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BIRD SONG AS A BASIS FOR NEW TECHNIQUES AND IMPROVISATIONAL PRACTICE WITH THE BAROQUE FLUTE

by

STEPHEN PRESTON

A thesis submitted to the University of Plymouth

In partial fulfilment for the degree of

DOCTOR OF PHILOSPHY

Dartington College of Arts

April, 2004

THESIS CONTAINS

CD

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Abstract

Subsequent to a period of training as a flautist, I ultimately specialised professionally on the baroque flute. Consequently, a significant part of my research for a PhD was practice-led. My later career; concerned with dance and choreography, represented a widening and diversification of my interest in music in particular, and the allied arts in general. This was (and continues to be) paralleled, however, with a substantial research-interest in aspects of the performance of music and its potential interconnection(s) with modalities of speech.

However, my own research commenced with a strong desire to discover new performance techniques on the baroque flute. Earlier performer/composers on the instrument explored, documented and analysed new ways of performing on the instrument. This research continues that form of practice-led investigation. This investigation has been centred on performance-experiments of an often improvisatory kind, but by the time of its completion, I too became a performer/composer on the instrument.

The research became focussed on a critical and analytical study of birdsong. Birdsong offers a degree of pitch and timbral variation of phenomenal power. My research questioned and interrogated the structure; modes of delivery and sonorities in birdsong because I wanted to devise a new method of playing that might approach these avian sonic possibilities and by absorbance, produce a new musical language on the baroque flute. Previous ornithological writings (Thorpe; Armstrong, Hartshorne, *et al*) have frequently considered birdsong as a form of music. Thus, my research examined documentary outcomes from research into birdsong in the form of analysis of recordings, and critical scrutiny of sonographs. Birds 'perform' in varying degrees of tonal, atonal and microtonal systems. The research paralleled these treatments of pitch and harmony. It also addressed issues of structure, dynamics, timbre, rhythm and the physical aspects of delivery with the intention of devising a new 'method' for the generation of a new music for the instrument.

The research has of course been polymodal and interdisciplinary. It consisted of the following methodological, practical and theoretical domains, namely:

- *critical and analytical readings in the science of ornithology; especially birdsong*
- *critical and analytical readings in historical models for performance on the baroque flute;*

- *field-studies in the form of recordings and notational transcriptions (via Messiaen and Cowie, et al) of birdsong;*
- *practical experiments as a soloist (improviser) together with collaborative, experimental and practical research with an ensemble and/or another baroque flautist.*

The purpose of this research was to find new techniques for contemporary musicians, accompanied by a body of writing that embodies a kind of treatise on the instrument with potential for use by other contemporary musicians. Thus, the written thesis, together with recordings of experiments, improvisations and concert-performances should be considered as a collective body of new knowledge in relation to performance on the baroque flute in particular, but with potential for use by other (or all) musical instruments.

My findings are that:

- *a new performance technique is required as a result of a study of birdsong and with the effect of producing a vastly extended repertoire of effects and pitch frequencies on the instrument;*
- *this new technique generates a new musical language particularly in respect of treatments of microtonality; new breathing and fingering techniques;*
- *the technique is transferable by teaching and demonstration to other performers and of potential use for contemporary composers writing for the instrument;*
- *these new techniques were enhanced (if not made entirely possible) by field-studies and cross-disciplinary (arts/sciences) and illustrate the potency of cross-field research in the generation of new music.*

The principal outcome of my research was the development of a system of playing that has now been named by me as ***ecosonic performance.*** It is so-named, because the performance-techniques developed are based on a phenomenological study of the ecology of sound in birds; themselves already ecosonic performers.

This written thesis is a documentation of my modalities of research, experimentation and practice. It is designed in the form of a commentary/treatise, and should be considered as a form of 'primer', not only for the baroque flute, but also for the further investigation of the performance-capabilities of any musical instrument.

Acknowledgements

Many people have helped me in my research both knowingly and unknowingly and I thank them all here whether named or not. Those who I thank here are the people who had in one way and another, a material effect on the outcome my work.

First of all, my wife, Sarah Cremer, who has patiently endured my obsessions for many years, unfailingly encouraged me, and taken the strain by providing essential emotional and financial support for a process that seemed might never end.

This research would never have been possible if it had not been for Edward Cowie – hugely inspired and inspiring both professionally, as composer and musical colleague, and as a friend – at all times unstintingly generous with his time, immensely stimulating in the range of his conversation and interests, and completely practical in his support.

Thanks also to my brother Robert Preston and to Heather Cowie, whose practical and insightful conversations helped me through some dark moments; and to my brother Ilric, with whom I have shared my love of natural history.

To the biologists: Brian Goodwin, who gave me the seed thought for the ecosonic system; Peter J.B. Slater for generously giving me his time and knowledge on birdsong in general and duetting in particular; and Michelle Hall for sharing her paper on duetting with me before it was published; and Philip S. Corbett for discussing his thoughts on song and pointing out some interesting papers I had missed.

To two American composers: John Thow for his love of the baroque flute, and John Luther Adams for his love of birdsong and the natural world, and who both generously shared their thoughts and time with me via email.

I owe a debt of gratitude to two musicians. First, the violinist Pavlo Beznosiuk, who spent many hours and much enthusiasm allowing me to experiment with ways of adapting the ecosonic system to the violin and with trying out different forms of improvisation. And special thanks to the baroque flute player Amara Guitry, a unique student and colleague, who learnt and mastered the ecosonic system, enabled me to explore the model of duetting birds, to perform my work in public, and to begin extending ecosonic improvisation to

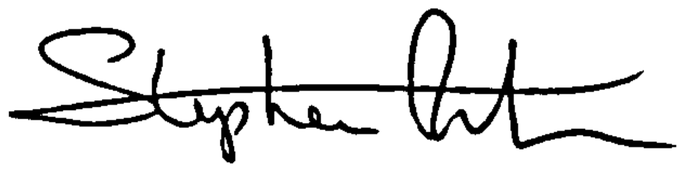
electroacoustic areas of exploration; and secondly as a computer slave, who spent far too many hours on the computer, editing and organizing the recordings of my work, and solving my computer related problems.

