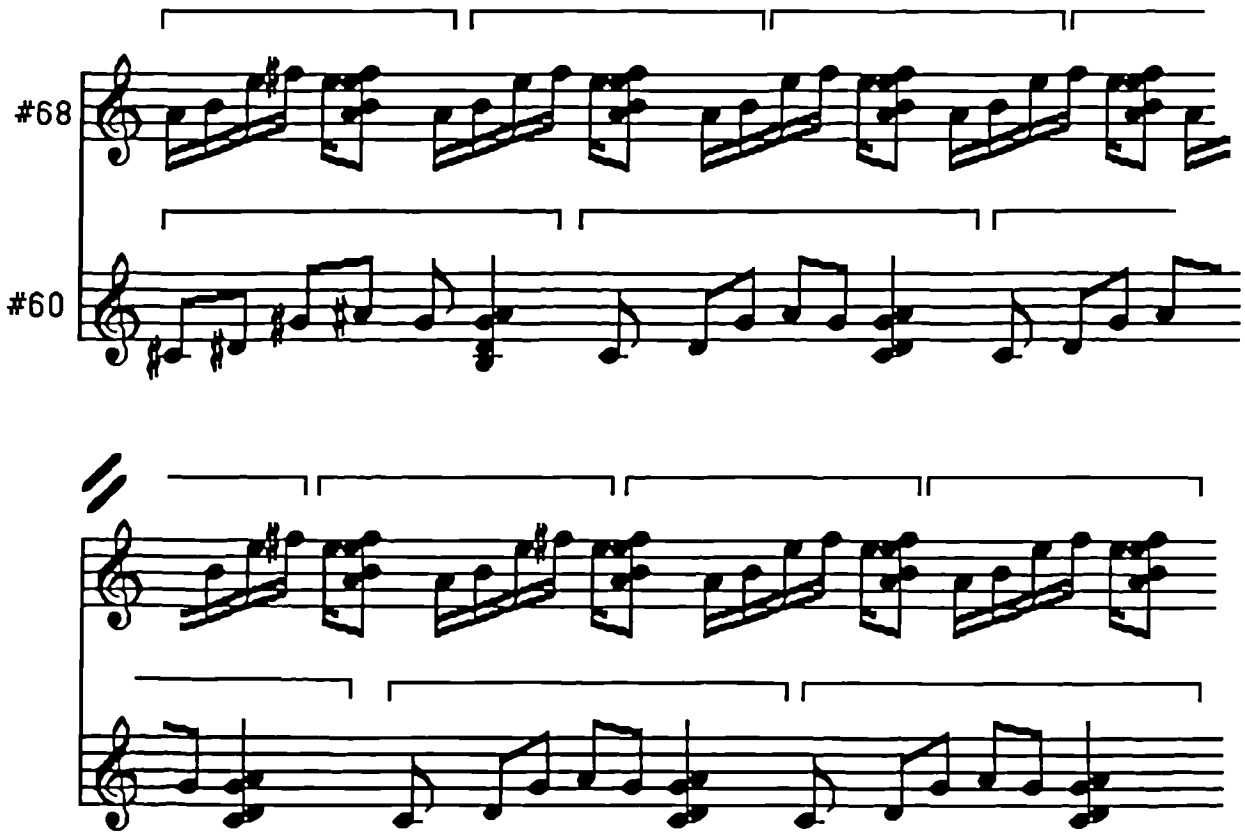


Figure 4-6a : Acuerdos por Diferencia : Looped rhythmic object articulated at 8:5 ratio

As it can be seen from Figure 4-6a, the cycle reflects the ratio: it takes the same time for 8 repeats of the object triggered at higher note number 68 (A) as it does for five repeats of triggered by note 60 (C) to recommence the cycle. More interestingly is that this reciprocity is also reflected in the pitch and the durations, which implies that the example can be interpreted from the point of view of either pitch class or as being made of octuplets against quavers or quaver quintuplet against semiquavers.Fig. 4-6a thus illustrates the case of a rational rhythmic object, that is, where the metrical durations are divisible exactly. However, in *Acuerdos por Diferencia* I also looked into the process using looped rhythmic objects or segments of it whose duration was irrational. See for instance Figure 4-6b, which illustrates such a case with the same 8:5 ratio.

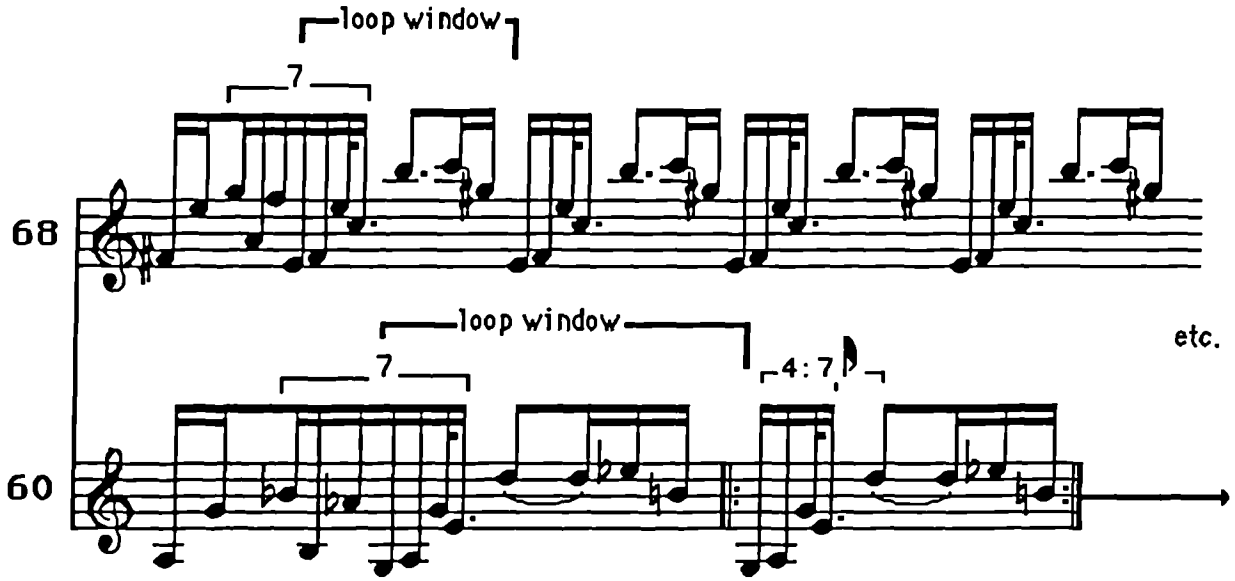


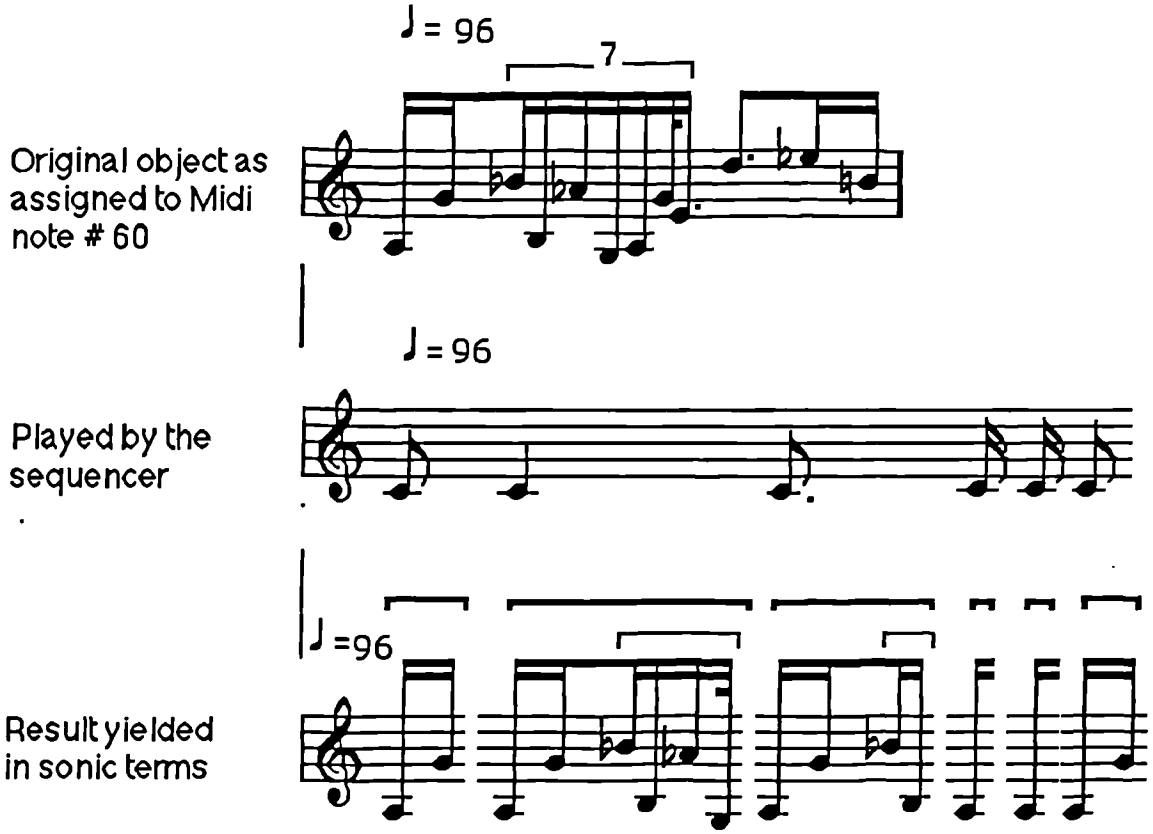
Figure 4-6b :Acuerdos por Diferencia : Irrational rhythmic object articulated at 8:5 ratio

The more complex implications of this strategy begin to become apparent. As suggested before, in the context of a work for instrument and electroacoustic sounds, the potential not only lies in the rhythmic complexity which may result from local manipulations of rhythmic objects themselves, but also on the correlations that may be established through the sequencer at other structural levels. Let us examine a further possibility which arises once the object (and thus the midi note number to which it is assigned) is related to a sequencer. In sequencer

terms, all duration values (from whole notes to semi-demi quavers) have a fixed resolution in computer clock ticks[13]. In Mark of the Unicorn's Performer, for example, the crochet consists of 480 clock ticks, the quaver 240 clock ticks, the semi-quaver 120 clock ticks, and so on. These clock-tick durations are then "played" by the sequencer at a tempo arbitrarily set by the user. Now, we have considered the previous examples somewhat in abstraction, not taking into account their inner speed , only analysing their rhythmic relation in terms of a pre-established interval/ global ratio. However, when the computer clock speed is made to correspond to the (metronomic) tempo of rhythmic objects, the reciprocal relations pointed out before can be transferred to sequencer tempo in relation to computer clock speed. Say for instance, with regards to Figure 4-6a, that the tempo of the object as sampled was ♩ =96, which would imply that, in a 8:5 ratio with another version of itself, it would bear a relation with the tempo of ♩ = 153.3 (96*8/5) and, of course, with its reciprocal (a major sixth below) of ♩ =60 (96*5/8).

Consequently - in terms of computer control - it may now be clearer how a correlation of this kind may be said to be established between the pitch content, tempo and duration of the rhythmic objects with the pitch, tempo and duration as represented by Midi data on the sequencer. Without stopping now to consider how these reciprocal relations were used as a large-form structuring strategies in *Acuerdos* , let us discuss some of its repercussions in terms of stringing and local organisation.

Take again the object in Figure 4-2, but this time let us examine what it yields when three midi note events of simple clock-tick duration (a quaver a crochet dotted quaver, two semiquavers and a quaver - 240, 480, 360, 120, 120 and 240 clock ticks respectively) are triggered one after the other at a tempo equal to the *tempo of the object itself* :



Acuerdos por Diferencia. Figure 4-7 Stringing with single Midi notes

Whilst for the sequencer only 6 durations of the same note number have been articulated, the result is far more complex in sonic terms. Whilst the durations in the sequencer are entirely rational, the result includes figurations which are not rational in themselves (the split septuplet group), an aspect which may further exemplify the magnitude of rhythmic or melodic complexity this method of stringing can provide. Obviously, if seen in this way, Midi note numbers only represent triggers of specific duration which function as window length[14]. For that reason, composing with sound objects of distinct rhythmic profile and durational ratios on a sequencer demands a higher level of abstraction which requires the benefit of a systematic approach to circumvent the limitations of the sequencer "score". In passing I shall point out that, although composing music in this way expands the compositional possibilities of the sampler and the sequencer as a tool, it nevertheless poses problems of representation when expressing the computer score or tape part in traditional notation.

In *Acuerdos por Diferencia* I extended this method of stringing with other ratios and more than one rhythmic object at a time. Sound sources were therefore recorded played at several related tempos in order to keep a spectral coherence and a consistent articulation quality amongst the rhythmic objects. In general it was possible to design objects with irrational figurations and still be able to determine a representation in Midi note values or duration in the sequencer, also an important point since a click-track would be eventually required. See the Figure below:

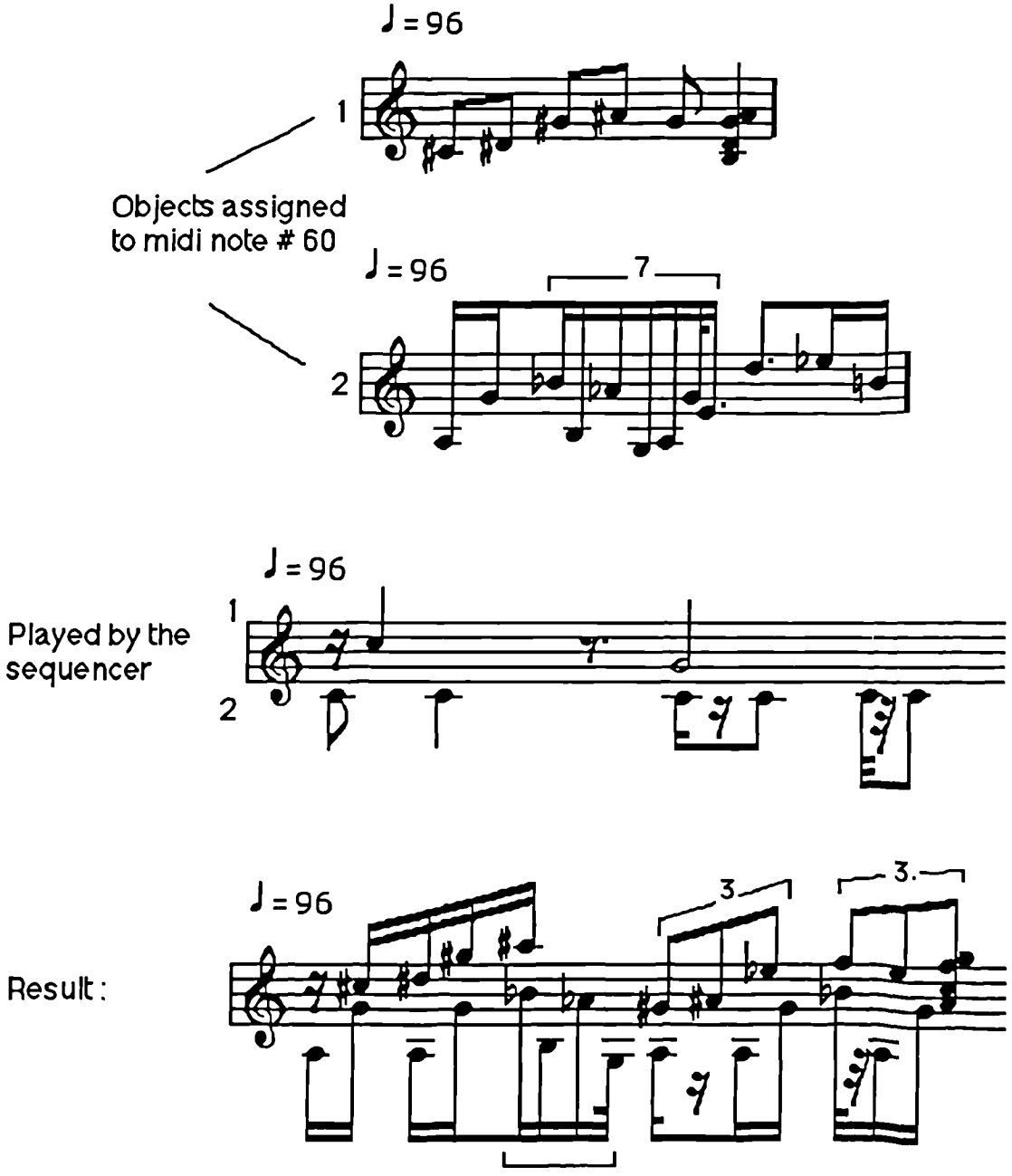


Figure 4-8 : Acuerdos por Diferencia : Stringing together two objects

I have limited myself to *consonant intervals* between an "octave" of Midi note numbers (say from note 60 to 72) because Midi equipment, and keyboards in particular, have been designed in accordance with Western equal temperament. This implies that all intervals are repeated at the octave. (For the purpose of clarity, I shall keep referring to them as in an idealised harmonic series). Therefore the reader must be aware that such basic ratios as 2:1, 3:2, 4:3, 5:3, 5:4, 6:5 and 8:5 are all relative to the octave (or 2:1) in which they lie[15]. Ratios such as 9:8 (a major second) and 16:15 (semitone) are of course available in the standard (Midi) keyboard. However, because Midi note number values cannot be expressed in decimals (say for instance Midi note number 60.5), the use of smaller ratios presents a limitation which can only be surmounted by the use of pitchbend. Pitchbend is a Midi message which affects the speed at which the sampled sound is read by subtracting or adding to the Midi note number triggered. This is done in small steps[16]. So it *is* possible to use other more complex ratios other than those of equal temperament intervals such as those found in just and mean tone temperament, say, for instance ratios such as 10:9 (minor tone) or $\sqrt{5}$:2 (mean tone whole tone) or 81:80 (syntonic comma). This, of course, implies programming consistent equivalencies between pitchbend amounts and their equivalence in the sampler. I have been speaking of ratios as one would do for frequency ratios, but I have only been referring to them insofar as they correspond to the purely *geometric* ratios thereafter generated by appropriately assigned Midi events.

In order to focus exclusively on the combinatorial possibilities of rhythmic sound objects, I have purposefully omitted any reference to the pitch or the timbre features of the sampled objects. However, one can hardly abstract these features because, in practice, they are unseparable from the phenomenon of sound itself. When these features are brought to the fore, the potential of the strategy outlined above is enriched, suggesting ways by which rhythm, pitch and timbre may be bound compositionally. Indeed, when taken into the realm of pitch and timbre, sets of altogether more complex ratios could be the departure point for the sys-

tematisation of complex rhythmic and harmonic syntaxes, as has been proposed by other composers[17]. This type of *sound -to-process* integration was one of the main ideas behind the formal structuring of the work.

4.5 Formal strategies

Unlike other works discussed here, in *Acuerdos por Diferencia* I did not have a pre-conceived plan as to how material should be structured in larger formal terms. Rather, the idea of a possible structure came as a result of experimenting with sound material and developing embryonic ideas into full blown strategies. I shall now consider the work from the point of view of the finished product, although this procedure may seem to contradict the manner in which I actually composed the piece. *Form* is not the structure created by the artist, but that which is perceived or apprehended. In order to keep that wider perspective at hand, I shall keep referring to the strategies which informed my choices, in the hope of clarifying the link between what I intended and what resulted in perceptual terms.

I structured the work into four continuous sections which I shall refer to as *Dance*, *Train*, *Strum* and *End*. Except for a short tape solo towards the end of the *Strum* section, all the sections feature the harp and play with no interruption. My structuring thread required that in the four sections, tempo, metric, harmonic and timbre relations would evolve continuously through faster and brighter areas, a process which was intended to be seamless, as I will discuss below. (Fig. 4-9).