Finally, I thank my parents. My father, who filled me with a great love for the sounds and sights of the natural world – in particular of birds and birdsong; and for his interest and financial assistance in support of my research. And my mother, to whom I dedicate this research, who instilled in me the love of music and who supported the development of my musical career. I was very fortunate in being able to play her the results of my work two days before she died.

Author's Declaration

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University Award.

This research was supported with a part-time fee bursary and other financial assistance provided by Dartington College of Arts.

Signed 

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CONTENTS Page

Abstract 3

Acknowledgments 5

Author's Declaration 7

1 INTRODUCTION: Backgrounds and Overview 12

1.1 Backgrounds 12

1.1.1 Music 12

1.1.2 Dance 13

1.1.3 Birdsong 15

1.2 Overview of the thesis 15

1.2.1 *Chapter 2* First phase: Four stages of investigation and exploration 16

1.2.2 *Chapter 3* Second phase: The ecosonic system 18

1.2.3 *Chapter 4* The ecosonic system in practice 20

1.2.4 *Chapter 5* Summary and reflections 20

1.3 The baroque flute: a brief description and terminology 20

1.3.1 History 20

1.3.2 Construction 21

1.3.3 Pitch 22

1.3.4 Fingering and Scales 22

1.3.5 Tessitura 23

1.3.6 Fingering chart notation 23

1.3.7 Instruments used in this research 25

1.3.8 Notes on terminology 25

2 FIRST PHASE: Exploration and investigation 27

2.1 Extended techniques 28

2.1.1 Introduction 28

2.1.2 Aims 29

2.1.3 Method of approach 29

2.1.4 Assembling techniques 30

2.1.5 Description of techniques: with comments on sources of technique 37

2.1.6 Application of technique: some possibilities 46

2.1.7 Summary 47

2.1.8 Conclusions 47
2.2 Atonal explorations in Slonimsky's *Thesaurus* 49
2.2.1 Introduction 49
2.2.2 Choice of source and materials 50
2.2.3 Method of practise/approach 50
2.2.4 Exercises and improvisation studies 51
2.2.5 Summary 52
2.2.6 Conclusions 53
2.3 Microtonal explorations 54
2.3.1 Introduction 54
2.3.2 Aims 54
2.3.3 Source of quartertone fingerings 55
2.3.4 Exercises and improvisation studies 57
2.3.5 Quartertone techniques 57
2.3.6 Microtonal speculations 59
2.3.7 Summary and conclusion 60
2.4 Mapping the Flute 62
2.4.1 Introduction 62
2.4.2 Method of practise 63
2.4.3 Description of technical means employed 64
2.4.4 Recording of information 64
2.4.5 Summary of results 66
2.4.6 Conclusions 66

3 SECOND PHASE:Ecosonic Solutions – Keys from the past 68
3.1 Introduction 68
3.2 The unfolding of a system 68
3.2.1 Silence and emptiness 68
3.2.2 *I Ching* symbolism 69
3.2.3 The *I Ching* and the baroque flute – analogies 70
3.2.4 A fingering chart not a system 71
3.2.5 Fu Xi + Leibniz = the ecosonic system 71
3.3 Description of the ecosonic system 72
3.3.1 Organization of the Super-row 72
3.3.2 Fixed-fingerings and moving-fingers 74

3.3.3 Finger-rows 75
3.3.4 Super-row and finger-row characteristics 75
3.3.5 Fixed-fingerings:action and function 77
3.3.6 Moving-fingers:action and function 78
3.3.7 The actions and functions of the little finger of the right hand 82
3.3.8 Using fewer or more than three moving-fingers 82
3.3.9 Summary of characteristics of sound and interval related to fingering order 82
3.4 Graphic, musical and verbal communication and notation of ecosonic fingering 83
3.4.1 Binary arithmetic notation 83
3.4.2 Decimal notation and spoken communication 84
3.4.3 Music notation 85
3.5 Summary 86

4 THE ECOSONIC SYSTEM IN PRACTICE 92
4.1 Introduction 92
4.1.1 Solo Improvisations 92
4.1.2 Duetting 93
4.2 Working methods 1: exercises 94
4.3. Working methods 2: form and structure 95
4.3.1 Form and structure 95
4.3.2 The meaning of structure 96
4.3.3 The meaning of form 96
4.4 Working methods 3:models and durations 96
4.4.1 Model and structure 97
4.4.2 Duration and form 98
4.5 Examples of models 99
4.5.1 Solo song models and studies 100
4.5.2 Models for duetting 102
4.6 Examples of notated improvisations 103
4.7 Examples of notated improvisations 103
4.8 Trio improvisations 105
4.9 Summary 106

5 SUMMARY AND REFLECTIONS 109

5.1. Interdisciplinary thinking: an outline of areas of research and enquiry 109

5.1.1 Visual art 110

5.1.2 Science 111

5.1.3 Ornithology 112

5.1.4 Music 116

5.2 Reflections on birdsong, music and language 118

5.2.1 Sources of expression and points of intersection 119

5.2.2 The energy of birdsong 123

5.2.3 Human sound making as birdsong 123

5.3 Problems of conception, perception and reception 130

5.4 Future developments 132

5.4.1 Content, form, structure and meaning of birdsong 132

5.4.2 Other bioacoustic models 133

5.4.3 Ecosonic techniques on other instruments 133

5.4.4 Ecosonic improvisation ensemble 133

5.4.5 New compositions 133

5.4.6 Electroacoustic improvisation 133

5.4.7 Duetting 133

5.5 The Flute as Syrinx 134

5.6 Conclusions 136

BIBLIOGRAPHY 1 138

BIBLIOGRAPHY 2 141

APPENDIX 1: Birdsong notations 154

APPENDIX 2: Music notations 164

APPENDIX 3: Technique sketches 173

APPENDIX 4: Ecosonic fingerings from zero to 63 178

APPENDIX 5: CD's 1 – 4 Track Listings 181

APPENDIX 6: List of Illustrations 186

1 INTRODUCTION: Backgrounds and Overview

The real voyage of discovery consists not in seeking new landscapes but in having new eyes.[1]

Introduction

This chapter is divided into three sections: the first section is a brief summary of my professional background followed by a few words on how birdsong has been part of my life; the second section provides an overview of the three chapters that form the body of the thesis, and of the closing chapter, which summarizes some essential aspects of thought underlying the research; the third section consists of information regarding the baroque flute that is pertinent to relating the details on performance given in this thesis, to the instrument.

1.1 Backgrounds

Expression is not the world giving meaning to me, but me giving meaning to the world.[2]

1.1.1 Music

My experience as a musician has been diverse although it began straightforwardly enough. I started playing the Boehm flute at the age of fifteen, played in the London Schools Symphony Orchestra, and won a scholarship to study at the Guildhall School of Music. My professional career began while I was still at the Guildhall, when I was invited to join a trio with the harpsichordist Trevor Pinnock and the cellist Anthony Pleeth. At the same time I was also performing with a new music group, which was of considerable interest to me, and had undertaken a certain amount of freelance orchestral work.

The trio rapidly became extremely successful, giving regular broadcasts and concert tours. It was on one occasion when we were on tour that I first encountered the baroque flute. The instrument interested me, particularly as the trio played a repertoire that was mostly, although not entirely, from the 18th century. At the same time I was becoming increasingly disillusioned with the standardization of orchestral and chamber music performance and interpretation. Over the next two or three years I taught myself to play the baroque flute recreating the technique from 18th century flute method books.

---

[1] Marcel Proust, quoted on a poster outside the Natural History Museum, London.
[2] T. Takemitsu 'Nature and Music', in D, Rothenburg & M. Ulvaeus (eds), *The Book of Music & Nature*, (Conecticut: Wesleyan University Press, 2001), p.188.

Much of this period of study was spent exploring the flutes in the Carse Collection of woodwind instruments housed at the Horniman Museum in South London. It was the Music Curator at the Horniman who started off my career as a specialist performer on early flutes when she invited me to play for a prestigious touring exhibition set up in conjunction with the Victoria and Albert Museum and the collection of instruments at the Paris Conservatoire. Before abandoning the Boehm flute completely, however, I examined as much of the new music repertoire for flute as I could lay my hands on – and decided that I had nothing to lose.

The touring exhibition, which continued for a year, set in motion my career as a soloist; as a member of the newly formed period orchestras and chamber ensembles, that then began to appear (such as the English Concert and the Academy of Ancient Music), and as a recording artist with a worldwide reputation. During this period, I broadened my studies of historical instruments and performance practice to include the flutes and music of the late 18th and early 19th century. At the peak of my studies, I was working with ten different flutes a day.

Throughout this period I also pursued a growing interest and involvement with historical dance. This resulted in the founding of two dance companies and led to a second career choreographing historical dance for opera and dance-company performances. Over a period of time, my interest in dance coupled with dissatisfaction with the 'early music movement' led to my giving up a full-time performance career as a flute player.

1.1.2 Dance

I became aware of the fundamental significance of dance in the development of music in general and of Baroque music in particular, when I began researching performance practice in 18th century France. This discovery fed a natural interest in dance that gradually developed into a deeper involvement as I learnt to read Baroque dance notation. A series of choreographed performances of Bach's B minor suite for flute and strings (BWV1067) in which I performed as the solo flute player, led to the idea of presenting my own dance performances. These began as small scale presentations, using the work of other choreographers, and evolved into my creating a company of ten dancers and nine musicians – the London Baroque Dance Theatre. This company focused on the performance of original, notated Baroque dances, and new works, most of which I choreographed myself, using Baroque techniques and forms.

The research I undertook into historical dance, the work I did with my company and the talents of the dancers with whom I worked, significantly changed the views of dance that I had held when it had first aroused my interest in relation to Baroque music. Consequently after ten years of working with dance from the 17th and 18th centuries, I created a new company that would explore the contemporary implications of historical dance. I worked with this company experimenting particularly with juxtaposition of contemporary and historical dance forms and ideas, up to the moment when this present research was begun.

Among my interests in historical dance was its relevance and application to a contemporary artistic language. It became apparent to me that dance is an art form so immediate that it is very easy to miss the significance of its immediacy. Dance deals in human aspirations as they are expressed through the body, and it cannot truly communicate with us if it does not do so in terms of bodily shapes and movements that directly relate to our daily lives. This was certainly the case in the 17th and early 18th centuries when dance mirrored the body in society.

The knowledge of dance as being rooted in the daily activity of the body and of its historical range was used by Rudolf von Laban in the development of his life's work on the creation of a system of describing and recording body movement. Like other significant early 20th century artists his work and his thinking crossed boundaries – it was expansive, visionary and acutely perceptive. I read his works extensively and they influenced my thinking on qualities of movement and sound production in relation to the human body and later, to the avian body.

This brings me to the beginning of this research, which started off with the intention of creating a contemporary form of 17th century court masque in the fusion of dance, music, poetry and visual art. The logistics of time and money, however, made the pursuit of such a project impossible and in order to continue my research I turned to the most readily accessible resource – myself as a flute player, and my interest in sounds from the natural world.

1.1.3 Birdsong

Perhaps the most wonderful thing about birds is their song. The more one listens to their music, gathering knowledge and understanding of their musical language, the more beauty the subject holds.[3]

Birds have always been a part of my life. From earliest childhood my father's love of birds made them a focus of attention, watching and listening to birds in the garden, on holiday and on regular Sunday afternoon walks. The radio was always on for the broadcast programmes of Ludwig Koch, James Fisher and Peter Scott, which were essential listening.

As a child I associated birdsong with most times of the day from the dawn song of the song thrush, the early morning rasping of jays, the jazzy chatter of sparrows and the bubbling and whistling of starlings, and the afternoon song of blackbirds, to the clamour of the evening chorus and the night-time conversations of tawny owls. The 'kaaring' of jackdaws in empty morning streets and skylark song over cornfields were a significant part of the joy of summer holidays.

Birds have been a consistent and important presence throughout my adult life although I did not begin to develop any knowledge of them, beyond that of visual recognition until the start of this research. The sounds of birds filled and shaped the world in which I grew up with something that was good, happy, alive and magical; and that is more so today after having forged new connections with song.

1.2 Overview of the thesis

My research fell into two phases. Chapter 2 is divided into four sections each covering the four stages of exploration that made up the first phase. The second phase is described in Chapter 3, while the work arising out of this phase is detailed in Chapter 4. Chapter 5 discusses information relevant as background to the thinking and process of the research.

It should be born in mind, even when it is not apparent in the writing, that birdsong remained constantly in my ear during this research, although to begin with it was a very distant voice guiding me towards my destination, only growing in presence as the work progressed.