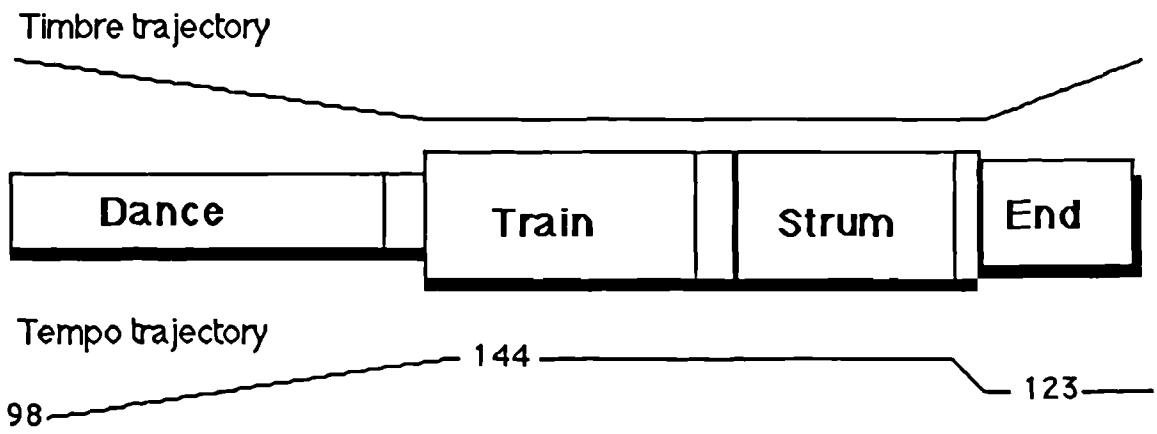


Figure 4-9: Acuerdos por Diferencia : Sectional timbre/tempi trajectory scheme

The outer Dance and End sections of the work (bars 1-161 and 346 to end) are constructed by means of the rhythmic object strategy outlined above. In both sections, the object illustrated on Figure 4-1 above formed the basis of the computer part, on top of which the live harp balanced. Once edited to a duration equivalent to 6 quavers at ♩ =98, the object was looped in its entirety. A schematic table is given below as an example of a few of its figurations and reciprocal tempos obtained at transposed durations of midi note number 60:

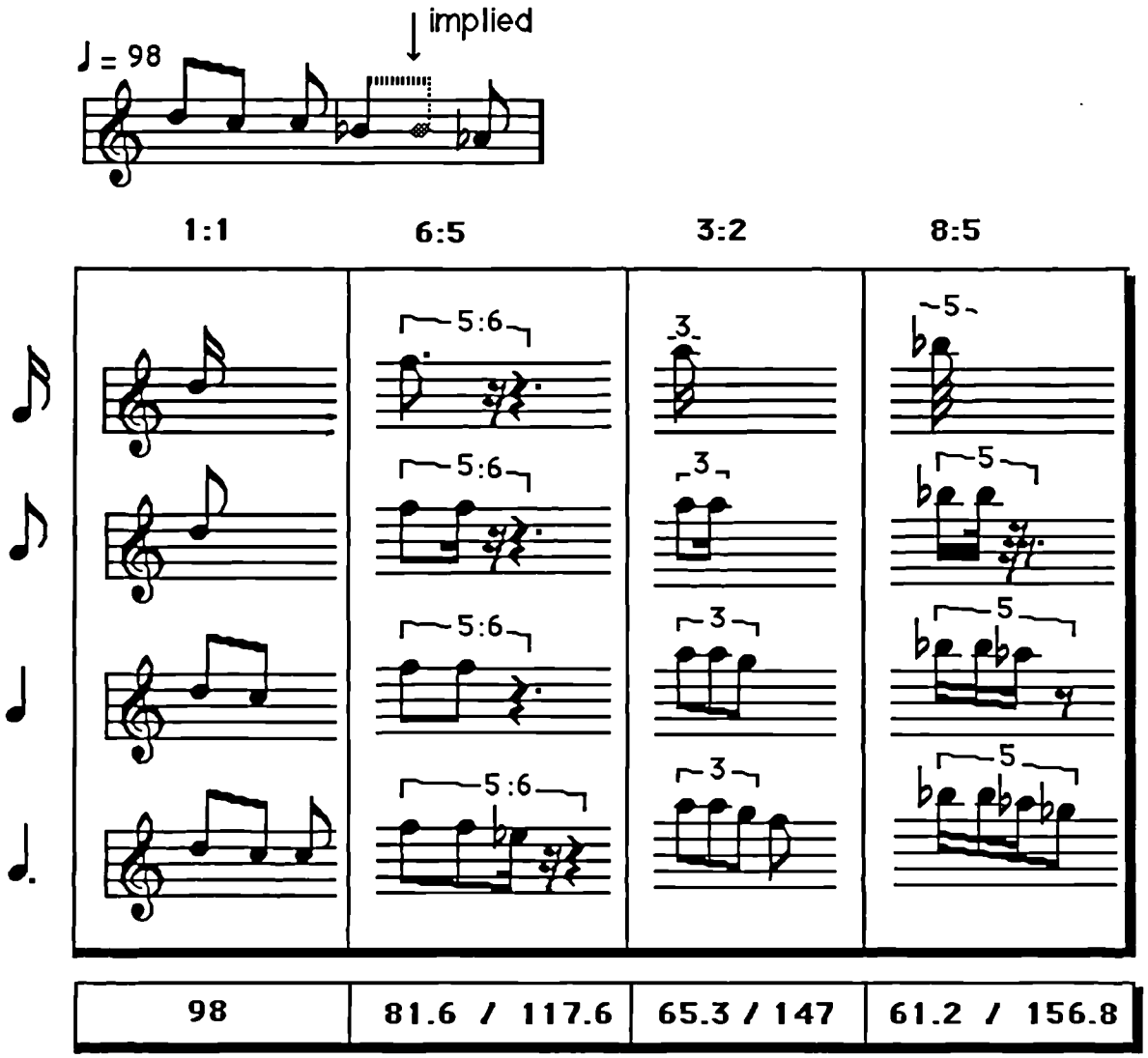


Figure 4-10: Acuerdos por Diferencia: Figurations and reciprocal tempi derived from rhythmic object

In transcription, the specific timbre features are impossible to express. As may be inferred from the table above, only the attributes of the strumming attack and its transients are allowed to appear with the shortest duration window, whereas longer durations make for a more resonant sound, and allow its melodic, pitch

and timbre contour as indicated above to become readily distinguishable. The ternary metric wave of the sections is based on the shape of the object: an accented strum on the first and fourth quavers when the sample is played on its entirety. (ie. for a duration of 6 quavers at ♩ =98 - one complete bar of 6/8 or 3/4). With this duration, its pitch content and open-attack morphology appear unaltered.

The most distinguishing characteristics of the electroacoustic part in these outer sections are several highly ornamented gestures consisting of fast harp-like figurations (yet impossible to perform on a live harp) which function as a rhythmic "hocket" to the live instrument. In harmonic terms, the electroacoustic sound juxtaposes the gestures of the live part. Yet the æolian profile of the rhythmic object is so strongly defined that it forms a kind of harmonic core from which tension launches from or contracts towards. To digress slightly, one of the beauties of modes as working materials is that they may be arranged effectively according to their tension relationships. In simple terms, the greatest number of alterations ((flattened notes) that are applied to a mode, will produce a perceptually "darker" scale formation. In the harp this principle lays well because the tension between modes corresponds to slacker or tighter string tension.

To encourage a dynamic relation between the implied mode of the rhythmic object and those used on the harp, I kept the instrumental writing and articulation in these sections mainly chordal, but varied the harmonic flavour of the chords quite freely between two perceptibly different modes: a locrian and a myxolidian mode, and used the aeolian as a pivotal middle point. Because the rhythmic hocketing between the parts was kept fairly even with the metrical flow, the rhythmically freer scintillation between modal flavours created a unique sense of *separateness* between harmonic and rhythmic motion which determined to a large extent the character of the sections. (Fig. 4-11)

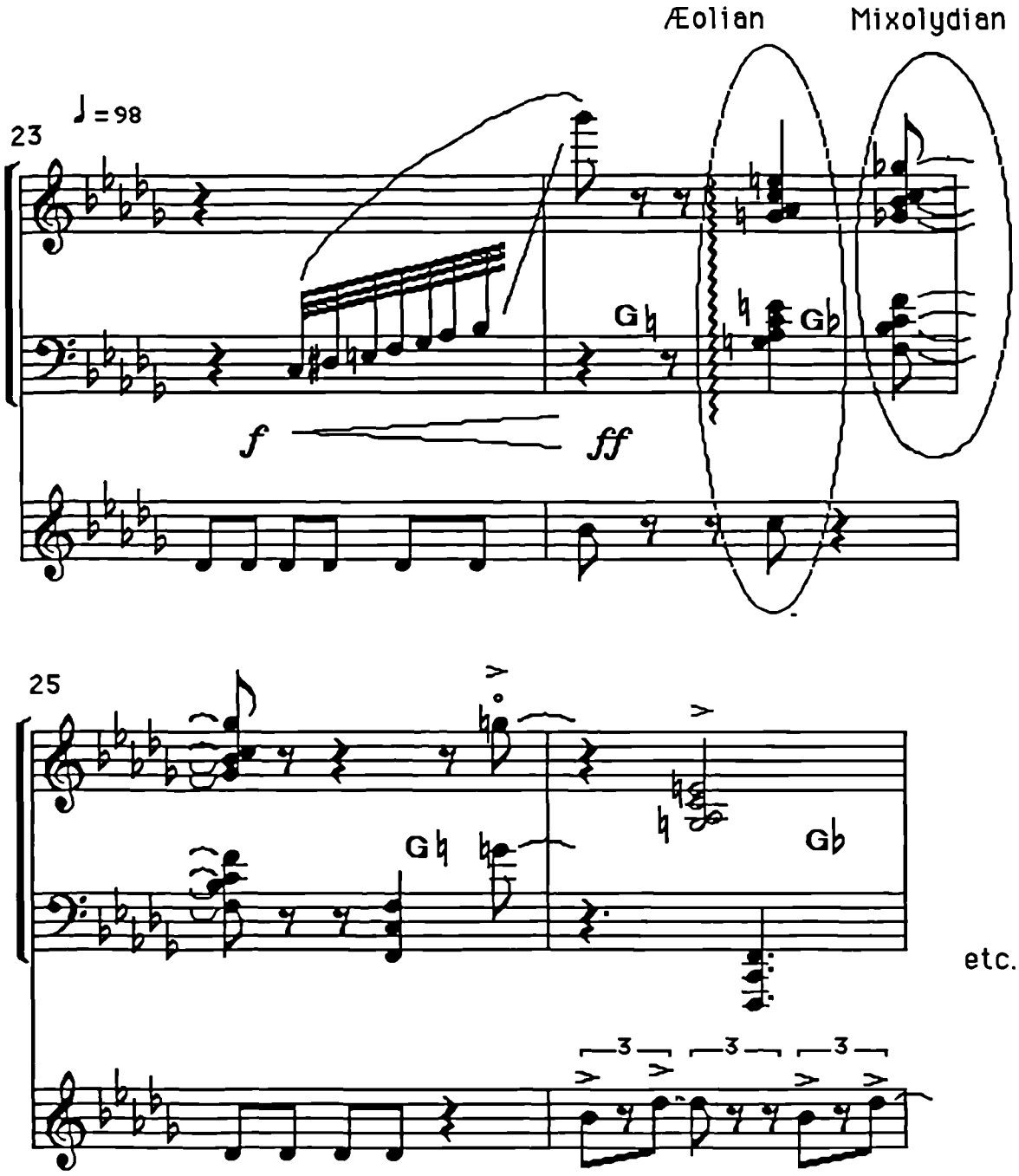


Figure 4-11 : Acuerdos por Diferencia : Rhythmic scintillation through modal ambivalence

4.5.1 Transposition of rhythmic objects and timbre areas

As explained before, via sequencer score and sampled objects I sought to define cohesive harmonic, timbral and rhythmic relations throughout entire sections of the piece. But this now warrants a more detailed explanation. As considered above in terms of geometric ratios, the transposition of a Midi note number corresponded - in terms of tempo and rhythmic profile - to equally well defined propor-

tions. This was also true for the timbre and pitch content of rhythmic objects caused by transpositions of the note to which they were assigned.

In general, transpositions can be thought of as being nothing other than the speeding up or slowing down of the rate at which numbers are read, perceptually (and as far as my elucidation of timbre and colour is concerned) these changes make an important timbral difference. Upward transpositions (towards higher Midi note numbers) will *obscure* the timbre characteristics of the rhythmic object because it will loop at a faster rate: its characteristics become faster and there is less resonance. When transposition is effected downwards the timbre of the samples becomes more resonant as it takes longer for the sample to speak; the rhythmic profile and *open continuity* of the sound slow down whilst its inner timbre qualities become more readily distinct. The attack becomes softer and wood-like whilst transients and noise are evenly distributed within the warm resonance of more discernible partials. The acoustic qualities of the actual recording also become evident (placement in the stereo field, distance, etc.). By simple transposition of rhythmic objects one can "modulate" between closed and open types of timbre areas. In *Acuerdos por Diferencia* this principle was used to differentiate the timbral colour between the sections: as they have faster tempos, the durations are shorter, thus paradoxically a "darker" less resonant area is generated. (refer to Fig. 4-10 above)

At high transpositions, the changes are, of course, more dramatic. Sustaining the looped object at more than 2 octaves above its original "pitch" will fuse the repetitions of the sound (the looped portions) into a granular pitch continuant[18]. This type of iteration is used in *Acuerdos por Diferencia* as a quasi-orchestral colouring device to reinforce specific pitches or the resolution of arpeggios on the harp in the *Dance* and *End* sections .

In the case of looped objects being played with short durations at very fast tempi, the timbral result is a quasi-metallic attack with a slight quivering resonance. In

this instance a rhythmic objects is no longer useful for its intrinsic rhythmic characteristics, rather it is now a "note" and thus susceptible of being used for its punctual quality. This approach characterises the entire *Train* section, where the rhythmic object is played in such a restricted manner. A short sequence of such short durations is repeated, patched through a filter whose cut-off frequency has been assigned to velocity. As the volume is increased, the filter opens up revealing some of the metallic grittiness of the sound . The overall crescendo gesture gradually becomes a kind of motoric swell, its regular graininess only disturbed by the omission or diminution of one of the "notes" in the repeated sequence, a step which creates sudden off- balance accents which imply a shorter metrical wave. This rhythmic stagger generates a sense of forward movement, which is then taken over by a glissando on the harp. At each appearance (several in the section) the gestures are amalgamated with similarly fast crescendo made of iterated *jarana* and harp sounds. When they reach their peak, high pitched continuants on the synthesiser help to timbrally mix the texture with the live harp glissando. (Fig. 4-12)

4.5.2 Rhythmic and harmonic modulation

I have already spoken about the movement between perceptually dark and bright modes locally in the context of the first section, and globally in terms of open and closed timbre as corresponding to movement between faster or slower tempi. Given the technical constraints of the harp, this idea seemed to be ideal for *Acuerdos por Diferencia.* When modulating to scales with more sharpened notes it is usually best to take advantage of the enharmonic possibilities of the harp and start at a "very flat key" in order to gradually release pedals and avoid impossible spellings[19].

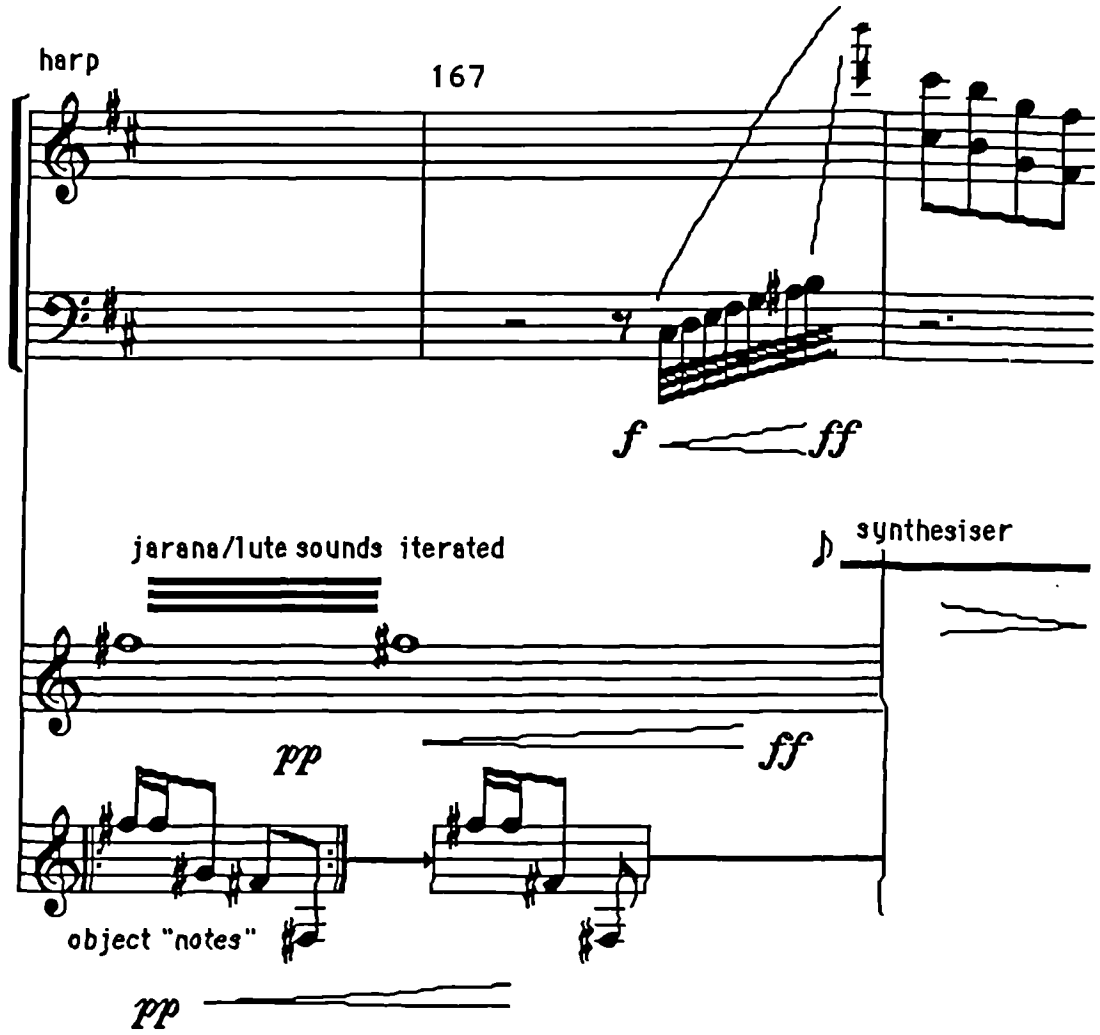


Figure 4-12 : Acuerdos por Diferencia : Typical timbral mixture

Laterally to these instrumental considerations, I felt I needed to develop a more systematic approach to make the piece work in terms of harmonic movement. In computer terms, Midi notes represent not only pitch classes belonging to a given scale formation, but also the specific rhythmic cells assigned to them. Therefore, modulation between rhythmic entities can be easily inferred from any predetermined harmonic functional modulation between pitch classes. As I have discussed above some of the rhythmic and timbre implications of transposition with regards to simple ratios, I shall not dwell on those in detail here. What is relevant is that in the context of modulation, the shortening and increment of the duration of sampled rhythmic cells (as one moves to higher and lower modal centres) gave me the opportunity to effect gradual seamless changes towards faster or slower tempi (and darker or brighter timbre areas) which inevitably carries har-

monic functionality. In other words, the modal centres correspond to the tempo implied by the rhythmic object that particular (midi) note articulates. Hence, through its reciprocal relations with tempo and pitch, the duration of rhythmic objects (themselves durational patterns to a great extent) can elicit timbral as well as harmonic functionalities at interrelated levels of connectivity, and not only at the metrical sphere of the more familiar *rhythmic modulation* [20].

An illustration of rhythmic-harmonic modulation can be found in the transitions between the *Dance* and *Train* sections and between the *Strum* and *End* sections of the piece. In the first case, the modulation is effected between a ternary metric wave at 98 BPM to a duple at 147 BPM. It works in the following way. At the end of the *Dance* section, the metric flow is weakened by the low frequency notes in the harp which alternately fluctuate between a 2:3 hemiola and the ternary metre, whilst its top notes and a loop on the computer reiterate in a diminution of 3:4 with respect to the pulse. This top harp line gradually increases the suggestion of a new pulse at 130 PPM, which the computer then contradicts by re-articulating similar short harp-like sounds at a 9:8 ratio to the new pulse. In the background, throughout the transition, a grainy texture made of a 6:4 iteration of a lute string sound gradually emerges. At the peak of the crescendo the harp plays arpeggios in duple meter and establishes the new tempo of 147 BPM (3:2 ratio from the original). This transition is paired up with modulation between the modal centres of C aeolian to E-G myxolidian and a shift towards a darker timbre region. (see bars 150-165). A similar transition, this time in a 5:4 ratio and between a C mixolydian and an E æolian is created on tape between the last two sections.

4.6 Final considerations

To my mind, one of the most rewarding aspects of the composition of *Acuerdos por Diferencia* was being able to construe a syntax entirely compounded from the sound sources and appropriated to the constraints of the technology available.

The mimesis between live harp and electroacoustic sounds was achieved by imposing a rhythmic morphology coherent with the instrument's idioms. Thus the overall motion and timbre of the work form an indivisible whole which is in my view acoustically resonant. Moreover, the multi-level rhythmic structure - the *rhythm of rhythms* - is a strong catalyst of formal boundaries in the piece which prompts the sense of a global timbral and harmonic locomotion. *Acuerdos por Diferencia* is perhaps one of the first pieces where I have been able to control the flow of the work's own "time" through structural constraints. It is a work which is perceived as "happening faster" than it actually takes to perform.

Footnotes on Chapter 4

[1]With financial assistance from the now defunct Greater London Arts Association, which was the main funding body for artistic projects in the London region until 1989.

[2] The Salvi electric harp is a prototype developed in London by The Salvi Harp Manufacturing Company, which is based on a standard harp, but is equipped with a series of electronic pickups, one for every group of three strings plus one for the whole of the frame. These transducers are placed below the soundboard, and are reunited at the bottom by a small preamplifier which has two output sockets. The manufacturer's idea was to create an instrument which could be easily amplified without the usual problems of acoustic feedback. Although it was not successful as a concert instrument because of its lack of radiation and resonance, the electric harp has had a considerable impact amongst session players in the UK.

[3] An excellent reference archive of the harp's repertoire and role in Mexican music can be found in the *in situ* recordings of anthropologist José Raúl Hellmer and others which were done in the 1950's to the 1960's and issued as a series by the Instituto Nacional de Antropología e Historia (National Antropology and History Institute) in Mexico City during the 1970's.