---

[3] L. Howard, L., *Birds as Individuals*, (London: Collins, 1952), p.166

1.2.1 *Chapter 2* First phase: Four stages of investigation and exploration

The first phase proceeded through four stages which were concerned with finding sonic materials for the development of a new sonic vocabulary and a systematic means for creating an improvisational language out of this vocabulary. These four stages explored extended techniques, atonalities, micronalities, and the baroque flute itself.

1st Stage: Extended Techniques

Extended techniques encompass all those techniques that lie outside the conventional, classical use of the instrument. In the case of the baroque flute, this comprises a large body material developed on the Boehm flute that has barely been explored, and in many cases, possibly not explored at all. Other sources of material discussed are taken from historical techniques, some of which paralleled the position of avant garde material when they were proposed in the 18th century. Finally there are materials suggested by birdsong and which may be uniquely performed on the baroque flute. Details are given of the sources of techniques, methods of performance, and practical applications.

A fundamental hypothesis, underlying the first phase of research, was that extended techniques would provide the basic sonic materials for an improvisational vocabulary. It was evident, however, that a vocabulary made up from the dissimilar sounds of disparate extended techniques would require a context in which it could be developed into an improvisational language.

2nd Stage: Atonality

The word 'atonal' is used in this thesis according to the first sense of the term given under the entry 'Atonality' in New Grove.[4] In this sense it refers to all musical systems that are not tonal or arranged hierarchically in relation to a tonal centre.

Atonal scale systems as laid out in Nicolas Slonimsky's *Thesaurus of Scales and Melodic Patterns*[5] were the focus of this first investigation into developing a contextual system. The creation of a context was essential if a vocabulary of extended techniques was not to remain anything other than a disparate collection of sounds. An atonal system would provide the means for creating an improvisational language out of such a vocabulary.

---

[4] *New Grove 1*, s.v. 'Atonality'.
[5] N. Slonimsky, *Thesaurus of Scales and Melodic Patterns* (New York: Schirmer Books, 1947).

This stage of research had two aspects to it.

1. The first aspect was to discover which was the most effective atonal system for improvisation.
2. The second aspect was to establish how a vocabulary of extended techniques which could be integrated in that system.

The conclusions drawn from this exploration were, that although the intervals of atonality had appeared to reflect the varied and flexible intonation of birdsong, further investigation revealed this flexibility to be illusory, and that the semitone division of the octave became the source for an increasing sense of oppressive confinement.

3rd Stage: Microtonality

The term microtonality is used in reference to musical scale systems constructed of all intervals of less than a semitone.[6]

This stage of research covered an exploration of scales offering a greater choice of pitches than those available in the semitone division of the octave, and consequently offering more flexibility in the choice of intervals. The research was split between practical work based on an original 18th century quartertone scale for baroque flute and theoretical considerations of smaller divisions of the octave such as the system of the 20th century American composer Harry Partch.

There were three objectives to be achieved:

1. The acquirement of a technique for performing with quartertones.
2. The development of an improvisational system founded on quartertones.
3. The creation of a context for extended techniques, dependent on 2 above.

Smaller microtonal intervals were considered when it became apparent that there was expressive potential in fractional divisions of a semitone and the baroque flute was ideally suited in producing such intervals.

This stage drew to a close with the acknowledgement that to develop music conceived and played in quartertones was to follow a route of increasing technical complexity and

---

[6] See *New Grove 1*, s.v. 'Microtone'.

intellectualization. This was not considered to be consistent with an improvisational system based on birdsong or with the nature of the baroque flute.

4th Stage: Mapping the flute

Strictly speaking, mapping the flute refers to a process of investigation into all 128 fingerings that are possible on the instrument – these are comprised of 64 fingerings without using the single key and 64 with the key.

Stage 4 concludes the first phase of research while providing a transition into the second phase. As an investigation into all possible fingerings on the flute and into the sounds they produced, it is a summary of the previous three stages of research. Where it differed from these three stages was that it was pursued for its own sake without necessarily seeking particular results.

The question of how to establish a systematic context, and yet create a language out of a highly varied sonic vocabulary, remained unresolved. At the same time, the 128 fingerings seemed to present a possible solution but it was not clear how they could be used.

1.2.2 *Chapter 3* Second phase: The ecosonic system

The research described in this chapter covers the background, creation, and development of the ecosonic system. A systematic analysis in and survey of birdsong, produced technical challenges in respect of their potential relocation to a musical instrument. In particular, the physiology of the avian syrinx enables the production of pitches and sonorities which at first hearing would seem to be impossible on other instruments, though perhaps less difficult on the flute. However, by means of new kinds and systems of fingering, I have invented a new kind of performance technique on the baroque flute; one that mirrors many aspects of the natural sounds produced by birds.

Ecosonic performance is the name given to modalities of performance devised by me during my research and remain now as the single most important technical resource for the generation of new sounds and new music on the baroque flute.

Ecosonic solutions

The ideas that had guided the research of the first phase were replaced by new conceptions concerning music, birdsong and flute playing. The answer to finding the sonic potency so

characteristic of birdsong lay in a facility of execution and the absence of a predictable system (in terms of conventional music that is).

Two observations in particular made me acutely aware of the extent of unpredictability in birdsong. The first arose in using recordings of song and discovering that repeated listening to a recorded song was not the same as listening to the repetitions of a live song. No matter how unvarying a life song may seem to be, nevertheless it undergoes subtle, unpredictable changes in quality which are not conveyed by a recording of that song. If the progression and timing of these changes were completely predictable, they would surely sound no different from the recordings. This sense of unpredictability was reinforced by a second observation that arose by playing the same note repeatedly on the flute. These repetitions did not satisfactorily translate the repetitions of the songs on which they were modelled; on the contrary, they sounded mechanical. This, again, led me to the conclusion that repetition in birdsong is rarely totally predictable – that subtle changes may arise.

The idea of modelling was developed initially as an answer to the problem of mimicry. It was not the aim of this research to develop imitative techniques and improvisational forms that copied birdsong, but to create original techniques and improvisational forms that were based on birdsong. This required immersion in song while maintaining a distance from it, which in the earliest stages gave rise to what at first seemed to be an intractable problem: how were the research aims to be achieved without mimicry?