[4] For a detailed description and discussion of Mexican and South American guitars see Montanaro (1983).

[5] It is perhaps worth mentioning that in sixteenth century Castillian, *acuerdo* stood for a consonant "accord" or an actual chord. *Diferencia* , on the other hand, referred to a polyphonic passage or a variation of a theme. See for example the organ works of Antonio de Cabezón, the undisputed master of Spanish polyphony.

[6] Subsequent to the conquest of the American continent, European (Spanish) baroque music was literally transported to the new colonies in Mexico, Central and South America. But whilst that music evolved in Europe, it remained "frozen in time" in the colonies, and is still alive today as folk music. A whole discussion on this musical heritage and its preservation as "living" folklore is still to be written.

[7] The tuning of the harp strings was as follows : C, D, E (*alteration*), F, G, Ab, Bb, C.

[8] PDLT or *Près de la table* means, in harp terminology, close to the soundboard. The sound obtained, though it 'dies' quicker, is richer in upper partials and attack transients.

[9]The Yamaha TX802 Synthesiser is a third generation (16 bit) frequency modulation synthesizer consiststing of 6 oscillators grouped in any of 32 preset algorithms. The volume output of each oscillator (and consequently the modulation index) can be made sensitive to velocity (in Midi terms, speed of attack) which allows for highly variable transients and a dynamic harmonic trajectory within one type of algorithm.

[10]The modern harp tends to be most resonant at the second, seventh and tenth partials. For further reference see Chaloupka (1970).

[11] See Chapter 3 for a definition of a rhythmic object.

[12] In sampler terminology 'start point' is the point from which the sound is read, 'end point', the point up to which the sound is read. 'Loop length' is measured backwards from the end point to a point somewhere into the sound.

[13] I am referring to sequencer packages such as Mark of the Unicorn's Performer or Opcode's Vision, which have a resolution of 480 ticks to the crotchet. Most other packages have very similar resolutions.

[14] A concept which is only been employed for sound editing software in recent years (i.e. the Playlists of Digidesign's Sound Tools or the Edit/Play Windows in the Dyaxis system)

[15] This is brought about by multiplying (or dividing) their ratios by 2, or by a power of 2, which makes them lie within the range of ratios 1:1 to 2:1, which, as I have suggested before, is also analogous to the standard terminology for expressing frequency ratios in musical acoustics.

[16] *Pitchbend* is a Midi message which provides the possibility of "bending" the pitch of a Midi note number triggered. The data is sent in two bytes, the LSB (least significant byte) and the MSB (the most significant byte) which indicate the total range of the "bend" to the receiving device. The way in which this data is interpreted depends on the receiving device, but in general. controllers are limited to a fairly coarse (7 bit) definition which has been deemed by manufactures as being sufficient for "normal " bend requirements (usually within 12 semitones).

[17]See for example Barlow (1987).

[18]For a complete terminology of morphological sound models see *Spectro-morphology and Structuring Processes* by Denis Smalley (1986)

[19] See Chaloupka (1970 :19) and Rensch (1989)

[20] *Rhythmic modulation* implies the gradual change from one rhythmic idea to another as smoothly as possible.

Chapter 5 Así el Acero
Composition as choreomusical design

5.1 Background

Así el Acero, for tenor steel pan and tape was composed in 1988 on a commission from percussionist Simon Limbrick. Like the preceding *On going on,* this new work envisaged the use of electronic instruments live. In fact, the percussionist's initial request was for a piece which would be based around his small transportable set-up which consisted of a computer, a sampler and a synthesiser[1].

In *Así el Acero* I was confronted with the problem of composing for a non-standard instrument of which I knew little and for which hardly any literature existed [2]. I use the word "problem" for lack of a better word as in fact, this is a challenge which has long fascinated me. The process of formulating musical ideas without an immediate preconception poses interesting "what if" types of question which only get answered quite late in the sonic realisation of the idea itself. Hyperbolic as this may seem, it is a singular compositional circumstance which I believe generally elicits exciting unimagined solutions to serendipitous speculations. This circumstance, in the context of an already experimental exercise (the working out of sonic material with electronic resources) posed a doubly unknown psychological path in my approach to *Así el Acero*: reinvent the 'instruments' to invent the music.

The steel drum is an instrument of Caribbean origin, possibly invented around the 1940s by the African black agricultural communities in Trinidad [3]. Steel petrol containers were adapted as melodic instruments by hammering and thinning out the tops into small oblong or quasi-circular embossed shapes to produce individual tones. The bottom section of the containers was then cut off

and the "drum" was hung on stands by means of leather straps. The instruments are hit with short 12 inch wooden sticks to which a cautchum or rubber pad is fitted at the hitting end. The various sized instruments are combined into four or five different families according to range, the lowest groups requiring up to 10 containers each to obtain a two octave span. A modern day band can include up to a 100 drums played by 60 to 70 people. Traditionally, the steel drum bands have been accompanied by a "rhythm" section comprising idiophones such as maracas, claves or cowbells. Nowadays, the bands usually include in this section a standard drum kit and an electric bass, as can be found in bands around London.

Acoustically speaking , the steel drum tones do not posses a long resonance and its specific construction does not help this. The damping exerted by the main body on the resonant bosses is often too irregular, the radiated sound thus easily becoming a mixture of widely spaced and inharmonically related pure tones. As the "notes" get higher, the bosses become smaller and the damping increases. Admittedly, the inharmonicity between partials from the longer resonating fundamental tone of the container - directly related to its size and diameter - and the upper tones of the hammered areas themselves, give the steel drum a certain ambiguity in pitch and its characteristic clangorous sound. And, as can be easily observed, the pitch centre is often clearer when the bosses are struck with medium force in the middle of the resonating area [4]. Yet this acoustic 'conflict' undoubtedly accounts for a significant reduction in overall amplitude and resonance. This is not necessarily a disadvantage : whilst this might seem a hindrance for the solo instruments, the fact that resonance dies quickly may help the clarity of articulation and pitch within the big ensembles[5]. Nonetheless, its clangorous sound makes the steel drum a difficult instrument to "tune" accurately in other instrumental contexts.

The lack of sustaining power has consequently determined the most characteristic - even at times stylistically indispensable - aspect of steel drum technique : the roll. Yet contrary to widespread practice and belief[6], the instrument is capable of complex melodic and rhythmic figurations. This is especially true for the highest pitched instruments, the tenor and baritone "pans" (as they are called by the initiated). Their 'sticking' area usually comprises a range of up to two and a half octaves where the distance between tones is small thus allowing rapid articulation. Nonetheless, sticking paths do present problems of hand alternation similar to those found in standard marimba and xylophone technique, depending both on the type of music and the location of the notes. The placement of resonant bosses varies quite drastically for the two main current designs : the *Invaders* and the more Westernised *Fourths and Fifths* types[7]. See the Figure 5-1 below for the tenor pans:

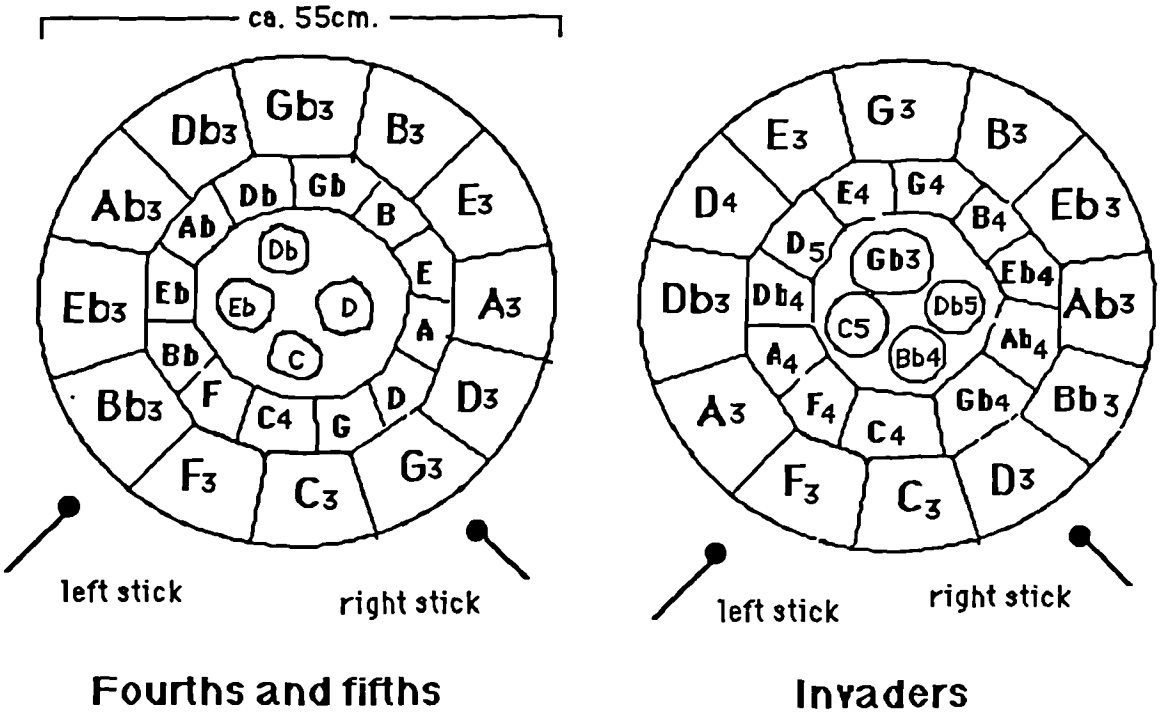


Figure 5-1: Así el Acero: Current tenor steel drum pattern designs

As can be seen from the diagram, the *Invaders* design has collections of diatonic triads at neighbouring places. See for example the F major triad starting clockwise at six o'clock or the E minor triad starting at 11 o'clock.

Other triads are formed by skipping two or three spaces to find the corresponding interval. Although the pattern is not repeated exactly for the upper octaves, the concomittant placement of functional triads is probably quite helpful for the type of mainly tonal/diatonic music played by steel drum bands. On the other hand the *Fourths and Fifths* type is more uniform, and although diatonic formations are not neighbouring, they remain at the same relative places throughout the entire range of the drum. For *Así el Acero* I used a *Fourths and Fifths* pan which Simon Limbrick had built for him in Trinidad.

5.2 Appropriating an instrumental technique

I have gone to a certain length to describe the steel drum because it is necessary to understand its design in order to ascertain the specific demands and difficulties it presents to the performer. But at the time, as a composer, I also felt I needed to clarify the instrumental implications to be able to appropriate and transcend the technique for my own expressive needs.

One aspect that struck me as extremely attractive about the steel drum's technique was the fact that, because of the small sticks and the circular shape of the instrument, the player had to move in a semicircular fashion, leaning forwards and stepping backwards to reach the notes and prepare for the following. Whilst this is also true for other large instruments eg. a percussion battery, mallet keyboards and the like, the movement required to play the steel drum is unique in its dance-like mannerisms. I found this very beautiful. So, the more I analysed the hand alternation and sticking paths, the more I felt compelled to speculate on how the ensuing movements of the player could be learnt, systematised and integrated into a musical discourse.

Therefore, I started by intuitively sketching out a simple classification of the

body movement into any combination of left, right, backward and forward, trying at the same time to determine how different musical passages played on the drum needed to be "sticked". I began by experimenting with straightforward passages, and quickly established that, with small differences depending on the musical context, sticking was nearly always alternate, which translated into very clear adjustments in the position of the player. Referring to the diagram above for the *Fourths and Fifths* pan, take for example the clockwise succession of rising fourths and falling fifths. If one were to play such a sequence in equal durations starting from middle C3 at six o'clock, it would involve a gradual forward movement to the left, the sticking pattern alternating between right and left hands and repeating all the way through to the tritone boss at 12 o'clock. Thereafter, the movement would revolve to the right, but backwards to the starting point. Obviously, the exact opposite happens in playing anti-clockwise. Another very different pattern can be observed by starting at middle C3 and playing rising minor seconds followed by falling major seconds. The path requires a circular and forward left-right-left body and arm motion.

Note that in the *Fourths and Fifths* design diatonic intervals are farther away and the hand alternation must often be broken off in order to have time to prepare the next interval. On the other hand, a chromatic scale lies well for alternate sticking because the intervals are nearly always at the same relative angle across the pan. The performer's movement in this case is mostly right/left depending on the starting point. A careful glance at the diagram will give an idea of the innumerable combinatorial possibilities specific to the design. To illustrate a further occurrence, see Figure 5-2. It shows the sticking path for the first octave of the ubiquitous C major scale. The bold arrows indicate the most likely - although irregularly alternating - sticking path. The plain arrows indicate the order of body movement direction which would be expected from the performer in relation to the drum:

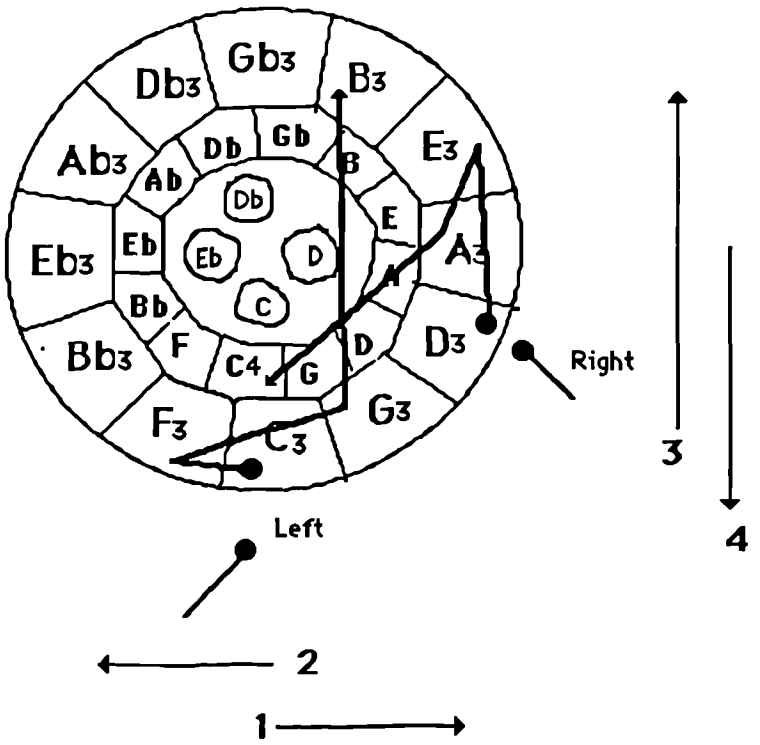
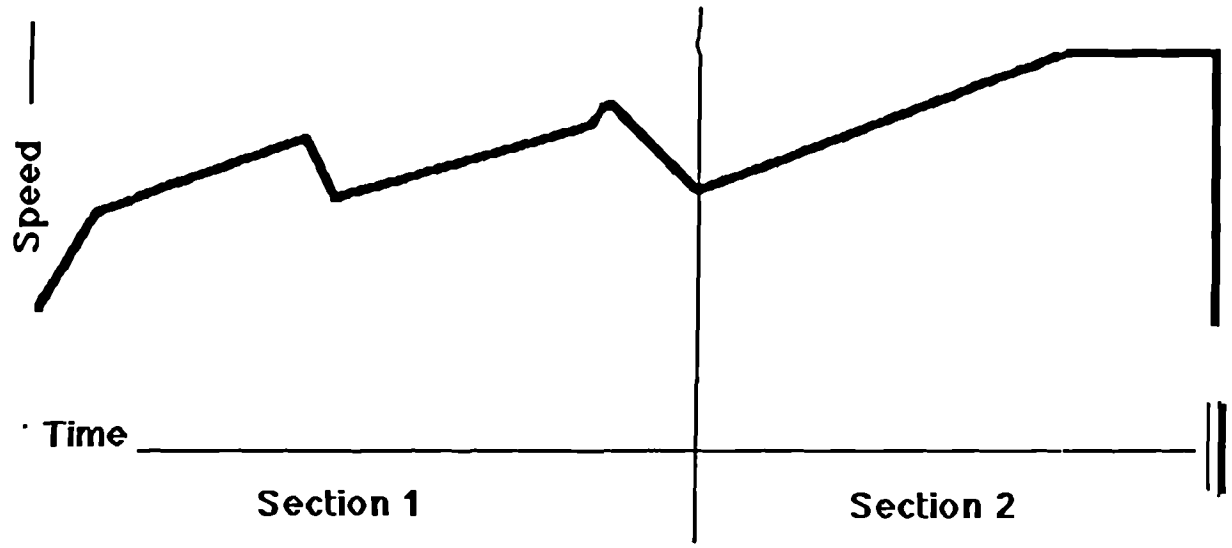


Figure 5-2:Así el Acero: Sticking pattern for a C major scale and body movement

This almost inherent ergonomical restlessness of the steel drum player was an inspiring realisation, because, however abstracted, it suggested a rich area of analysis and experimentation from which I could possibly extract a gestural vocabulary unique to the piece. But also , it suggested a more intuitive approach - plunging into one of the "unknowns" I spoke about before - to elaborate sonic material. The strength of model invited electroacoustic sound to be *casted by* instead of it *casting upon* the morphology of the instrumental intervention. As to its role, I envisaged it partaking in the piece as a pointillist aura, a kind of spatial *chiaro oscuro* in motion (more about this later). In brief, I suspected that propelling the choreographic qualities into the realm of a mixed piece could nourish the syntactical bond between the rhythmic entities I proposed to use and the dramatic delivery of the piece. I had here the chance to find a way of integrating movement and electroacoustic invention in a musical manner I had never been able to try before.

Motivated by that aspiration, I decided to approach the problem from a general point of departure and formulate a background scheme before working out the foreground details, a reversal of my previous demeanour in composing pieces involving electroacoustic sound. If movement and instrumental virtuosity were to be such important considerations, then I could compositionally hold back on the elaboration of electroacoustic materials. I went about it by originating a linear contour and rather than abstracting its formal fleshing out from extensive workings on pre-recorded material, I attempted to make all material - instrumental, gestural and electroacoustic - function within those arbitrary boundaries. I had often arrived at impulsion type of gestures, so to avoid repeating myself, I decided to venture on a more evolutive and continuous design which would somehow resemble successive breathing stirs. I imagined motion accumulating in two growing ascending attempts before a final unresolved outbreak, which would be cut off as if torn. Within this straightforward framework, both instrumental and electroacoustic sound would commence slowly, with little motion, gradually gathering momentum to reach the first and second peaks. Motion would then recommence with variations leading to the final and most active sonic and instrumental climax. To keep it simple, I divided the contour into two parts. See Figure 5-3.



Así el Acero. Figure 5-3 : Formal design scheme

5.3 Rhythmic objects and choreomusical design

With this formal scheme in mind, I would now like to go into more depth. For the sake of clarity, I will follow a slightly different order. I will first try to show how I approached the scheme in instrumental and *choreomusical* terms. Thereafter, I shall analyse how the electroacoustic material functions in its mirroring, triggering or juxtaposing of these aspects and how the two integrate.

Systematising a relation between sticking patterns and body movement was crucial to the composition of the work because it allowed me to predetermine an ideal unifying device at several structural levels. First of all, I knew from my experience in dance that the discursive strength of movement paired to music tightens the comprehension of a *formal* scheme in performance, imbuing the *when* and *where* of successive musical events with dramatic poise. But, on the other hand, I was not so sure that, stylistically, the method could serve to give the piece the virtuosic character I wanted nor how to achieve a sense of continuous unfolding, where even the smaller musical ideas, the sound objects could be clearly "reflected" by gesture. Could this framework be made operative at a micro-structural level?

I have explained before in this thesis how I had abstracted a syntax based on rhythmic objects through experimenting with pre-recorded and other electroacoustic resources. I shall dwell on that now from a slightly different perspective. Designing sound objects for *Así el Acero* had more to do with the manner in which they would be executed, rather than on establishing an initial morphological connection with pre-recorded or synthetic objects. As in the case with other pieces discussed previously, procedures such as simple or additive repetition, isoperiodicity, juxtaposition of pulses and harmonic rhythms were also used here[8], but these were employed later on in the

composition process. Due to the instrumental origin in its genesis, designing objects which would become gesturally characteristic in *Así el Acero* involved in most instances a deliberate study and challenge of the conventions of the steel drum's most accepted idioms. Consequently, bearing in mind the pan's specific layout, the apportionment of melodic and rhythmic attributes to objects became of paramount significance. As might be clear from previous examples, the instrumental implication of the *rhythmic* features was a very important factor, but, in deeper analysis, it became clear that it was more a question of the *melodic* behaviour of the objects - just how the patterns lay on the drum - that would achieve the gestural coherence I was aiming for and that would determine my final choices. By careful combination of these critical features, I hoped to project in the actual performance the integration of what I have referred to as a *choreomusical* design. Let us now examine the procedure starting with a typical rhythmic pattern (Figure 5-4).

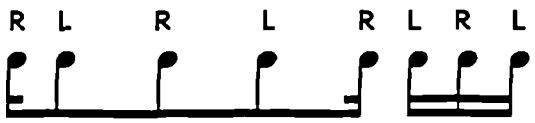
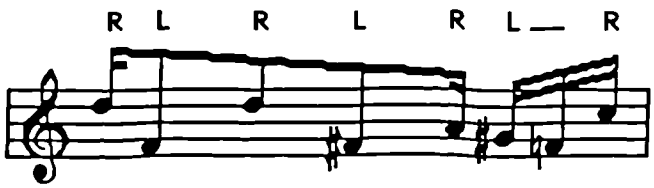


Figure 5-3 : Así el Acero : Rhythmic pattern

By itself, played on any given single pitch, the object does not require any extraordinary gesture. Once the player is in position, it suffices to use alternate sticking to play it, as shown above. But as soon as different pitches are assigned to the object, the player needs to adjust the sticking and move around the drum accordingly :



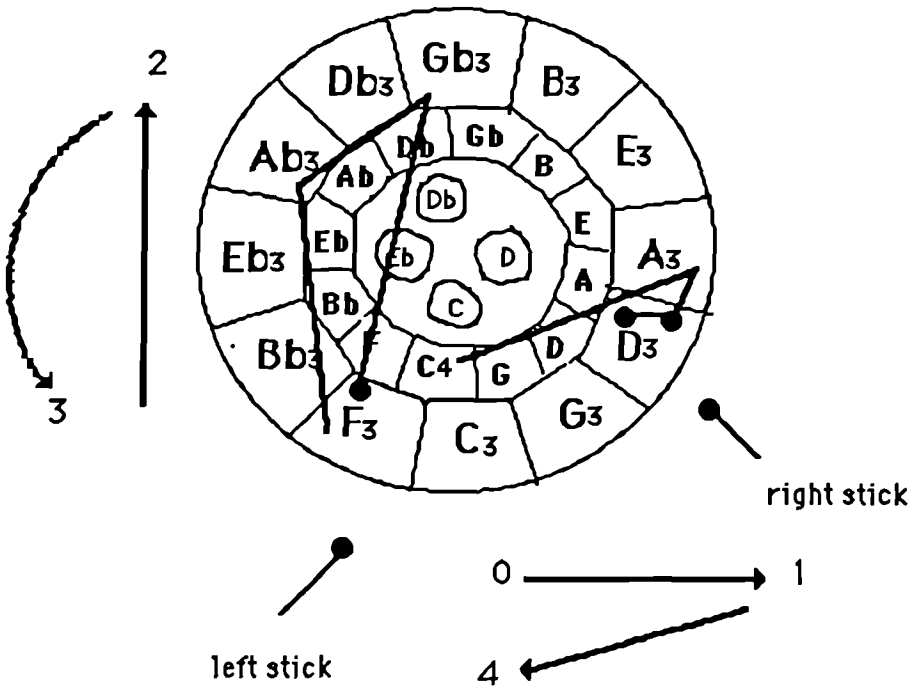


Figure 5-5: Así el Acero : Sticking paths and player's movement for a typical object

The overall durations of the movement can then be mapped out from the object (Figure 5-5).

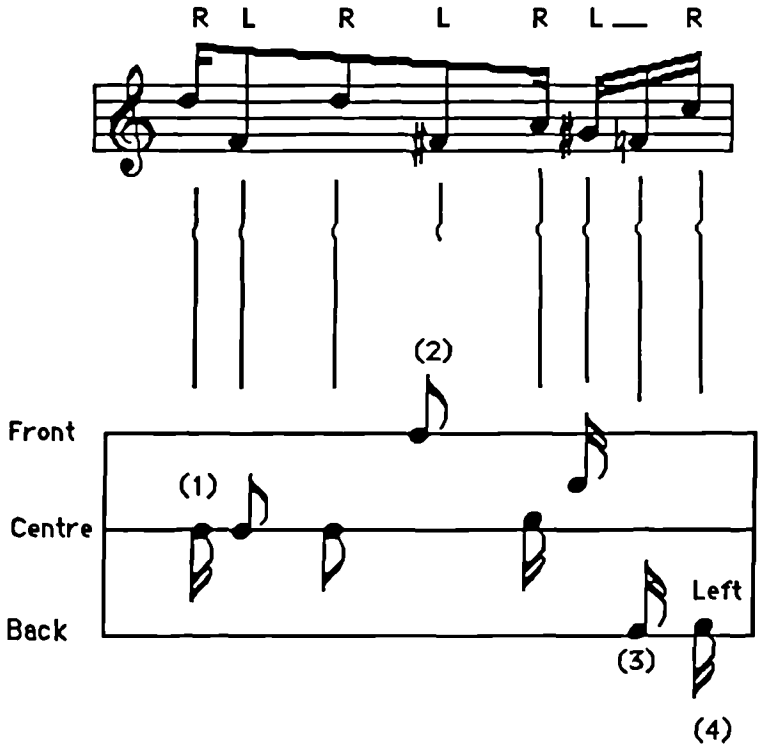
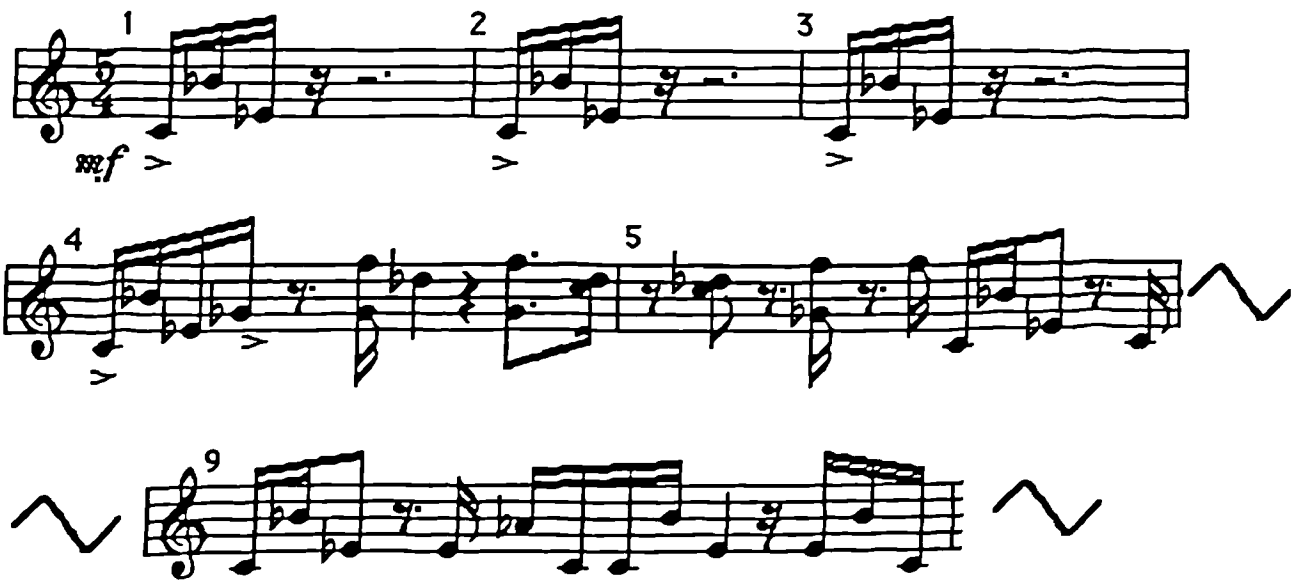


Figure 5-6: Así el Acero : Mapping out of player's movements.

Arguably, to translate the player's displacement is not particularly relevant, primarily because nearly all notation lacks the necessary logographic depth to express actual spatial dimensions[9]. But recording movement - even as approximately as that - was compositionally very useful. Mainly, it made it possible to conceptualise with a certain consistency the *gestural* rhythmic patterns that emerged from the intertwining of the melodic and rhythmic rationale. But in a wider sense, transcription made it feasible to systematically relate gesture to structure-bearing harmonic progression. Take for instance the opening 20 bars, which were amongst my first successful attempts at integrating the predicate. In this passage, movement hinges on the gradual drift between two *states.* The opening state begins with leftward gestures through a repeating rhythmic object made out of three neighbouring pitches (C3, Bb3, Eb3) of a dorian mode on Eb. This transforms very slowly, increasing in speed and eliciting a forward motion in the player, by introducing Gb3, F4 and Db3 and the more distant Ab3 a little later (bar 9) . Towards the end of the passage (bar 15) , D4, a foreign pitch to the mode is introduced, impelling the player to alternately move between left and right. The peak of the section retains the sideways motion, as the gradual enhancement of the opening motif gains cadential poignancy from newer pitches. (Figure 5-7).



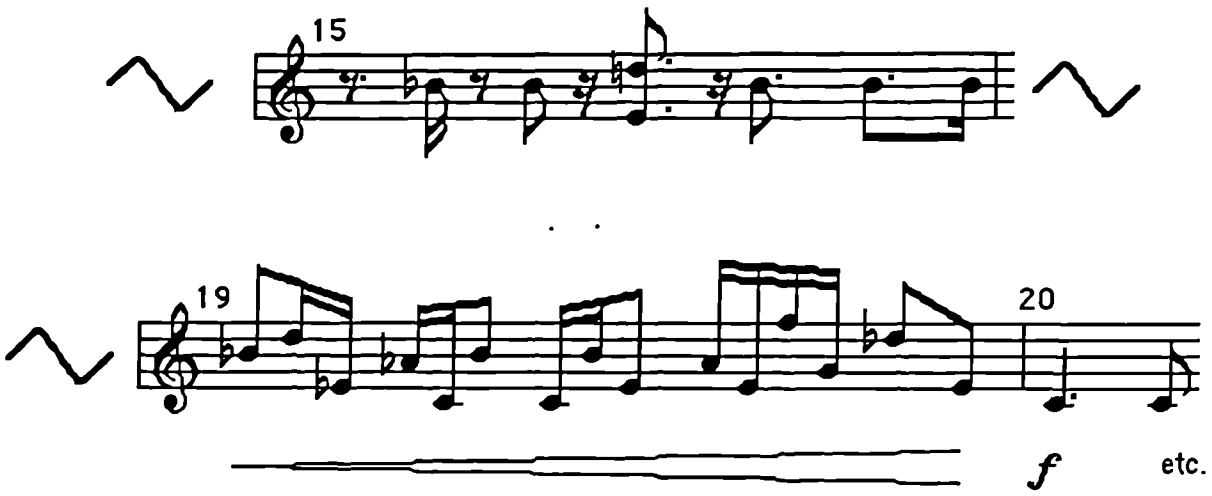


Figure 5-7: Así el Acero : Bars 1-20- choice of pitches according to gesture

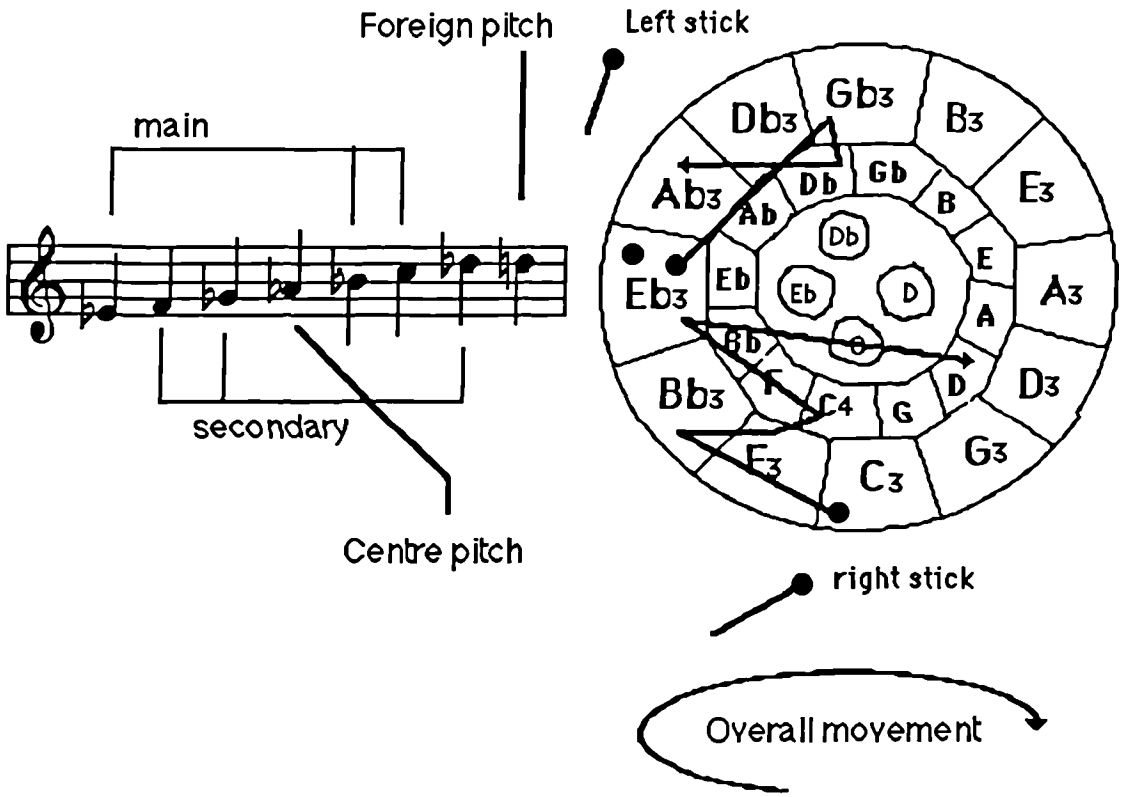


Figure 5-8 : Así el Acero : Melodic basis and sticking/ movement direction. Bars 1-20

As may hopefully be seen from Figure 5-8, the intertwining of the gradual crescendo with a motivical, harmonic and gestural expansion provides a perceptual and visual coherence to the passage which I believe is formally unequivocal.

Because I could now identify and represent the emerging *gestural* patterns in relation to harmonic design, I decided to attempt the opposite approach. I would formulate a gestural idea first, transcribe it into a rhythmic pattern, and only then design the melodic features of the objects. As long as the rhythmic exchanges (left-right-front or back) of the movement were allowed enough time to happen (ie. in not less than a semiquaver at ♩ =120pm) or did not counter the syncopated feel of the music, a certain degree of variation was possible. Take the following mnemonic representation as a departure. (Figure 5-9):

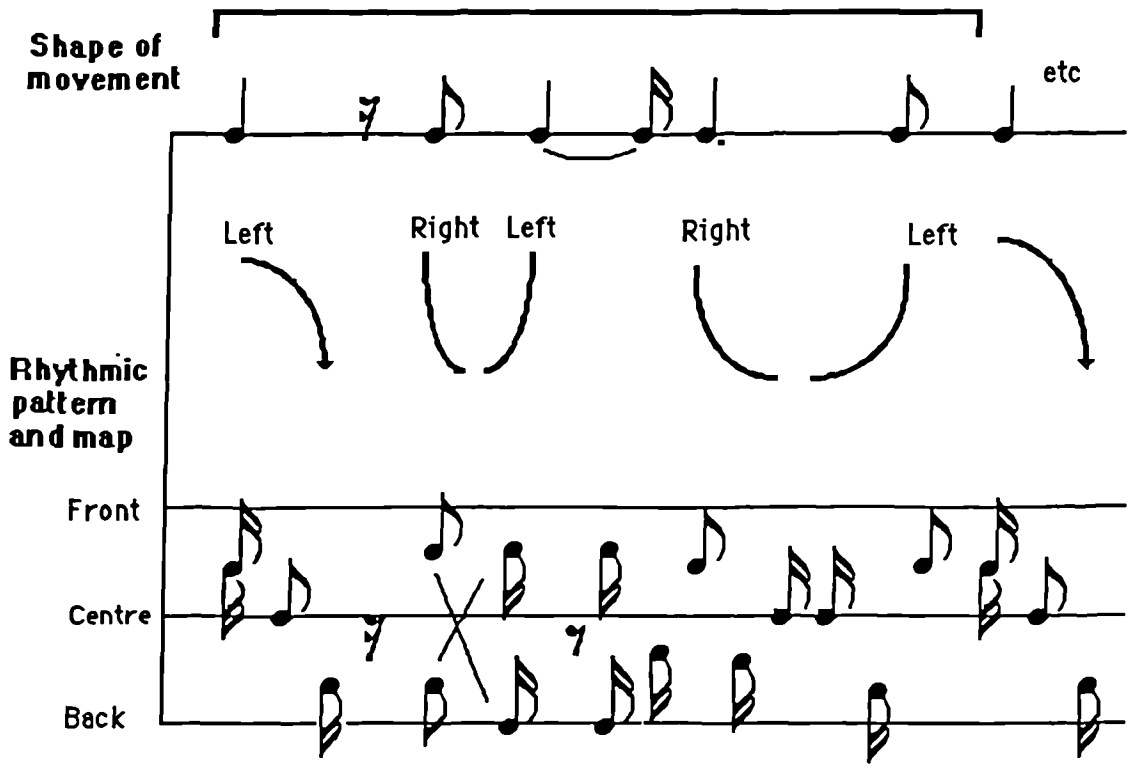


Figure 5-9: Así el Acero : Representation of a gesture

The main characteristics of such a gesture are the right-left shifts which happen after the initial leftward movement. I firstly allotted quite intuitively a durational value to each part of the movement. These were then subdivided (into not more than units of a semiquaver) to originate a rhythmic pattern. Subdivisions were necessary so left and right stickings could be assigned to them and generate in performance an arm/ body displacement mirroring the

form of the original. Thereafter, through trial and error on the drum, adequate pitches were selected, and a final melodic realisation, corresponding fairly accurately to the gesture was arrived at. The choice of pitches responded to the harmonic necessities at that particular point in the piece, but the method would still produce interesting rhythmic results even when pitches were chosen arbitrarily. Indeed, other pitches could also have been possible as long as their location in the drum satisfied the required direction of movement. Here is a small illustration of the solution to the gestural idea above, which was employed as the basis for the end of the first section (bar 111 to 125):

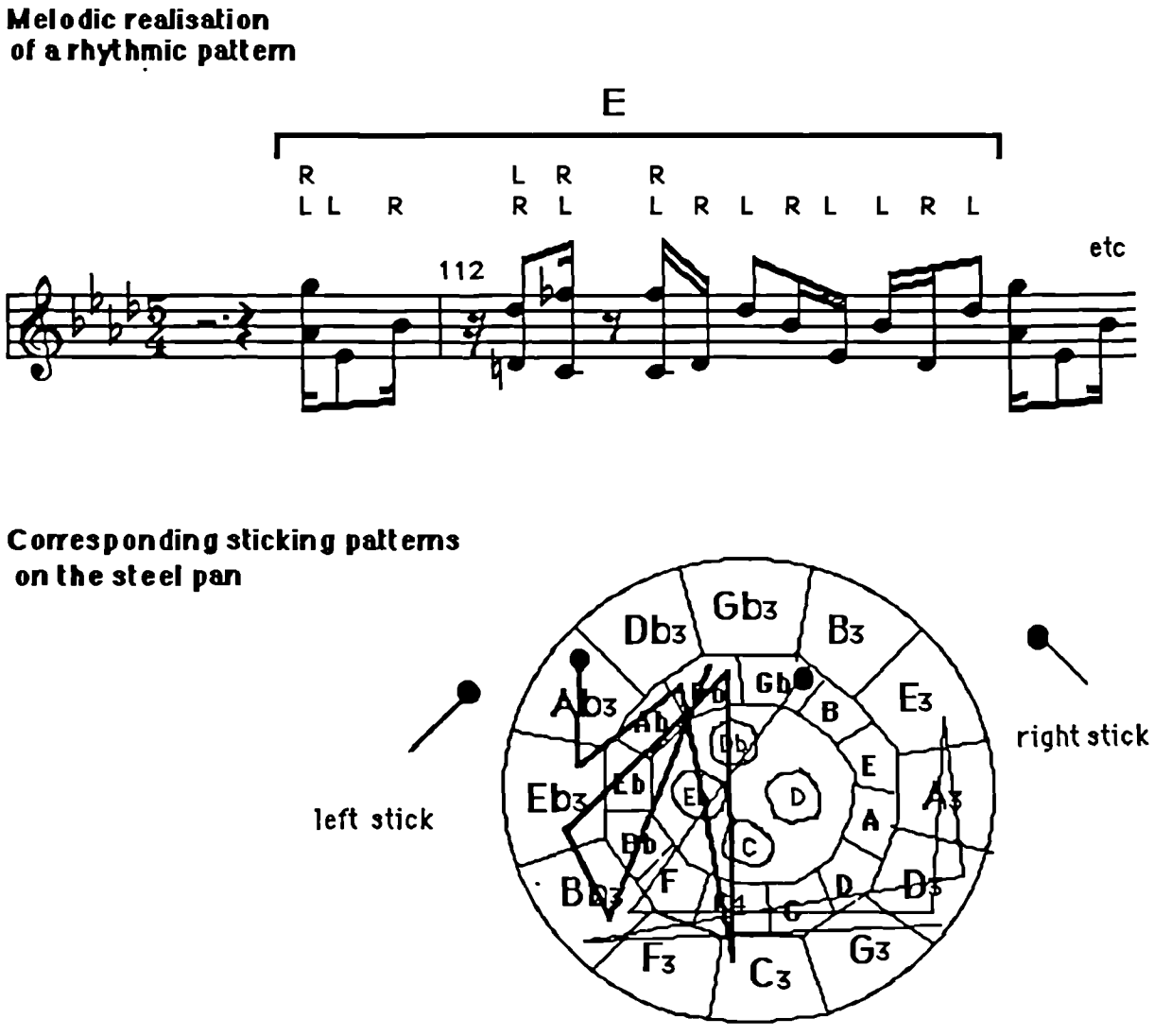


Figure 5-10 : Así el Acero : Melodic realisation from gesture/ rhythmic object

It interesting to note that when a pattern such as E in Figure 5-9 above is repeated, the full benefit of the process comes alive: music and movement are visibly bound. But even when the pattern is not repeated literally, either because other neighbouring pitches intervene, or the pattern is slightly displaced by a rest or an altered duration, the overall shape of the player's displacement remains basically the same. This flexibility encouraged me to approach both gesture and patterning more intuitively and focus on the *contrapuntal* relation between them over longer spans of music, as if I was sketching out independent lines of dance and music. I shall come back to this.