The solution was provided by the use of songs as models for sonic materials and structures. Increasingly, the practice of modelling was extended to explore any model that might produce effective improvisations. This included generalized concepts as well as precise models, both of which were particularly fruitful for developing duetting improvisations.

Research in this second phase would be characterized by openness to all possibilities. Thus ideas generated from the philosophy of Chinese painting were explored, the results of which led to the development of an improvisational system out of two chronologically, geographically and culturally separate but interestingly related, non-musical systems. These two systems were the Chinese philosophical and prognosticatory symbolism of the *I Ching*, and the European binary arithmetic code created by Leibniz (see 3.2.1 to 3.2.5).

The application of the binary arithmetic code to the ecosonic fingering system, is outlined in detail together with the structure of the ecosonic system and the terminology relating to its use. The flute is treated as an open system instrument for producing sounds. The equivalent of tonalities exist only at the moment of performance shaped by the sounds of individual fingerings within a particular sonic environment.

1.2.3 *Chapter 4* The ecosonic system in practice

The subject of the fourth chapter is the application and development of the ecosonic system by means of exercises and improvisations. It includes descriptions of some of the exercises used to develop a knowledge of the sound materials generated by the ecosonic system and to develop facility in finger technique. Approaches to developing form and structure through the use of time-limited improvisations, and the use of avian and other improvisational models, are outlined. The value of working in duet with another baroque flute player is considered and details of solo and duo improvisations are given. (See 4.1.2).

1.2.4 *Chapter 5* Summary and reflections

Chapter five summarizes the background sources to this research, underlining its interdisciplinary nature, attempting where possible to indicate how the sources influenced my work, and assessing the advantages of such an interdisciplinary approach. Following this are reflections on the relationship between birdsong, music and language. Although these reflections occupied me most intensely at the very start of my research, it was felt that they would interfere with the flow of information if they were placed before the presentation of the work itself. The chapter closes with a summary of future directions in which it is proposed to develop the work created in the course of this research.

1.3 The baroque flute: a brief description and terminology

The following sections give a brief overview of details about the baroque flute that are pertinent to understanding aspects this research related to the management of the instrument.

1.3.1 History

The baroque flute is a 20th century name for the flute used from the late 17th century up to the early 19th century, i.e., from the late Baroque to late Classical periods. This was the instrument for which composers such as Bach and Mozart wrote. It was developed in France in the second half of the 17th century, from the cylindrical, six-holed, keyless

renaissance flute. As a result of its construction, the baroque flute is a much softer-sounding instrument than the modern Boehm flute.

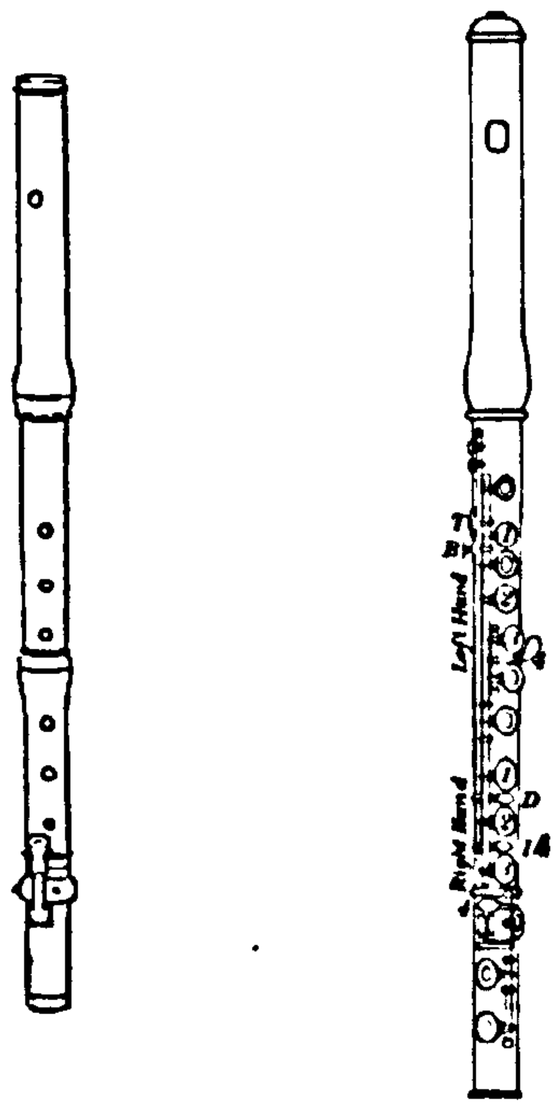

Fig. 1.1

A comparison of baroque and Boehm flutes.

1.3.2 Construction

Typically, the modern baroque flute is made of wood, such as box, ebony or African blackwood. It is usually constructed in four separate sections, which are generally referred to as joints: i.e., the head joint, left and right hand or middle joints, and the foot joint. (For a comparison between the baroque and Boehm flute see Fig.1.1).

The bore of the body is conical, tapering towards the foot joint; the head joint is cylindrical.

The head joint is pierced by a single hole – the embouchure – which is where the breath is introduced into the flute. Unfortunately this nomenclature is potentially confusing as the configuration of the lips in blowing the flute is also called the embouchure. The context usually clarifies the intended meaning.

In the three joints that constitute the body of the flute, there are seven holes. Six of these holes are open – three on the left and three on the right hand joints. The seventh hole,

which is situated in the foot joint, is covered by a simple lever key which is kept closed by a spring and is opened by the little finger of the right hand (see Fig.1.2).

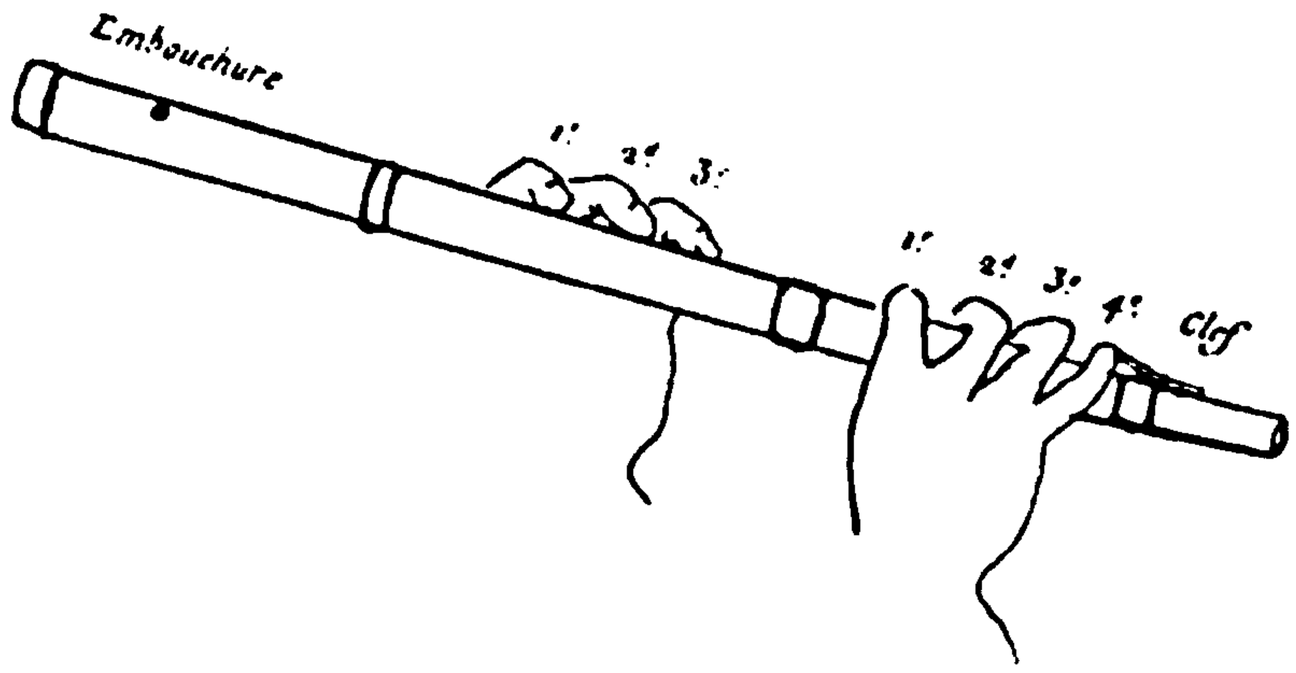

Fig.1.2

Disposition of hands and fingers on the baroque flute in relation to the embouchure and key (redrawn from Delusse *L'art de la flûte*).[7]

1.3.3 Pitch

The baroque flute is generally pitched at $A_4 = 415$Hz, i.e., a semitone below the modern concert pitch of $A_4 = 440$Hz.

Pitch register is indicated throughout this thesis using the American Standard system, for example, middle C is represented as C_4.

1.3.4 Fingering and Scales

Conventional baroque flute fingering is numbered from the index finger of the hand nearest the embouchure. Thus, the figures 1, 2, 3, 4, 5, 6, 7, as shown in Figs. 1.4 and 1.5, denote successively, the 1st, 2nd and 3rd fingers of the left hand, and the 1st, 2nd, 3rd and 4th fingers of the right hand as they are shown in the Delusse figure above (see Fig.1.2).

Fingering the natural scale

The natural scale of the flute is D major: i.e., the notes of the D major scale are produced when all the holes are closed and the fingers are raised one at a time in sequence starting from finger 6.

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[7] C. Delusse, *L'art de la flûte traversière* (Paris, 1761; Geneva: Minkoff Reprints, 1973), '*Position des mains sure la flûte*'.

Cross-fingering

Other diatonic scales and chromatic notes are produced by cross-fingering (see Fig.1.3), so-called because not all the fingers closing the holes are adjacent, i.e., there are one or more intervening open holes. Cross-fingering lowers the pitch of a natural fingering in the first register and either raises or lowers the pitch in the upper registers, or assists the production of modifying the pitch of a harmonically produced note.