5.4 The elaboration of electroacoustic materials

So far we have discussed the appropriation of steel drum technique and its gestural consequences in the structuring processes of *Así el Acero*. There are however, a number of related aspects which can not be meditated upon in such abstracted terms because they stem directly from the actual sonic construction of the piece. These of course refer to the elaboration of electroacoustic sound materials which -although simultaneous to experimentation with the steel drum, require a separate discussion.

As I mentioned at the beginning of this chapter, *Así el Acero* was to include a computer controlling a synthesiser and a sampler. These hardware requirements seemed a constraint, specially because the synthesiser, a 4 operator FM Yamaha TX81Z offered little in the way of polyphonic capabilities[10]. (Later in the composition process, surmounting this limitation generated a very useful technique through the *alternate performance* mode - see below). The sampler, a 12 bit Akai S900 was however fairly powerful and initially provided good means to create a model of a steel drum with which many of the ideas discussed here were tried out before committing them to the player.

My sound sources included mainly note-type sounds recorded from the steel drum, sounds from a *shekeré* or *acbé*, a wooden idiophone of African origin[11] and longer swelling type sounds created on the *Chant* programming environment by my colleague Ian Dearden[12]. All of these were sampled at maximum resolution and programmed as independent Midi controllable instruments.

My first inclination was to use short steel drum sounds to extend the resonance of the live drum by means of iteration and granular synthesis. I could then employ the longer *Chant* sounds together with the sustaining capability of the synthesiser to bond the instrumental and electroacoustic sound. I thought that - given the possibility of creating similar inharmonic spectra to those of the steel drum on the FM synthesiser - this would be a straightforward operation. I soon became aware that this was no easy task, as the clangorous behaviour of the steel drum's sound was too unpredictable to be modelled with such primitive sound resources, the more so as its spectral quality is totally dependent on the manner in which it is struck. The decisive point came when, in analysing the drum's various sonic possibilities, I stumbled on the gestural consequences of its sticking technique which I have examined in some detail above. This suggested a change of tack and - as I described before - a compositional *a posteriori* : rather than to mould the resonance from the inside (as I believe a sonic extension does), the electroacoustic sound should act as an exogenous sonic *aura* , shrouding or unveiling the contours of instrumental and gestural motion. But, I was unsure where to start tackling this goal.

5.5 Electroacoustic materials: integration strategies

I mentioned before the contrapuntal bracing of harmonic and rhythmic progression *vis a vis* instrumental gesture. I would now like to discuss the

strategies used to integrate the electroacoustic materials with the live instrument. One of the most important strategic considerations came from the spatial nature of movement itself. It seemed to me that a spatial interplay akin to the player's movement could be set in motion through the careful placement of electroacoustic sounds within the stereo field. At any rate, the resources at my disposal were well suited to this approach.

(i) **Sideways motion and panning in the stereo field.** As I was interested in shadowing the player's movement in the electroacoustic part by opposing, rather than imitating the sounds of the steel pan, I experimented with sounds on the TX81Z which could work with a facility termed *alternate performance mode* [13]. I was particularly looking for sounds that would resemble a kind of lustre "snare" and which would blend well with the live drum and the shekeré sounds played by the sampler. I thus designed a group of inharmonic sounds with fuzzy attacks, short decays, and with a considerable amount of noise on the sustain portion, close in coloration to the low partials of the drum's shell.

Uncanningly similar to the sticking patterns on the steel drum, the *alternate performance* mode allowed me to paraphrase the player's movement in the stereophonic field (as well as to overcome the polyphonic limitation of the machine). For instance, by assigning the sound to a "patch" which would send it 4 times to the right and 4 to the left, a fast iteration of the same midi note would produce a right to left shimmering movement. By having a number of patches with all the possible LR alternating distributions (from 1 and 7 to 7 and 1) it was possible, by recalling them at the appropriate moment, to create shifting movement "auras" around the player and the musical gestures. (Figure 5-11)

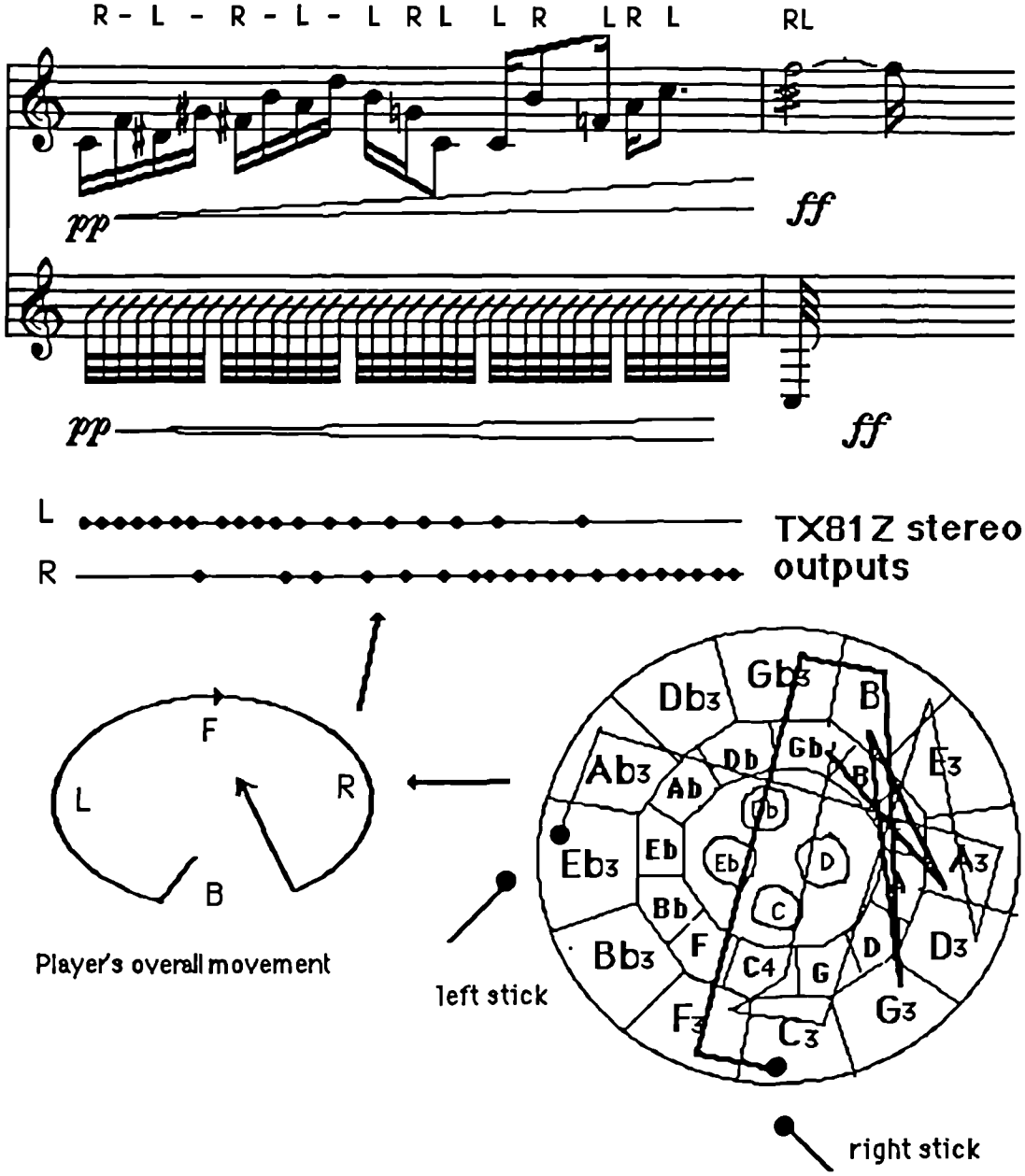


Figure 5-11 : Así el Acero : Left to right movement mirrored by the synthesiser

(ii) **Centering the image.** The Akai S900, basically a monophonic sampling device could, on the other hand, provide a more pointillistic sound conglomerate made out of sampled steel drum sounds which were, in any case, timbrally and perceptually closer to the live instrument. These sounds were used in an opposite way to those on the synthesiser, ie. to "tighten" the central part of the stereo image and to encourage the tape to cohere acoustically with the live drum. On the other hand I sampled Ian Dearden's sounds in "false stereo"[14]. As these were extremely inharmonic but had a

strong centrifugal morphology , they were used to incite outward sonic travel and to bond the sounds in the centre to the synthetic ones moving to left and right.

(iii) **Shadow playing.** I termed *shadow playing* the doubling of the live steel drum by the same pitches with steel drum sampled sounds. The doubling was very sparse and fairly random, although I kept it where it coincided with the weaker notes on the live instrument. As these were located at random in the stereo image, slight phase and spatial differences between the two created an interesting glittering illusion which reminded me of a shadow. Another related technique was to double, this time with synthetic metallic sounds, the lowest notes in the drum, creating slower pace lines which hocketed with the lines on the steel drum. This was mainly used as a colouring device to help the crescendi passages in the piece, as in the last section.

(iv) **Kick**. This technique was used to integrate the live instrument with the tape and consisted in selecting a particular rhythmic motive or a metrical wave from the steel drum line and bringing it to the foreground by repetition, forcing it to pulsate against the steel drum. This was used in transition passages and was usually done with low *shekeré* single impulsions or continuous sounds created by iteration. This provided what I have termed "kick" or "off the beat" rhythmic stimuli to the player.

5.6 Final considerations.

As mentioned in the beginning of this dissertation, a symbolic equivalence between sound and physical movement may be drawn because it rests comfortably on our experience of movement as producer of noise and generator of rhythm. In *Así el Acero* one of the biggest challenges was to compose a piece for an instrument which I hardly knew and which I had to learn as I composed the piece. In doing so I came across the possibility of integrating my perception of movement as in dance to the compositional process. Throughout this chapter, I have discussed the musical results of this strategy. Yet, in many respects the strategy *is* the work. In other words, the relation between the conception and the realisation of the work is only truly unified in performance by its choreomusical profiles. It is towards the compositional potentiates of performance that *Así el Acero* points.

Footnotes on Chapter 5

[1] The final version was realised on tape but the work has been performed many times using the originally proposed set-up, ie. computer sequencer controlling a sampler and a synthesiser.

[2] See Hayward's comments on this subject in her recent handbook (Hayward,1993:3)

[3] According to the musicologist Fernando Ortiz, by 1940 the Trinidadian bands consisted of a collection of heterogeneous steel and metal artefacts, amongst which the steel drum or "ping-pong" was the most celebrated . He suggests that by 1950 (the time of his writing) steel drums were already being tuned and bands made exclusively of steel drums were becoming the rule (Ortiz 1950: 440-442)

[4]My observation after experience is that the isolation between the hammered bosses and the main body of the instrument is usually uneven, which disperses and dampens some of the most powerful discrete frequencies in favour of (undampened) inharmonic components, particularly when excited with greater force.

[5]I am indebted to steel drum specialist Richard Murphy for pointing this out to me.

[6]See for example Behague's whimsical notes (Behague1963:212)

[7] There exists a further design called the *Desperado* model, which is a variation on the *Invaders* design. This type has been widely promoted in the USA, through the emergence of steel drum virtuosi such as the composer -performer Andy Narrel. In the UK at least for the last twenty years, independent bands and schools have mainly favoured the *Fourths and Fifths* type.

[8] Refer to Chapters 2 and 3 for a detailed explanation of these procedures.

[9] The problems of notation in dance are a typical case. See for example Laban notation.

[10]The Yamaha TX81Z is a second generation (12 bit) frequency modulation synthesiser, consisting of 4 oscillators grouped in any of 8 preset algorithms. As with other FM synthesisers, several aspects of the algorithm and envelope generators could be made sensitive to velocity or other midi controllers. The TX81Z's software architecture included "performance" patches where the single sounds could be grouped and assigned to respond to different midi channels, transposed and balanced. It includes a tiny signal processing chip capable of producing short delays. The instrument' s total polyphony was eight simultaneous sounds.

[11]The *shekeré* or *acbé* is an African idiophone now widely found in Cuba and Brazil which consists of a large gourd , the size of a football, which is covered with a net of beads and has an opening on the top area. It is played by a combinations of throws, hits and shakes.

[12]The *Chant* programming environment was developed by Xavier Rodet, Yves Potard and Jean-Baptiste Barrière based on the model of a vocal tract and the production of vocal sounds. Refer to Rodet, Yves Potard and Jean-Baptiste Barrière (198:15-32).

[13]Using this mode the synthesiser sends the audio signal alternatively to the left or right outputs every time it receives a midi note-on command for a total of four reiterations to each side. This can normally be controlled by assigning sounds to a left or right output, while triggering them independently via separate midi channels. However, in alternate performance mode the synthesiser handles less Midi data to a similar effect and program changes are avoided.

[14] Obtained by sampling separately the left and right sides of a stereo signal and placing them as close as possible on corresponding left-right memory slots assigned to the same midi channel. Although inaccuracies in phase were inevitable, an approximated stereo image was possible.

Chapter 6 Mannam
Composition of confluences

6.1 Background

Like its predecessor *Papalotl* for piano and tape, *Mannam* was the second of a pair of works composed for the same combination: a Korean 12 string zither, the kayagum, and electroacoustic sounds on tape. The work was composed during the winter of 1991-1992 on a commission from the Group de Musique Expérimentale de Bourges in France[1] to be premiered at the 1992 Synthèse Festival in Bourges, with Inok Paek playing the kayagum.

As discussed previously, the composition of a work which involves a soloistic instrument presents, at first light, certain dilemmas with regards to the conceptualisation of the instrument's contribution to the work. These dilemmas are particularly familiar to composers working with electroacoustic means, where sound materials, of an instrumental source or otherwise, can be made to acquire ambivalent discursive roles ranging from the purely abstract to the mimetic and anecdotal. At one extreme of the many choices available to the composer seeking to integrate a "live" instrument with electroacoustic sounds, is the possibility of entirely eluding pre-conceived idioms and thus attempting to propitiate an enticing combination in instrumentally "unorthodox" ways [2]. At the other extreme, the strategic choice may consist in appropriating an already known or more conventional instrumental technique and to impose it on the non-instrumental sounds[3]. Whichever the stance taken may be, a balance between instrument and electroacoustic sounds nevertheless depends on the composer's insight to establish coherent dynamic, morphological, timbral and rhythmic hierarchies, unless certain perceptual ambiguities - as those pointed out before with respect to controllers[4] are consciously intended to be part of the musical discourse.

The reason I bring up these generalities is to place in a wider context the fact that, in composing for an instrument and a tape , the composer is ultimately inventing *the interaction* between an instrumentalist and electroacoustic sounds and not that of a "set of fingers" with a machine. In composing music for the steel drum in *Así el Acero* , that simple truth elbowed me in the direction of a compositional strategy based on the movement necessities of the player. The approach was sufficiently general to prompt the creation of a genuinely imaginary relational context but sufficiently narrow to prevent a puerile and unidiomatic use of the instrument.

In the case of *Mannam* , the development of a global relational strategy was less direct, in the first instance, because of my lack of a pre-compositional familiarity with the kayagum. But on the other hand, and perhaps more significantly, because of the slow process of grasping the deeper æsthetic and musical archetypes which impregnated the performer's perception and performance of music in general, and to which her instrumental *métier* is associated. Although a discussion of such cultural conditionings is beyond the scope of this writing, I shall touch upon some of these through the analysis of the work. However, my first contention here is that collaborating with an Eastern musician played an influential role in my appreciation of the deeper idiomaticisms of the instrument and therefore in the choices of sound sources and integration strategies which I took during the composition process of *Mannam.* This resulted in a preliminary work, a description of which may help to illustrate this evolution.

This first piece, entitled *Gateless Gate* , was composed the previous year. Briefly, in that work I explored the kayagum as a melodic instrument soaring across mainly percussive material on tape. I based this approach on the assumption that this would provide the player with an open and somewhat familiar environment in which she could ornament the instrumental lines in a

manner akin to Korean melodic thinking. However, I found out that my proposal restricted the player, who tended to lose her place without recovery. This, I found in later analysis, was because the material on tape was not rhythmically cohesive enough to elicit a natural sense of breath and global phrasing, especially as the lines became increasingly melodically complex. In addition, the timbral and morphological connection between the instrument - based on a mixture of drum and string-like sounds - was not gestural enough to imprint a sense of harmonic evolution which might have compensated for the lack of rhythmic interaction. Through this first experiment I came to realise two important points. Firstly, with regards to the player, that the key lay in the structure of phrases, specifically that intervallically narrower but larger-breath phrases would possibly allow the player to propose abundant ornamentation and to grasp the larger harmonic boundaries better. Secondly, with regards to its integration with the tape, I determined that a good balance should not depend so much in "hollowing" the acoustic space on tape for the instrument to resonate on its own, but rather on the composition of supporting and *continuant* gestures to the instrument which (apart from extending the resonance itself) could imprint a sense of dramatic poise and rhythmic progression to the phrases.

In view of these preliminary inferences, I decided to approach the connection between instrument and tape in *Mannam* as it were, from the "outside" , as if I were establishing contexts for the kayagum, rather than impose materials alongside each other. I imagined a hypothetical scenario whereby I could have two different styles of music interacting by juxtaposition and / or progression. Not meaning to imply that I sought to literally compose "quasi-Korean" or "quasi-Mexican" sounding fragments, I nevertheless wanted to make an appeal to musics familiar to both of us. I thus sought a kind of cross-cultural psychological framework to assist me in producing music towards which both the instrumentalist as the performer and I as the composer would

feel a certain degree of rhythmic identification with and to which we could both respond in a natural, intuitive manner. Hence the title *Mannam* (which can be literally translated as "encounter") was chosen. Before I embark on an analysis of this strategy I would like to make a brief parenthesis and present a description of the kayagum.

6.2 The Kayagum

According to ethnomusicologist Keith Howard, zithers in Korea can be traced as far back as the 3rd century. The kayagum is thought to have been developed around the end of the 5th century as reported on the historical treatise *San-kuo Chih* (The History of Three Kingdoms) by Chen Shou (ca. 297 AD), where a reference is made to a legendary set of pieces written for the instrument. However, the earliest manuscripts found have been traced to the end of the 15th century. (Howard 1988).

The instrument used in *Mannam* is the smaller of two kayagum types : the *Sanjo Kayagum* , nowadays one of the most well-known and popular Korean instruments. Like its bigger relative the *chongak kayagum* used in court music, it is a plucked 12 string zither with movable wooden bridges. Its convex body is a rectangular shaped box made of a combination of hard woods: pawulownia for the top and sandalwood for the sides, back and lower ends. The strings are made from raw wound silk and run from small tuning pegs located at the top end alongside the sound board, over a low fixed bridge and across the individual movable bridges, and finishing on looped cords attached to the lower "horn shaped" end of the instrument. Additional string is kept elegantly in coils tucked behind each cord loop. Openings in the back act as sound holes. See Figure 6-1 below:

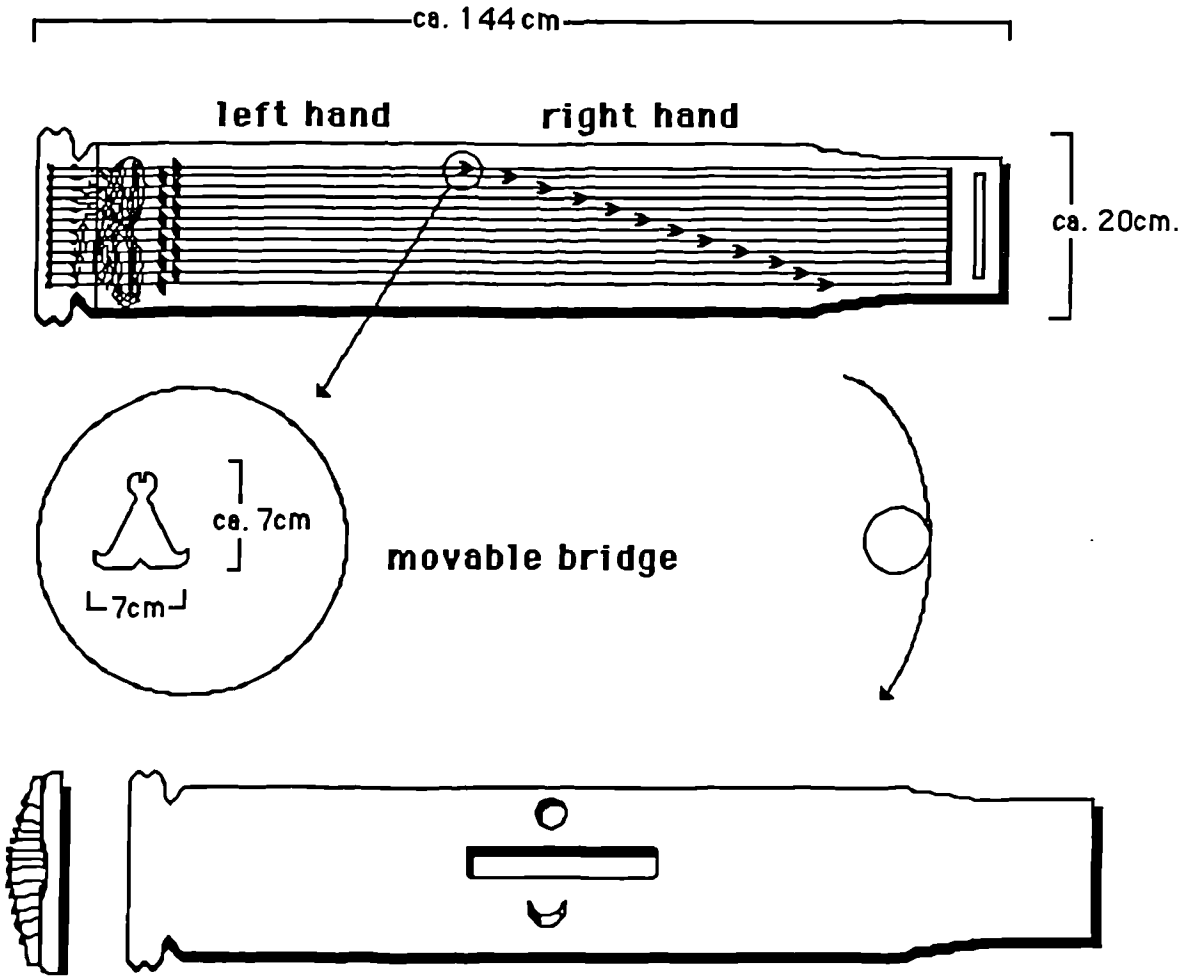


Figure 6-1 : Mannam : The *Sanjo* Kayagum

The kayagum is played sitting cross-legged on the floor. It is placed over both knees, with the horn shaped lower end slanted to the right. The right hand plucks a string between the top and the movable bridge, the left hand presses on the string at the other side of the bridge. There are a number of basic right hand plucking techniques which also include the use of a quick flicking finger movement. Left hand ornamentation techniques range from sharp lowering or raising the pitch of the plucked string to altogether slower bends and vibrato. The strings can be tuned by either (i) changing the position of the movable bridges along the sound board, (ii) by pressing on the lower end of the string or by (iii) means of the tuning pegs. Several kayagum tuning systems are currently in existence and are chosen according to use and type of music (ie.

court and popular styles). The exact intervals of Korean tuning systems in general do not correspond to the Western concept of temperament. However, in transcription to Western notation the different tuning systems for the kayagum can be broadly regarded as displacements of a standard pentatonic ordering starting at a pre-selected but variable pitch level (usually somewhere around D_2 or Eb_2) [5].

The tuning system used in *Mannam* was the so called *Sanjo* (scattered melodies-popular style) mode starting on D_2 . I adopted this tuning partly for convenience in transcription but also because it was the tuning employed in much of the pre-recorded source material. I wanted to keep a certain consistency, mostly for reference when dealing with sampled sounds. The mode is transcribed below:

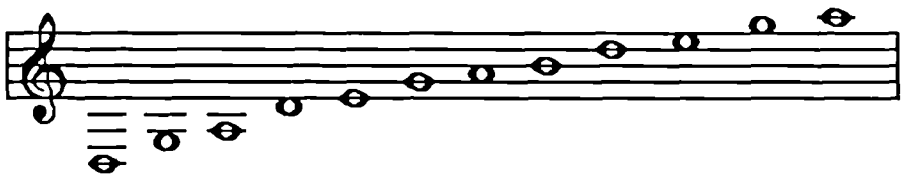


Figure 6-2: Mannam: *Sanjo* tuning used in Mannam.

6.3 Developing a formal strategy: confluence

As said before I had formulated the idea of a "two sided" superstructural directive. With this as an embryonic notion , I started to examine firstly what should characterise the two different types of material on the kayagum and secondly, the ways in which I could string together and organise two opposing musical archetypes in order to establish the interaction between instrument and tape.

Although I had gathered certain documentary experience with regards to the question of melodic structure, my first consideration focused on the strong emphasis that the instrumentalist put on the melodic element of her playing.

Inok Paek's perception of phrase structure was rooted on what I can only describe as a sense of a melodic "arch" , by which a melody would be deemed to be complete when returning to the initial tone where it has started, or to any of the other tones of the mode considered important[6]. On the other hand, passages containing distant or chromatic intervals, as in the first piece, made difficult this discernment, whilst those with stepwise motion favoured comprehension. In a similar manner, now in terms of rhythm, her perception of a natural phrase length was constantly related to breath lengths rather than exact measured units. Within this arch concept lay an extremely intuitive and yet consistent manner of ornamentation where by the player would associate pitch inflections with the overall direction of the fragment. Some of her favourite ornaments in cadences, for instance, consisted in raising the pitch towards the penultimate note and lowering the pitch to reach the last note of the melody. These gestures were assumed necessary for the cadential sense to be, according to her, æsthetically "correct". Other similar instances consisted of tying together two successive rising notes in the middle of a phrase, causing a pitch inflection in the direction of the interval, instead of articulating separate ornaments. To summarise, the interest seemed to reside in those aspects of the melody that were ephemeral.

As a composer, I make these comments with due caution; they are after all, only my perception of Inok Paek's musicality. However, at the time of composition, it seemed evident that I should incorporate these considerations into my train of compositional thought in order to produce structures that would lend themselves to spontaneous ornamentation by the player. I hoped that through this approach I would also be able to satisfy my scheme and generate characteristic material for one of the contrasting types of music, sections which I shall refer hereafter to as the "melodic" strands.

In order to predict some of these melodic inflections, I experimented as follows. First I composed relatively short and stepwise moving fragments and presented them to the player. She would then try them out on the spot , offering different possibilities of phrasing and ornamental realisation. Any necessary adjustments and revisions were done by trial and error. I took copious notes so I could systematise the models and compose larger structures in my own time, relating them then to the design and intervention of electroacoustic materials (see below). Example 6-1 shows one of such fragments as composed together with a transcription of the final result. Ornaments have been realised for the purpose of illustration, but were indicated in the score only in conventional kayagum mnemonics.

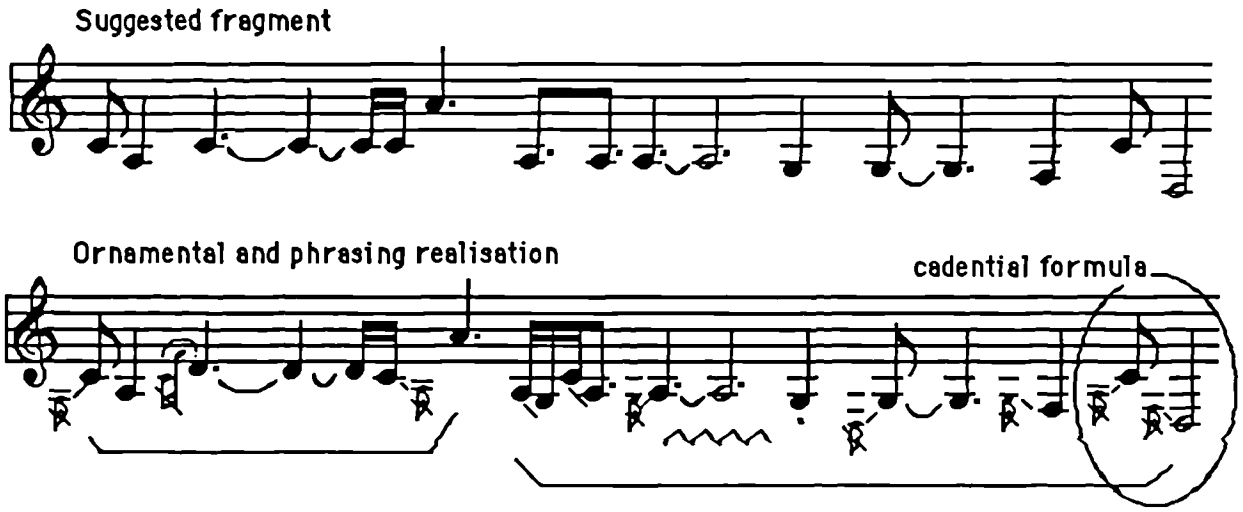


Figure 6-3: Mannam : Ornamental and phrasing realisation of a suggested fragment

By opposition to this type, I envisaged music that would not rely on my surmise of Inok Paek's æsthetic disposition and instrumental suggestions. I wanted a different instrumental texture that could be used in blocks. My solution was to come up with strands for the kayagum that were mainly constituted of chords , a strategy which would require a manner of playing more akin to my own appreciation and understanding of the potential of a plucked instrument, as in, for instance, *Acuerdos por Diferencia.* By this understanding, I mean in a first sense, such types of gesture that could carry structural weight more in vertical

terms, that is, by implying wider intervallic movement and harmonic motion and shape not related to pre-determined melodic contours, but to rhythmic reiterations. On the other hand, this could help to propitiate a denser acoustical mass by the additional string resonance and stronger attacks. This approach may have seemed somehow unidiomatic and brazen in conventional kayagum terms, but it nevertheless fitted comfortably with my idea of opposing it to the melodic strands on the basis of their contrasting textures. Figure 6-4 below:

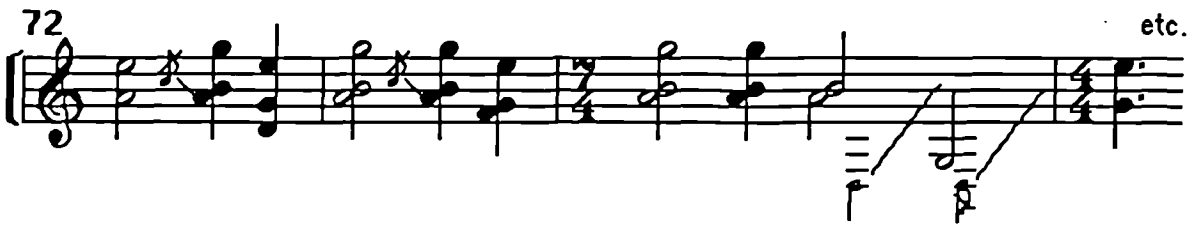


Figure 6-4: Mannam: Kayagum chordal material bars 72-74

I have so far been discussing music pertaining to the kayagum part because it was from it that I had established these two contrasting poles. However, my strategy contemplated the creation of material which mediated between the two, and this was the formal role that the electroacoustic material was to provide. Through it, I expected to generate movement and directionality in the piece as a whole.

I had noticed in the first piece a lack of rhythmic acuteness, which was due in the first place to the phrase construction, but also to a lack of a coherent gestural vocabulary on tape that would provide clear rhythmic stimuli to the player. I remarked in particular that Inok Paek responded inaccurately when agogic (length related) accents predominated . As soon as there were sounds or silences that could be interpreted as syncopated stresses, she would quickly regain her balance. Being very interested by the force of motion of syncopation myself, I decided to start investigating Korean rhythmic patterns.

Given the sheer enormity of the task, I focused on a number of available *changgo* (hourglass shaped drum) rhythmic patterns and cycles , which I recorded and analysed [7].

It is not the place here to describe what is already well documented[8]. However, one of the aspects I found most inspiring in *Changgo* rhythmic cycles was the way in which short phrase patterns (*karak)* are generated by accentuation and stress variations, creating pattern motivic sub-groups within the cycle. I was particularly struck by the variations to the underlying pattern at cadences, where the ternary metric wave is expertly contracted into *hemiolas* , creating a sensation of urgency and acceleration. See below:

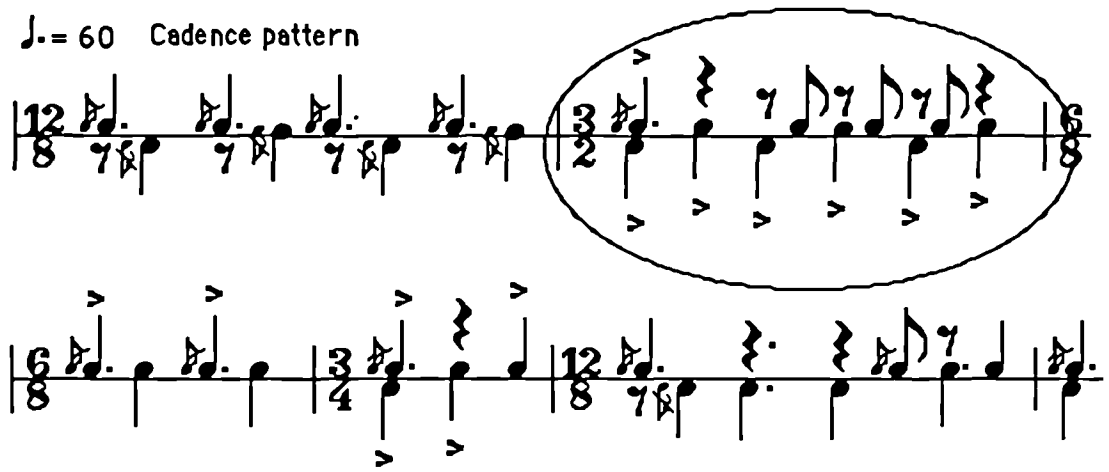


Figure 6-5: Mannam : Korean *Changgo* Cadencial pattern from *Sol Changgo Nori - Kutkori* section (as transcribed by Howard 1988. p 162)

I was happily surprised to find in many of these drumming patterns strong resemblances to the rhythmic patterns found in Mexican *mestizo* folk music, particularly the vigorous *hemiola* pattern and other accentuation variations between ternary and duple metric waves. See for instance, Figure 6-6 which illustrates the patterns of melodic instruments and bass line in a Mexican *Son de Mariachi.* This is not to suggest that æsthetic links should or could be traced between these musics, but a surface relation could be established if one considered the patterns in complete abstraction. In any case, I was

delighted to situate a connection between these two inspirational sources in *Mannam,* both of which I deemed to be physically and intuitively very close to my own perception of rhythmicity, performance and dance[9].

On the basis of this comparative analysis, I concluded that the rhythmic aspect realised on tape could provide in *Mannam* the mediating structure between the melodic and chordal textures. At the microstructural level, this idea was realised entirely by intuition, inventing patterns on the kayagum or rhythmic objects on tape (see electroacoustic materials below) as they best satisfied local formal necessities, ie. cadence, caesuras, beginning of phrases, reiterations, moments of *stasis*, forward movement etc.

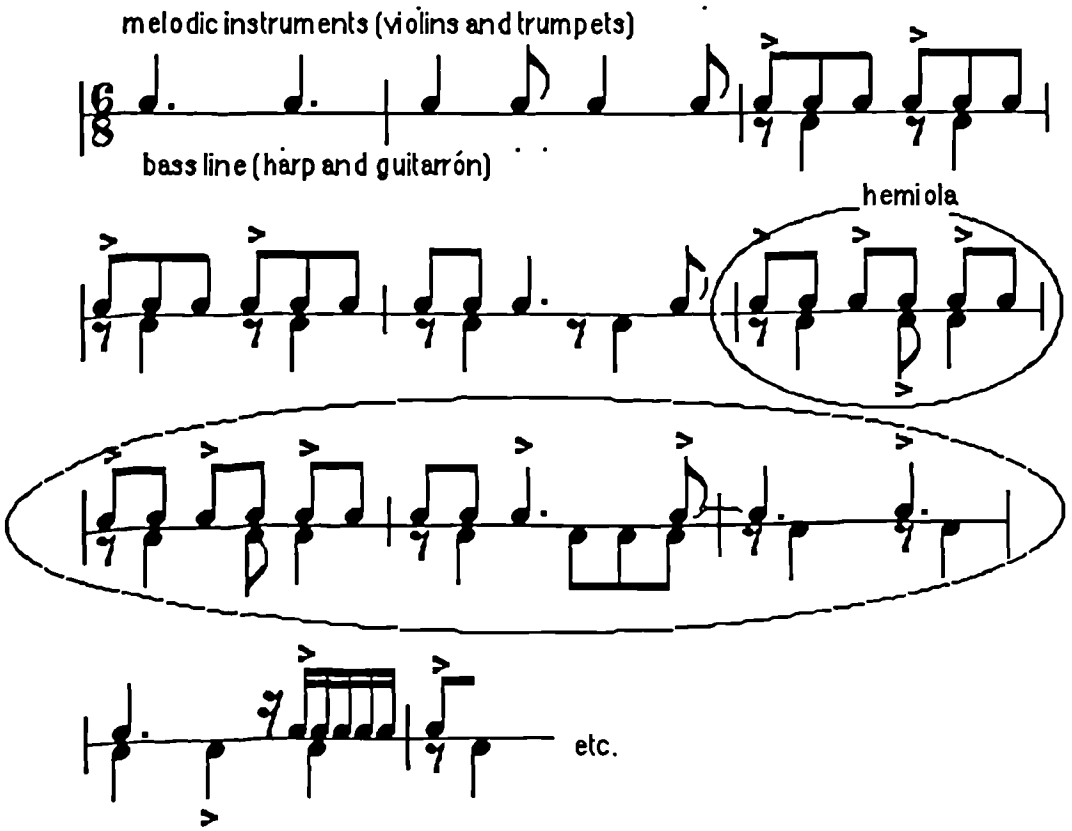


Figure 6-6 : Mannam : Typical Rhythmic patterns of a Mexican *Son de Mariachi* (transcribed by the author from a private recording of the *Son "El que se Vende").*

I also kept to the plan by introducing or rarefying the *hemiola* as a means to effect slow transitions between melodic and chordal strands. To establish a formal link at a macrostructural level, I followed the general strategy of

articulating the chordal material exclusively with duple metric flow and associated the melodic sections to waves of ternary momentum, as well as "free" flow sections at the extremes. Towards the end of the work, the differentiated material was gradually combined in the foreground and background levels to become indistinct during a short section preceding the tape solo. According to this outline, the formal structure which resulted in *Mannam* can be graphically schematised as in Figure 6-7 below:

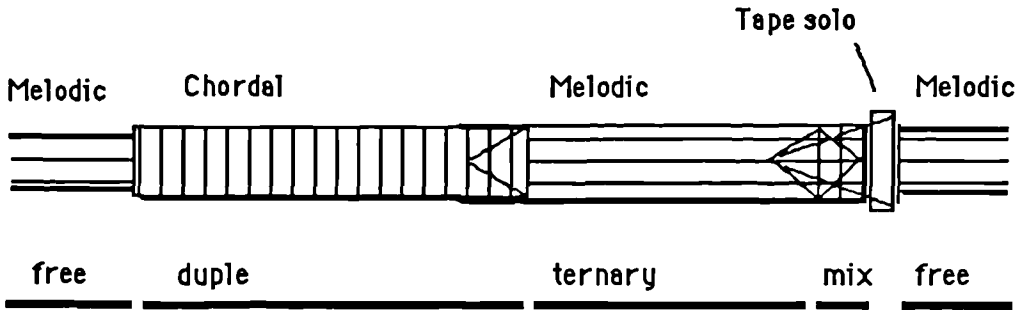


Figure 6-7: Mannam: Rhythmic / Formal scheme

6.4 The elaboration of electroacoustic materials

I have spoken so far of the overall formal strategy adopted in the composition of *Mannam*. I will now consider it from the point of view of the elaboration of electroacoustic materials and their interaction with the instrumental part. I must stress again that, in practice, elaborating a strategy and material is a simultaneous process where both inform each other. In real terms, the working method, like all the works discussed here, involved programming an instrumental "model" on the sampler with which I directly experimented [10] and took decisions regarding all sorts of material and interactions. For the sake of clarity I shall examine the different material separately.

6.4.1 Sound material for *continuant* gestures.

Generating *continuant* type of material was essential to create an acoustic balance between instrument and tape. The kayagum is not a very resonant instrument, and although its dynamic range is relatively wide, its carrying power is often limited by the position in which the instrument is played. The idea of creating sounds that could serve to compose gestures morphologically related to those possible or suggested by the instrument was realised by means of sustaining synthetic and sampled sounds.