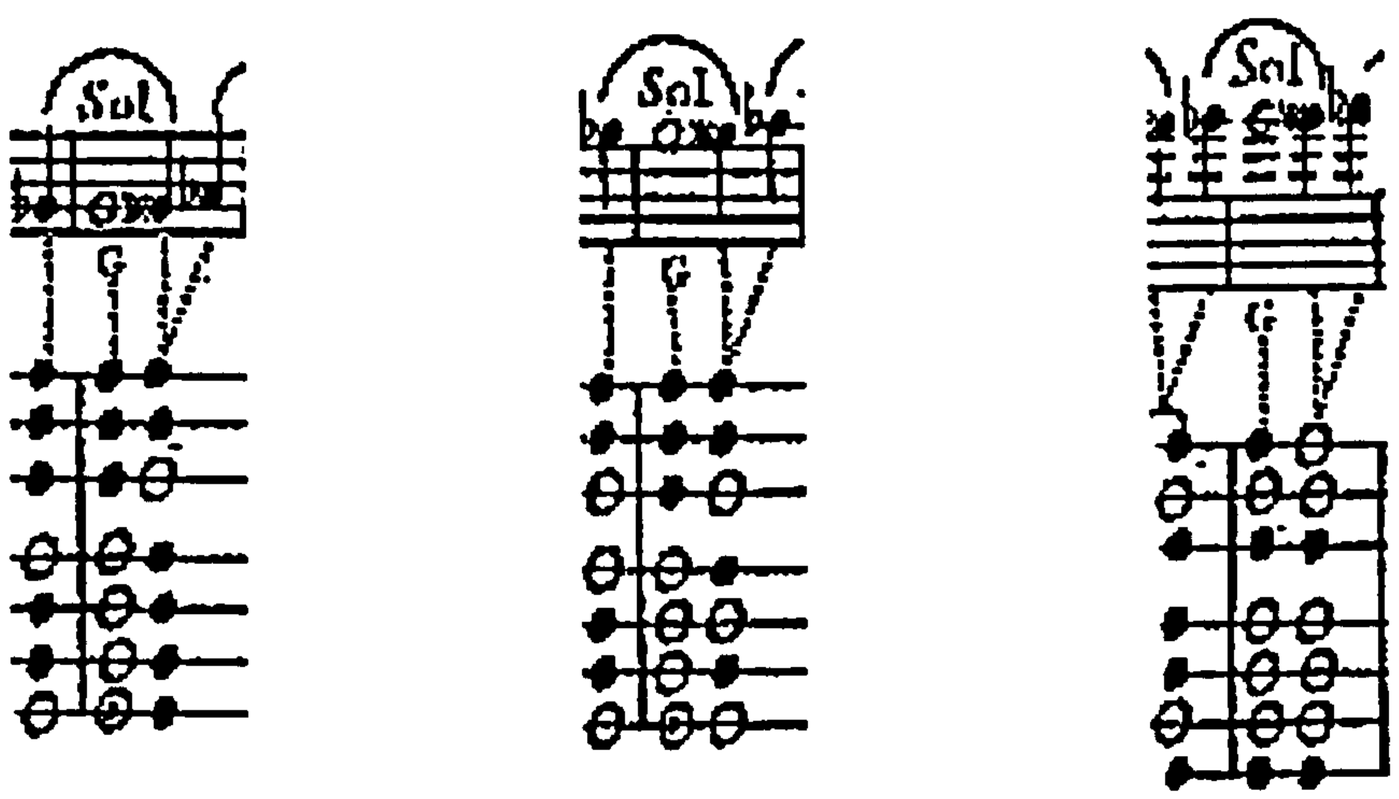

Fig. 1.3

Cross-fingerings on Gb, G and G#/Ab (from Mahaut *Nouvelle méthode*).[8]

(NOTE: Gb in 2nd register: third hole down should be closed).

Cross-fingerings modify the vibrations of the air column in such a way that sounds produced with this technique are different in quality from notes in the natural scale and may be less strong and clear. These factors depend both on the instrument and on the player's technique in handling the instrument.

1.3.5 Tessitura

The flute has a playing range of approximately three octaves, from D_4 to A_6 (see Fig.1.3). On some flutes it is possible to extend the tessitura down to $C\#_4$ or even C_4, and up to D_7.

1.3.6 Fingering chart notation

Fingerings are usually notated in one of two ways in historical method books. One way is to use figures to indicate the fingers lowered onto the flute by numbers and use horizontal lines for raised fingers, for example see Fig.1.4:

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[8] A. Mahaut, *Nieuwe Manier om binnen korten tyd op de Dwarsfluit te leeren speelen. / Nouvelle Méthode pour apprendre en peu de tems à joüer de la flûte traversière*, 2nd edn (Amsterdam: J.J. Hummel, 1759), p.7.

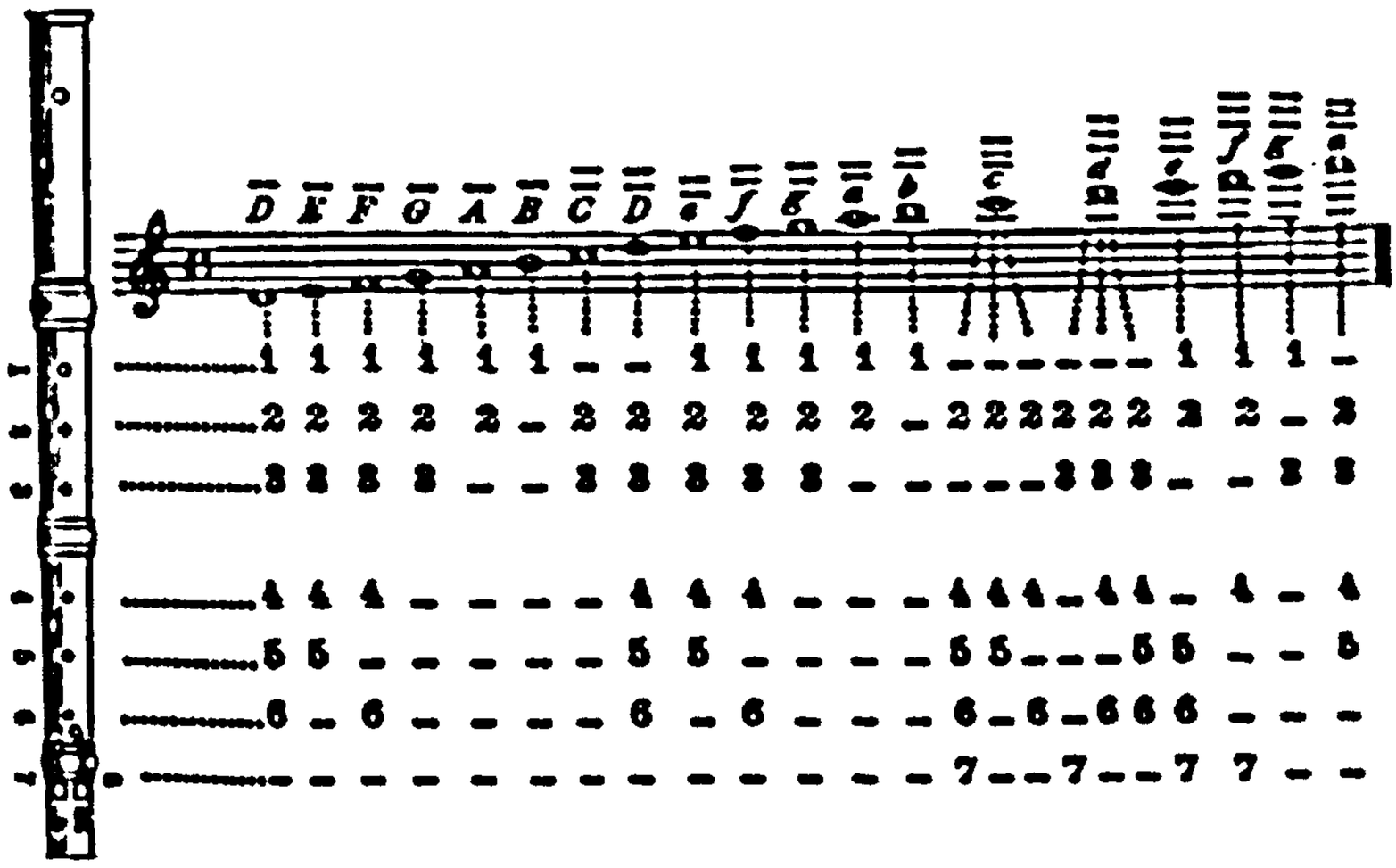

Fig. 1.4

Fingering chart showing the standard baroque flute tessitura D_4 to A_6, and the use of figures to indicate fingering (from Quantz *On Playing the Flute*)[9]

(Note: The second key indicated by 8, was added by Quantz to make an enharmonic difference between D# and Eb and harmonically related notes. This illustration has been chosen to illustrate the detailed approach to intonation in 18th century performance practice.)