(i) Synthetic sounds : a kayagum model

These included sounds modelled after the kayagum and produced on the Yamaha TX802 synthesiser[11]. Using algorithm #16 commonly used for plucked string simulations, I programmed carrier and modulating oscillators to be sensitive to midi data in different ways. The envelope generator of the carrier imitated the behaviour of a plucked string with an overly long decay and was made sensitive to velocity, so at high velocities, the attack would be very fast. The modulators were given slower or faster velocity-sensitive envelopes according to the inharmonicity of their frequency ratio to the carrier, but all were assigned fairly high pitch modulation sensitivity so I could accurately control their frequencies by glissandi and consequently the (frequency) modulation index through aftertouch (thus the spectral trajectory of the entire sound). A low frequency oscillator was also patched to close pitch modulation sensitivity to add a discrete vibrato to the decay. The sound was layered on itself eight times, which created some faint inharmonic overtones very similar in timbre to a kayagum string plucked forcefully, a sort of gigantic synthetic kayagum. This sound was crossfaded with the kayagum to extend its resonance or paraphrase the ornaments of the instrument by rising or falling continuant gestures. (Figure 6-8)

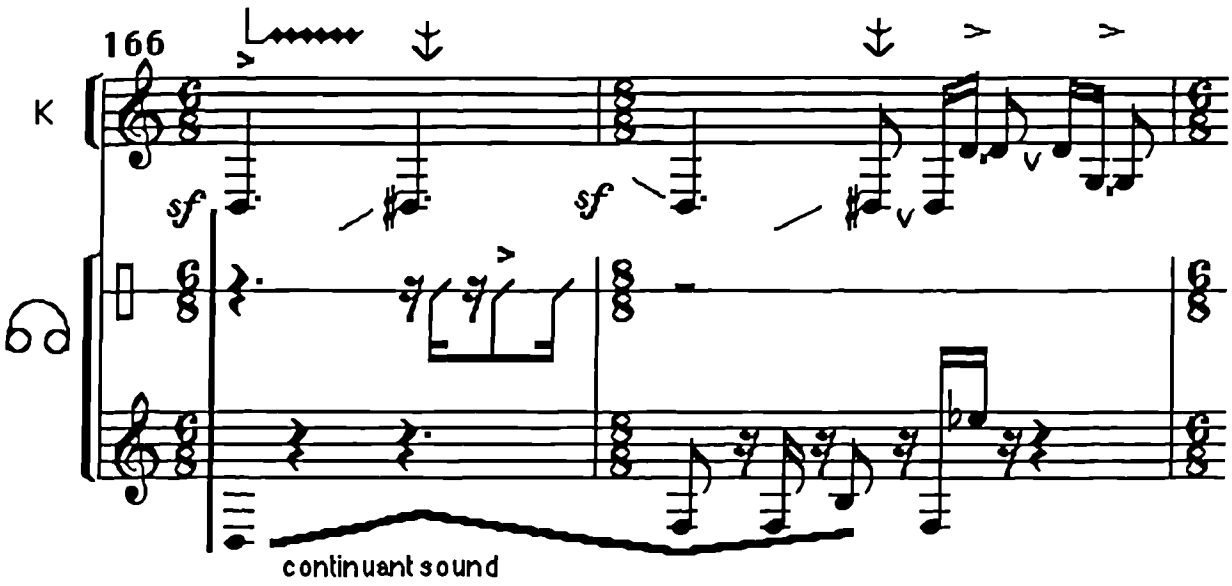


Figure 6-8: Mannam: Continuant gesture created by FM sound source on tape

(ii) Sampled sounds: ornamented continuants

Other continuant gestures were created by means of the Akai S1000 sampler. My main sound source consisted in two samples taken from a Korean court ensemble which included voice, wind, percussion and string instruments playing in unison the first tone of a melody, but articulating different melismatic ornamentations. As the sound had a rich and gradually evolving spectrum, interesting "quasi anecdotal" gestures were created simply by varying the duration of two slow unison iterations of the sample. I assigned it a slow attack sensitive to velocity so I could match it dynamically with the live instrument. These sounds were mainly used in the "free flow" sections at the beginning and closing of the work, in combination with the synthetic sound described above.

6.4.2 Sound material for *rhythmic objects* and instrumental coloration

As has been explained before rhythmic material was to act as a catalyst to the two kinds of kayagum playing. The sound sources used to generate this

material included mainly pre-recorded kayagum, *changgo* drum, and a number of isolated impulsions or plucked -string type sounds created on the FM and Linear synthesis Roland synthesisers. Two main types of gestural uses were assigned to this material; the doubling of the kayagum material as a colouring device and, the generation of sampled and constructed rhythmic objects.

(i) Synthetic sounds: colouring and simple juxtaposition.

These included metallic FM plucked-string-like sounds which "shadowed" the kayagum gestures. By fading in and out such sounds against their live counterpart subtle changes in the apparent colouring of the kayagum were obtained. This was also used to increase the dynamic range of the instrument in the mix. See a typical example below:

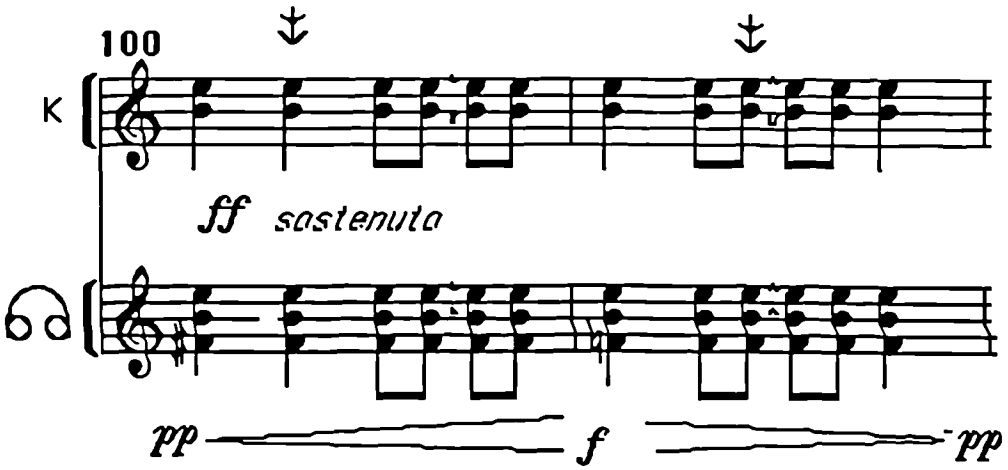


Figure 6-9: Mannam: Doubling of the kayagum (with FM sounds) for coloration

Another type of shadowing was done more randomly through the melodic sections, doubling isolated notes or portions of phrases played on the kayagum. (See bars160 to 166). Low plucked-like synthetic sounds from a Roland D550 synthesiser were juxtaposed mainly during the chordal section against the kayagum gestures to accentuate pulse points as in a kind of "walking bass". See another instance in the closing section of the work.

(ii) Sampled sounds: rhythmic objects and percussive impulsions

Many of the rhythmic objects were extracted from recordings of a number of *sanjo* pieces played on the kayagum by the instrumentalist and of Korean court music using bowed string instruments. Selected portions of these were processed with the Syter environment at the GRM in Paris[12] and later on assembled and edited at the GMEB in Bourges. The signal processing included interpolations between a number of amplitude modulated transpositions, filtering, delays and pitch shifting. Some of these objects were also used to double the live kayagum gestures.

The main rhythmic objects used structurally in the piece came from: (a) a strumming gesture produced on the lower end of the kayagum strings and; (b) from a two octave pitch-shifting ornament. Both are expressed here as corresponding to playback at Midi note 60, ratio 1:1:

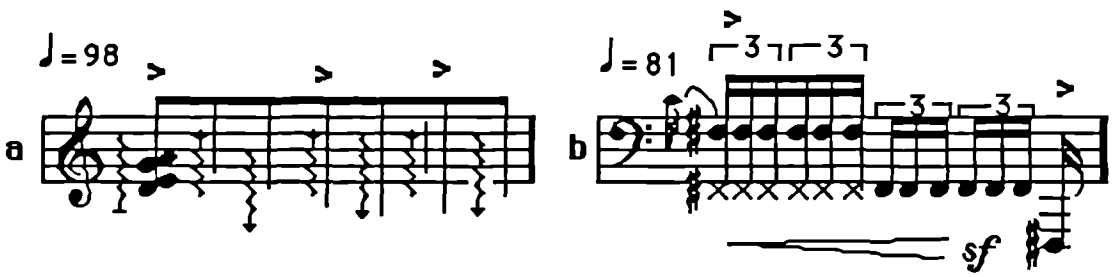


Figure 6-10: Mannam : Main rhythmic objects

I have discussed elsewhere the different types of techniques used to string together rhythmic objects, so I will not consider those techniques in detail here. However, as *hemiola* diminutions and augmentations were important in the transitions in *Mannam*, I will illustrate their placing. For instance, object **a** , which mainly featured in the chordal section of the piece, was used to sustain the duple flow. In addition, playing it back at [midi note] duration/pitch ratios of 4:3 or 3:2 generated the rhythmic and harmonic hemiola patterns which underpinned the kayagum cadences and phrase endings. See Figure 6-11

below (harmonic relations between kayagum and the electroacoustic sounds are not shown).

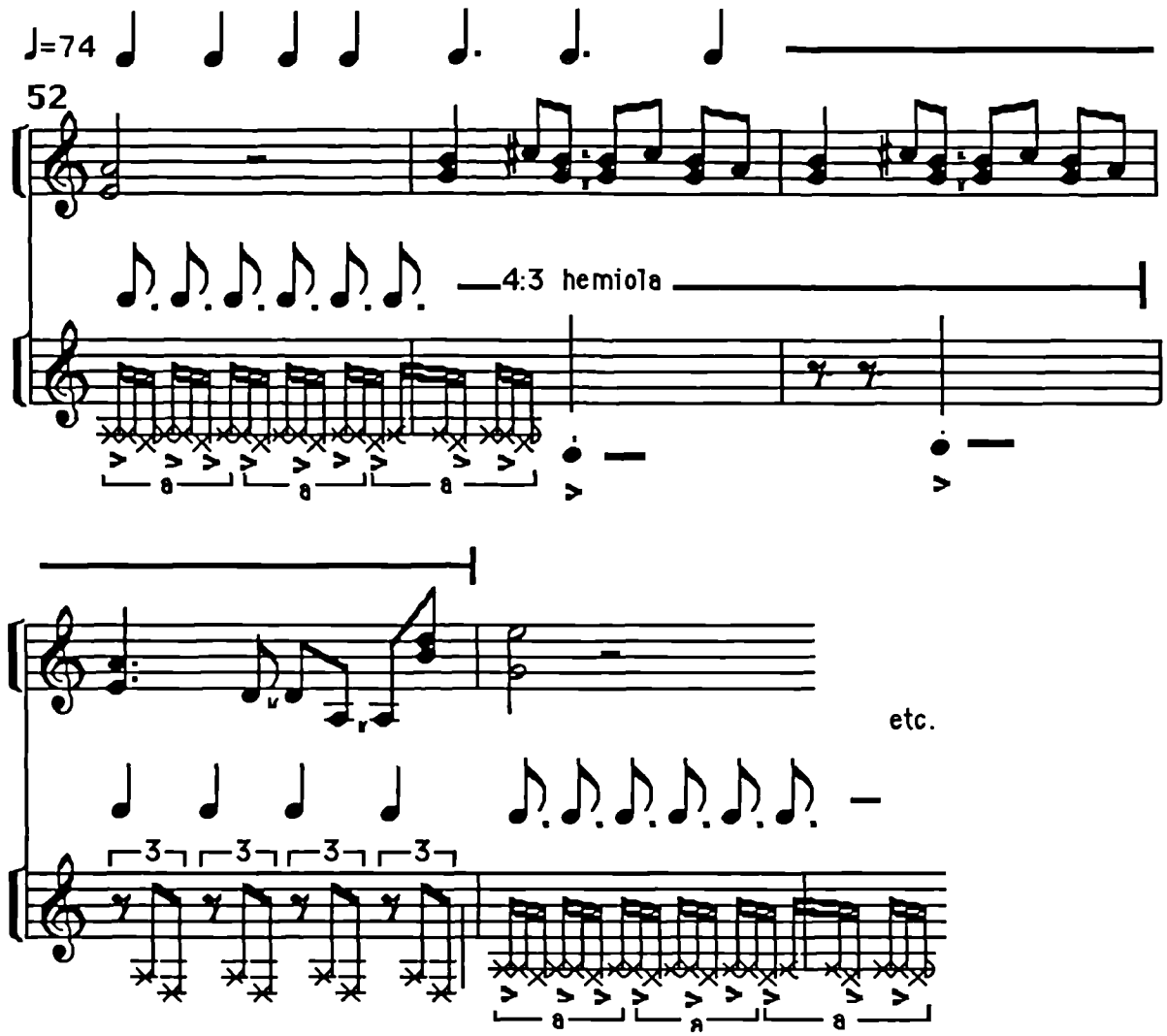


Figure 6-11: Mannam: Hemiola created by rhythmic object a. (bars 52-6)

Note that the object is played in its entirety, but transposed to the required ratio and only then re-articulated when necessary. A similar instance of the use of this object is the transition between the two main sections where it articulates by repetition the 5:4 metric modulation from ♩=74 to ♩.=54.

Object **b** is used in a similar manner in the melodic section, this time from the perspective of a ternary flow; so instead it is transposed to propitiate reciprocal 2:3 *hemiolas*. See for instance the cadence starting at bar 188:

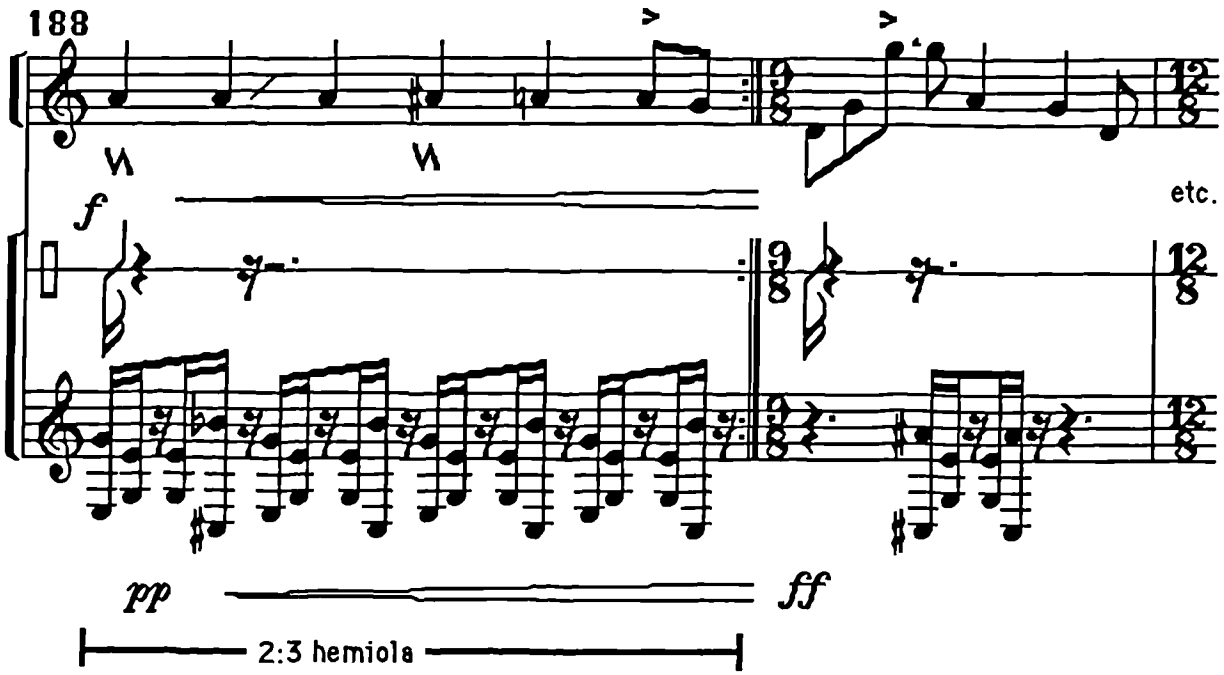


Figure 6-12: Mannam : Hemiola created by rhythmic object b. (bars 188-196)

Other sounds employed included short impulsion types such as *changgo* hits and short frequency modulated sforzando strings, which were used equally to create short iterated gestures and to double the kayagum and occasionally to generate cross-accentuation with the rhythmic textures created by the objects or the kayagum. Finally, straight kayagum plucked strings were employed to shadow the real instrument, paraphrase it and /or to create acoustic illusions between the live and an almost identical counterpart on tape. (ie. by differing provenance or location in the stereo field, echoes, delays, etc.)

6.5 Final Considerations

As discussed at the beginning of this chapter, one of the difficulties in composing *Mannam* was ascribing a consistent aural landscape to such an unfamiliar instrument. However, the process of solving this challenge was gratifying because, in the final analysis, it allowed me to rethink very carefully the "temporal space" required in the music to allow the instrumentalist to

perform more naturally, and hence convey my ideas better. *Mannam* is as much a confluence of style as it is a confluence of temporalities. In it, I attempted to create two kinds of temporal flows, not by locally slowing down or speeding up the music itself, but by establishing formal relations that in their onset, continuation or termination would be heard as always containing momentum in one direction or other. Indeed, by comparison to the other works discussed here, *Mannam* is possibly the one that points towards a more supple and ample sense of pacing and resonance.

Footnotes on Chapter 6

[1]The GMEB Groupede Musique Expérimentale de Bourges - was founded in the early 1970's by the French composers Françoise Barrière and Christian Clozier. The Group has devoted itself to the promotion of experimental electroacoustic music through an international commissioning policy, an annual 2 week-long Synthèse Festival and one of the most prestigious annual electroacoustic music composition competitions in the world, the Concours International de Musique Electroacoustique de Bourges.

[2]One example of this instance is *Clarinet Threads*, for clarinet and electroacoustic sounds by Denis Smalley

[3] As for example in *Triple Concerto* for flute, cello, piano and tape by Alejandro Viñao.

[4]Refer to Chapter 4, section 4.6: Notes on the WX7 Version.

[5]According to Howard, in Korean music practice the selection of a pitch level is entirely left to the occasion and in accordance to the pitch considered to be more stable on any of the instruments of an ensemble. The Korean melodic æsthetic dictates an intuitive adjustment in relation to what may be played.

[6] I was reminded recently by Inok Paek, of the tendency in Korean practice to consider the central tone of the chosen mode/ tuning system as the "mother" tone, whilst, other tones are the lesser "father" and the "children". It is somewhat unclear to me whether this hierarchy refers exclusively to the tones of the mode or if it actually encompasses the kayagum's actual strings that correspond to them. (Paek 1992).

[7]The *Changgo* is a double headed hourglass shaped drum used in much of Korean musical genres, including vocal, lyric, and ensemble court music. It is almost considered indispensable to *Sanjo* music, where it accompanies a solo instrument, such as the kayagum. I am indebted to Stephen Gibson for devoting an entire afternoon to record and discuss a number of Korean rhythmic cycles used in *Sanjo* music.

[8]See for example, Lee Hye-Ku (1981) and Howard (1988) and (1991).

[9] Interestingly, dance and musical performance are deeply related in both cultures.

[10] Three independent samples were taken for each kayagum string: a soft-to- normal pluck, a flick and a strong PDLT pluck. These were stacked on twelve different memory registers on the Akai S1000 and made responsive to velocity of attack. The pitch of the samples was also made touch-sensitive, so I could model the ornaments directly by improvisatory input.

[11]Refer to Chapter 5, section 5.2 for a description of the Yamaha TX802 FM synthesiser.

[12] Syter is a powerful 12 bit real time signal processor which worked at that time in conjunction with a PDP 11/73 mainframe computer. It includes two ADCs and 4 DACs which allows for the processing of mono or stereo signals. It was developed in the early 1970s by the Groupede Recherches Musicales in Paris, France. The predessessor of the Groupede Recherches Musicales was founded by Pierre Schaeffer in 1948, and is currently directed by François Bayle. This institution is devoted to the promotion and production of acousmatic and electroacoustic music in its own studios located at the Radio France Building in Paris. In addition to its research activities, the GRM also presents an annual concert series, *Le Cycle Acousmatique* and promotes the work of composers through a vigorous international commissioning policy.

Chapter 7 Contexts

7.1 What can compositional strategies explain?

In the foreword to this dissertation, I warned that a discussion of the works presented would focus on the actual *experience of composing.* I suspected from the start that even detailed descriptions of ideas and strategies employed in these pieces could miss a number of æsthetic "predicaments" which were nevertheless inseparable from the creative process involved in the composition of the works. My initial misgiving was underlined by the fear of finding myself torn between words which might serve to express my artistic aims and those words required to structure a rigorous critical appraisal. But then, decision-making in composition is similar in that it also stems from the concurrence of two elements: an individual artistic *élan* and the sonic specificity of the compositional task undertaken.

In writing about these works I have gradually become aware of the falterings which can emerge when composers discuss their own compositional strategies. Because one writes *after* the works have been composed, it becomes necessary to backtrack to a critical standing broad enough to contextualise the problems encountered. So in the light of the questions which the pieces have allowed me to address -more than those that they have answered, I am now convinced that a balance needs to be established. A brief summary of the broader issues surrounding the process of composition might help to establish further the context in which the works were composed and to glean their musical aims and æsthetic concerns.

As might be seen from preceding chapters, it is extremely difficult to separate technical from æsthetic matters because in my experience compositional insight usually comes hand in hand with technical expertise. It is true that in composition in general , both of these capacities take turns to inform one an-

other in the structuring of sounds and musical ideas. But when the tools employed for composing are themselves the vehicle for performance as was the case with the works in this thesis, compositional and technical resolve intertwine simultaneously through the process, starting from the moment of genesis, via the invention and evaluation of sounds, and terminating at the actual performance of the finished work. Put in other words, in the composition of works involving electroacoustic sounds, in whatever form this involvement takes, the link between aesthetic and technical matters is strong because the physical and temporal actuality of sound - upon which those technical and compositional strategies are taken - is inextricably bound to that of the finished musical work which is intended for the listener.

However, as far as the composer is concerned, one should bear in mind that, in general, compositional strategies resemble dilemmas and as such, rarely can claim to be predictable or logical solutions. Rather, their discernment deals with subjective choices made amongst a myriad of different and possibly equally valid alternatives. So, for instance, with respect to the works discussed, in choosing one sound object over another, where either of the two might have fulfilled a musical function, the decisive choices ultimately responded to questions of what I would call pöetic significance. Nevertheless, the process of choice does not take place in an artistic vacuum. In the everyday practice of composing one tries to solve such dilemmas in a personally satisfying manner trying as it were no to lose sight of the specific requirements, practical and otherwise, of the task undertaken. That is all that a strategy may hope to explain. To talk of a "pure" artistic goal in any of these pieces would thus be an ideal. What I am suggesting is that, perhaps, in the fervour of accomplishing complete and finished artefacts which can stand alone and *survive* as durable artistic products, the composer is already drawing a strategy in itself, and one which can only be validated within the changing realities of æsthetic and cultural conditioning over a period of time.

7.2 A question of context: are these works electroacoustic?

It may seem that many of the issues raised so far are not different from those pertaining to other forms of contemporary music and art. Yet, since I have been talking about ideas with respect to compositional strategies, I feel that the specific conditions surrounding the creation of works for instruments *and electroacoustic sounds* - "mixed music" - now warrants a broader examination of the æsthetic context which the term "electroacoustic" implies in my works. Why after all, do I consider these works as electroacoustic works? An enquiry in this direction is pertinent because the term "electroacoustic music" has simply become too confined a term to accurately describe the diversifying use of electroacoustic resources in musical thought and composition. Whilst many composers regard this as resulting from the emergence of apparently incompatible æsthetic concerns within the medium[1], for me this is not necessarily a negative development. As a practising composer - I am interested in expanding and originating ideas which may nurture electroacoustic and mainstream musical thought, rather than to restrict it to concepts which are by now common knowledge to music makers.

As a starting point I will consider electroacoustic music understood in its most "classic" form, that is, music ~~for~~ *electroacoustic sounds on tape*. This is convenient in that it will allow me to answer my question and make my final extrapolations to music involving the use of live instruments, whereas the reverse seems more difficult. This will also help me consider the broader view that the æsthetic concerns of *tape* electroacoustic music can expand *in spite* of a reluctance of some practitioners to think otherwise. Consequently, my claim for contextualisation here is pragmatic and seeks to offer an insight as to how my works in particular may contribute if at all to what I believe should be an evolving medium.

7.3 The general context of electroacoustic music and "mixed" works.

In musical composition, with the exception of methodologies where extraneous non-sonic models[2] have been employed as the organisational basis for compositional decisions, nearly every single sound which the composer might wish to use requires the elaboration of strategies combining technical competence with æsthetic resolve. For most intents and purposes, this is true for all musics, whether instrumental or electroacoustic. However, as has been discussed before, there are a number of aspects more characteristic than others of electroacoustic music composition. The argument can be outlined in several layers: the mode of production, the nature of the sound material and the abstract implications which the former two open up to the composer.

Electroacoustic music is composed and produced under very specific conditions, namely in the environment of the electroacoustic studio. Through the use of sound recording, signal processors, synthesisers and computers the composer can generate, select, act upon and organise sound aurally as in (an act of) performance. Instrumental music composition, on the other hand, prescribes in the musical score which acts as a representation of what is firstly imagined by the composer and then translated by the instrumentalist(s) into a performance. In electroacoustic music the composition process takes a direct route: the music comes to life as it is composed, so no prescriptive mediation exists between composer or performer, the sound material and the finished product. If it is said in talking about electroacoustic music that the composer *realises* the work is because we are referring to this mode of production.

It could be argued that there is no significant difference between this method of production to that of, say, the pop musician working with similar resources. But before we could even harness the power of technology as we know it to-

day, one of the aspects which differentiated electroacoustic music composition from other musics was the use and integration - via sound recording - of sounds previously considered "unmusical" to the musical discourse. Hence, in addition to appropriating the technology as a means to construct, manipulate and transform the *internal* architecture of all such available sounds as part and parcel of the composition process, the composer today has the possibility of manipulating sound material for its abstract and/ or mimetic qualities. Environmental sounds, voltage control, synthesis, noise, gesture and anecdotal content have all contributed to the emergence of unprecedented and varied compositional strategies[3]. The visionary æsthetic and listening postulates formulated by Schaeffer and others under the general heading of *acousmatics* have been thus affirmed.[4]

From this enhanced perspective, the *métier* of the composer working with electroacoustic means can be regarded as being extremely rich in possibilities. Yet, the æsthetic affirmation associated with the conception and integration of new sound materials and strategies has not been without its practical problems, particularly with regards to the listener. As suggested at the beginning of this dissertation,conception and perception are not always necessarily in agreement. The fact that the composer may consciously direct the musical discourse through the manipulation of the abstract and/or objective content of sound materials, whether pre-recorded or electronic does not necessarily reflect the listener's ability to discern the spatial and objective source from which sound is supposed to originate.

This touches upon what I consider to be one the most problematic areas of electroacoustic music: the establishment of a relation between foreground elements to a background, or simply the establishment of material which functions as a background at the appearance of other sounds of different structural import. In acousmatic electroacoustic music, the listener is often confronted

with a complex sound continuum consisting of several streams which evolve simultaneously in different dimensions (timbre, dynamics, density, motion and so on). Because of a considerable amount of information coming from a single emanation of sound (furnished by loudspeaker pairs), the listener is required to accomplish an elaborate task of differentiation within the virtual acoustic space in order to acquire the sense of aural perspective necessary to locate and focus on an individual foreground stream. In my experience, a slight increase in the complexity of an already complex continuum suffices to prevent the segregation of separate events[5].

Psychoacoustic analysis is outside the scope of this thesis. My contention here is compositional: it is not the acousmatic principle that is in itself problematic but its compositional misuse. We know from experience that the elements in complex continuums are more prone to fail in establishing clear morphological footholds for the discrimination of transformations between sound objects to be "learned", at which point the individual articulations of those elements and their recognition as being "the same" become easily masked. In slightly more technical terms, loss in gestural demarcation, onset differentiation, and progression significantly reduce the listener's ability to discern the hierarchy, of whatever kind, of individual elements, promoting a fusion of the streams and sound objects[6]. In this instance, background and foreground dimensions become one, translating - at a vertical level - into increased sonic density whilst horizontally, the once separate streams are perceived as a single monodic strand. Whilst this does not necessarily hinder the perception of the combined spectrum, or a conglomerate mass, in my view it diminishes the compositional *élan* because such fusion moves the attention away from the *relations* between the various kinds of material. I can thus conclude that unless the composer is aware of this problem, the alleged objectivity of acousmatic listening risks turning into extreme subjectivity. If background - foreground levels are not perceivable at any given point in time which might be

considered structurally significant by the listener, it is often because the acoustic space is too cluttered to allow the conveyance of the sound's or object's position and or identity: landscape is lost. Once this state of affairs is reached, the perception of form as a dynamic process ceases to operate, instead it leaves the listener clinging to other kinds of foreground objectivities and temporalities: the awareness of real ontological time passing by and, perhaps even more incompatible with the acousmatic approach itself - with the *visible* technological wizardry of the composer projected *at* him from loudspeakers.

Whether the boundaries of our processing and cognitive capabilities might be better explained by psychoacousticians or information scientists, the question for the composer is how he can turn the acousmatic potential to his advantage. Another question is how can he avoid falling prey to technical redundancy and to the excesses in textural information which overwhelm his listener and prevent the acquisition of a repertoire of codes with which he might work out structural and psychological signals meaningful to him (ie. where strands finish, where they begin, what causes what, how things continue, etc.). Can a balance be struck between generality and singularity or is it a question of structure and of *structuring* processes[7]?

I distinguish another related problematic area in some acousmatic approaches which refers to the prevalence of certain types of sound materials over others. I am also talking about the reluctance of much electroacoustic music to introduce and employ general references with a more definitive cognitive meaning: transforming streams or formed sound objects, such as clues to the origin of sounds, note-type sounds or rhythmic structures. Æsthetically, electroacoustic music of this type tends often to be, in my view, overly self-referential, but in too vague a sense: it refers to a limited and oversimplified set of conventions. As far as analysis goes, that is to me not a suffi-

ciently strong æsthetic reference to describe outstanding individual works in the repertoire from which we have learned beyond their methodology and/or structuring strategy. To explain my argument conversely; if I was to take for instance the work*Pentes* by Denis Smalley I would find it very hard and sterile to describe it in terms of frequency or amplitude profiles, simply because the work does not only *sound* as the profiles which indeed constitute it (I can hardly conceive of the Northumbrian pipes as "profiles"...) ; it is rather a musical "whole" which reflects higher-order psychological references from the manner in which the gestures start, continue or finish. These contain the deeper pöetic significance which in my view is far more an important embodiment of a compositional *gestalt* and therefore of a formal and emotional singularity: in sounding like itself it does not sound like anything else *but* itself. That is what makes that work so uniquely artistic to any listener.

In suggesting that electroacoustic music could integrate general references I am not saying that these have to be necessarily universal or pre-conceived. They can simply be references which *function* as symbols and formative elements within a singular context. If I have spoken of dance-like structures, rhythm and rhythmic objects extensively in the context of my own works it is because - besides their appeal to me - they provide function, and serve as temporal context to other elements which may be more or less significant at a macro-structural level. These not only determine starts and terminations, but point towards the psychological boundaries I have referred to above. In any case I bring them up as possible elements to be considered by others. But this affirmation could also be taken to the realm of "notes", that is, short impulsions of stable timbral structure, usually excluded from the electroacoustic vocabulary. Notes, as described here, (ie. as involving distinct *harmonic* spectra), are possibly the most abstract musical object and as such can potentially establish *relational* and evolutive patterns faster and more easily than formed sound objects or streams. This, of course, can be an acute point in the sense

that notes are associated with harmony in conventional terms. However, there is no apparent reason why (again, within singular contexts) the spectral architecture of notes cannot serve as a musical model or psychological context, especially as current computer technology allows the manipulation of the internal architecture of sounds. The same applies to microtonal note-type sounds and note-networks which can be used to provide temporal, textural, timbral and morphological perspective to other types of inharmonic continuant sounds. In a time and age where quantum physics has shown the implications of the behaviour and structure of particles in the forces governing the universe, I cannot find other explanations for the rejection of notes as a basic and particular structure in electroacoustic music than an obtuse æstheticism rooted on the lack of versatility and vision on the part of some of its composers.

However, my general point is that much electroacoustic music relies, in varying degrees, too heavily on one single and apparent type of material; resulting in a redundant, self-reflective and over-continuous abstract musical discourse, often to the disadvantage of the undeniable psychological power and inherent musicality in the "objective" or anecdotal content of sounds. It is a kind of circular faltering. In this sense, electroacoustic music tends to result, by virtue of a lack of timbral, acoustic and formal foreground or background, unimorphical and to certain degree unimorphological. I am not concerned here with works that allow the quasi-cinematic appearance of objects which the listener distinguishes in their physicality as being hit, broken, scraped, etc. In fact I feel greatly moved by such instances. But such works, after all, in allowing an unashamed interaction between abstract and mimetic significations, create an enticing dynamic emergence of simultaneous internal "codes" which ascribe musical (and <u>not</u> ontological) temporality as the music proceeds, enhancing their capacity for expressive, formal and dramatic significance. However, I am concerned with works which relinquish this capacity to carry within themselves

clear (non-redundant) indicators of their own formal attributes. I am referring in particular to instances where extremely attractive sound spectra and continuous streams fail to generate - in spite of potentially well defined gestural content - sufficiently strong connective and / or hierarchical relations, because the composer has consciously renounced the possibility of establishing *functional* links of some abstract kind as one more discursive element. Especially when, in a singular context, such a local strategy could have helped to convey a large scale sense of motion or form, foreground, or musical temporality without compromising the work's aesthetic rigour and the composer's sacrosanct artistic integrity. To work with the sensuous medium of sound does not necessarily mean that we should extricate our attention from abstract relations and processes.

These are areas where, in my view, the integration of instruments and electroacoustic sounds has a great deal to offer to the composer and the listener. In the first place, the acoustic presence of an instrument's resonance within virtual acoustic spaces on loudspeakers can establish - if the composer so wishes, or if the music so requires - the dynamic control over the evolution of acoustic foreground and background , so necessary to infer form-bearing structures. On the other hand, the timbral stability of an instrument, working in relation to dynamic electroacoustic sounds provides spectacular textural, spatial, spectral and morphological interactions, which result in unequalled aural perspectives. From the compositional point of view the integration of instruments and electroacoustic sounds points towards a whole array of combined strategies which may be established with respect to gesture, the evolution and re-construction of instrumental timbre, overall musical temporality, movement, humor, anecdote, etc. In fact, the compositional avenues opened by virtue of the acoustic coalescence can be, to borrow Jonathan Kramer's words (Kramer 1988) multidirectional and multiply "directable", more so by the input and singular energy of a performer. In that respect, music integrating instruments and

electroacoustic sounds has far more potential to be polymorphic and polymorphological than electroacoustic or instrumental musics could ever aspire to be on their own. Advances in performance itself will no doubt evolve more adventurous approaches to the already vast spectromorphological and spatial potential of combining real instruments with those emerging from virtual and imaginary spaces. I would therefore conclude by offering the suggestion that, with the design and development of new instruments and instrumental techniques, astounding compositional strategies which approach integration with electroacoustics will emerge. This may very well be where electroacoustic music, its composers and its listeners will find their most exciting future.

7.4 Concluding thoughts

Can we not aspire to a global, more demanding aural tradition which may encompass the experiences of electroacoustic, acousmatic and instrumental music? In assuming an insurmountable divide between the concerns of electroacoustic music and other musics, we might be suggesting the demise of such an unborn tradition. But a *tradition* in art is first of all a collection of artists with a common awareness and purpose. So, if it is conceivable to speak of such phenomenon as a "new tradition", then the term *electroacoustic* is itself also up for revision. What is it that we want to designate: a mode of production, a mode of listening, an awareness, a genre, a position, a poëtic intention? As practitioners, we must broaden the perspective beyond the singularity, since electroacoustic music as a designation of *genre* includes a variety of special categories. These categories also raise a number of pertinent æsthetic questions, which I believe, are not necessarily incompatible with the new awareness brought about by acousmatics, spectromorphology and computer control[8]. The question is whether this new awareness really necessitates that contemporary music and electroacoustic music run their separate ways. Whilst many composers - both those working exclusively in either the electroacoustic or the instrumental fields - might feel this a desirable or more secure position, I

suspect that the medium is still too young to take it for granted on the basis of a fairly limited musical repertoire. History seldom offers easy solutions: today it is not relevant to think that overthrowing centuries of empirical tradition will automatically renew musical thought with a "new" consciousness. This would simply reveal the kind of elitism which - in the words of Jacques Attali - "would result in the elimination of style and, at the same time, [on] the demand for its impossible recovery, the search for an inimitable specificity" (Attali,1977: 115). The present æsthetic and sociological exigencies on the composer are more complex than such a fallacious pursuit could ever resolve. Listeners' abilities to experience music are also changing realities.

If it is true, as Trevor Wishart points out, that "music can no longer be confined to the organisation of notes" (Wishart, 1985: 6) then, by the same token, music must not be confined at all. But if it was for any reason, it should not be so by anything other than the fearless imagination of a wiser breed of composer equipped with an indisputable experience in spectromorphology, instrumental practice, acoustics, and so on. And of course, an understanding of as many musical practices as he can possibly aspire to. There is no question in my mind that the efforts to contextualise and legitimise the nascent æsthetic enunciates of electroacoustic music composition will bear better fruit, if we, its *practising* composers , will formulate more global and artistically generous concepts which will enable the elements of true change in musical thought as a whole. The development of a theory can become an exercise in historical self-justification if it does not keep a broad perspective over its own achievements and limitations. Musical thought, the technology and the practice of music including that of electroacoustic music are changing in too many fragmented directions to allow us enough distance to establish to what extent this will transform our current musical aims. It might be therefore wiser to explore this æsthetic threshold than to settle for immovable theoretical pillars. Already within the last few decades, we have seen an erosion of the æsthetic pertinence and artistic permanence of works once hailed as "classics" in favour of

works which embody a more comprehensive æsthetic affirmation. Let us hope that new works keep on breaking unnecessary barricades. In the words of Jorge Luis Borges : "luckily we don't owe ourselves to *one* tradition, we can aspire to them all..." (Borges 1948:430)

Footnotes on Chapter 7

[1]This intransigent position seems to be at the root of ongoing debates as to what the genuine æsthetic concerns of electroacoustic music are or should be. See for example Lewis 1992.

[2] I am referring to such methods which take away certain choices from the composers' agenda, mostly found in the music of the twentieth century, namely those involving computer aids such as expert or ruled-based systems, "fractal" composition, through to total serialism and chance operations.

[3]See Simon Emmerson's discussion in his article *The Relation of Language to Materials* (in Emmerson 1986)

[4]At the core of electroacoustic music practice lies a number of theoretical principles of which *Acousmatics* is probably the most significant. Through the acousmatic principle the act of listening itself is proposed as *the* phenomenon of compositional inquiry. Once equiped with this listening discipline - reduced listening- (itself informed by acoustics, the objective) the composer can accede to and organise - by means of electroacoustic processes (sound recording, studio transformation techniques, synthesis) - a musical vocabulary constituted by sound objects and sound streams of different types, according to a phenomenological reduction of their properties.

[5]According to McAdams and Bregman (1979) the perceptual system groups sounds as coming from one single source until it acquires information to suggest an alternate interpretation.

[6]Whilst I am aware that certain sound material might not lend itself to the kind of hierarchical structuring that we may find in instrumental or tonal music for example, I am certain that the objective gestures or spectral categories must be able to mantain a certain degree of hierarchical invariance if the listener is to infer a significant formal relation between them.

[7]This question signals the deeper ph losophical dilemma of differentiation in art. The question has been masterfully considered by Gilles Deleuze, who proposes that we cannot distinguish an opposition between structure and genesis, structure and event or structure and sense. (Deleuze 1960 : 218-285).

[8]*Spectro-morphology* is a term proposed by Denis Smalley which refers to the manner in which the spectral and morphological characteristics of a sound are constructed and combined. (Smalley 1986).

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Part II

Recordings and scores

1.1 Work and recording details

Papalotl for piano and electroacoustic sounds (on tape)
Composed and realised at the City University, Music Department, London between July 1986 and January 1987.

First performance: Philip Mead, piano. Electric Weekend, Queen Elisabeth Hall, South Bank Centre, London, November 1987.

Recording details

Duration: 13'14"
Philip Mead, piano
Recorded at Kabaleta Recordings, Cambridgeshire, May 1991 by Gef Lucena and Javier Alvarez. ¢ Matchbox Music.

Released commercially on Saydisc CDL 390. August 1992.

Prix de la Confédération Internationale de Musique Eléctroacoustique (CIME), Bourges, France, 1988
Mention-Prix Ars Electronica, Linz, Austria 1988
Euphonie d'Or- International Composition Competition, Bourges, France, 1987.

On Going on for baritone saxophone and electroacoustic sounds (on tape)
Composed and realised at the City University, Music Department, London between July and October 1987.

First performance: Stephen Cottrell, saxophone, Javier Alvarez, sound diffusion. Music Centre, University of East Anglia, October 1987.

Recording details

Duration: 11'42"
Stephen Cottrell, saxophone
Recorded at the City University, London, March 1988 by Javier Alvarez

Released commercially on Overhear OhM 001 CD. ¢ Javier Alvarez.

Acuerdos por Diferencia for harp and electroacoustic sounds (on tape)
Composed and realised at the City University, Music Department between August and January 1989.

First performance: Hugh Webb, harp, Javier Alvarez, sound diffusion. Park Lane Group Young Artist Series, Purcell Room, South Bank Centre, London. January 1989.

Recording details

Duration: 11'29"
Hugh Webb, harp
Recorded at Valley Recordings, Littleton-on-Severn, September 1990 by David Wilkins. ¢ Matchbox Music.

Released commercially on Saydisc CDL 390. August 1992.

Commissioned by the Park Lane Group with funds provided by the Greater London Arts Association.
Honourable Mention- International Composition Competition, Bourges, France 1988.

Así el Acero for tenor steel pan and electroacoustic sounds (on tape)
Composed and realised at the City University, Music Department between March and June 1988.

First performance: Simon Limbrick, tenor steel pan, Javier Alvarez, sound diffusion. London Percussion Festival 1988, Almeida Theatre, July 1988.

Recording details

Duration: 9'11":
Simon Limbrick, tenor steel pan.
Recorded at the City University, London, August 1988 by Javier Alvarez.
Mastered at Valley Recordings, Littleton-on-Severn, September 1990 by Javier Alvarez and David Wilkins. ¢ Matchbox Music.

Released commercially on Saydisc CDL 390. August 1992.

Commissioned by Simon Limbrick with funds provided by the Hinrichsen Foundation, London

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Mannam for kayagum and electroacoustic sounds (on tape)
Composed and realised at the City University, Music Department and at the composer's studio in London between November 1991 and April 1992.

First performance: Inok Paek, kayagum, Javier Alvarez, sound diffusion. Electrifying Exotica, Purcell Room, South Bank Centre, London. May 1992.

Recording details

Duration: 14'50"
Inok Paek, kayagum.
Recorded at Valley Recordings, Littleton-on-Severn, May 1992 by David Wilkins. ¢ Matchbox Music.

Released commercially on Saydisc CDL 390. August 1992.

Commissioned by the Group de Musique Expérimentale de Bourges 1990.
First Distinction- Prix Ars Electronica, Linz, Austria 1993.