The second way represents the holes of the flute graphically, with a filled circle to indicate a closed hole and an open circle to signify an open hole (see Fig.1.5, which also shows the extension of the tessitura downwards to $C\#_4$).

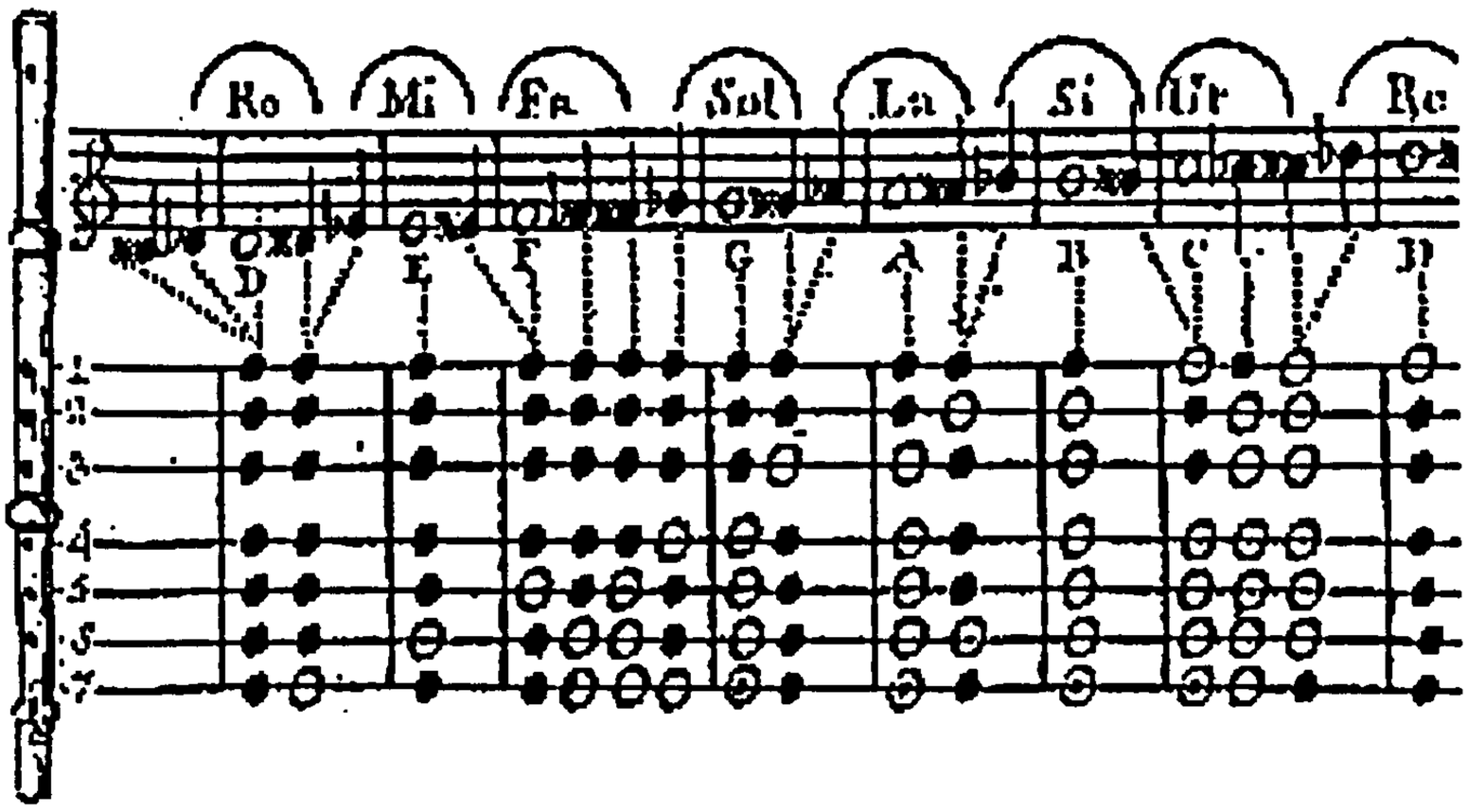

Fig. 1.5

Extract of fingering chart using filled and open circles to show closed and open holes. Note: the $C\#_4/Db_4$ is produced by rolling the flute inwards. (From Mahaut *Nouvelle méthode*).[10]

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[9] J.J. Quantz, *On Playing the Flute*, trans. E.R. Reilly, 2nd edn (London: Faber and Faber, 1985), p.42.

1.3.7 Instruments used in this research

The instruments used for this research were modern copies of 18th century instruments. They were:

- A four joint baroque flute made by Roderick Cameron after an original in the Victoria and Albert Museum, London, by Bressan circa 1720. Pitched at A415.
- A four joint baroque flute by Martin Wenner after an original by Carlo Palanca circa 1783. Pitched at A415.

1.3.8 Notes on terminology

Baroque flute, flute, and Boehm flute

Throughout this thesis, the baroque flute will be referred to either as the baroque flute or, more frequently as, the flute. Its modern counterpart will be distinguished by the designation, Boehm flute.

Register

The three octaves of the flute will be referred to throughout this thesis as either: 'lower register' (D_4 – $C\#_5$) middle register (D_5– $C\#_6$) and 'upper register' (D_6 – $C\#_7$) or: 'first register', 'second register', and 'third register'.

Resistance

This term is of significance in **2.1** Extended Techniques. Resistance on wind instruments is a term for the degree of effort needed to make a sound with the breath. The baroque flute has very low resistance and can be made to sound with almost a whisper of air. By contrast the oboe has high resistance and oboists may have to breath out unused air before they can take in a new breath. Low resistance makes a technique such as circular breathing (see under **2.1**), extremely difficult.

Embouchure

There are occasional references in Chapters 2 and 3 referring to changing the tuning and intensity of pitch by rotating the body of the flute inwards or outwards from its normal position: Fig.1.6 shows the embouchure in a normal position (according to Schwedler) and an inwards rotated position.

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[10] Mahaut, *Nieuwe Manier* p.7.

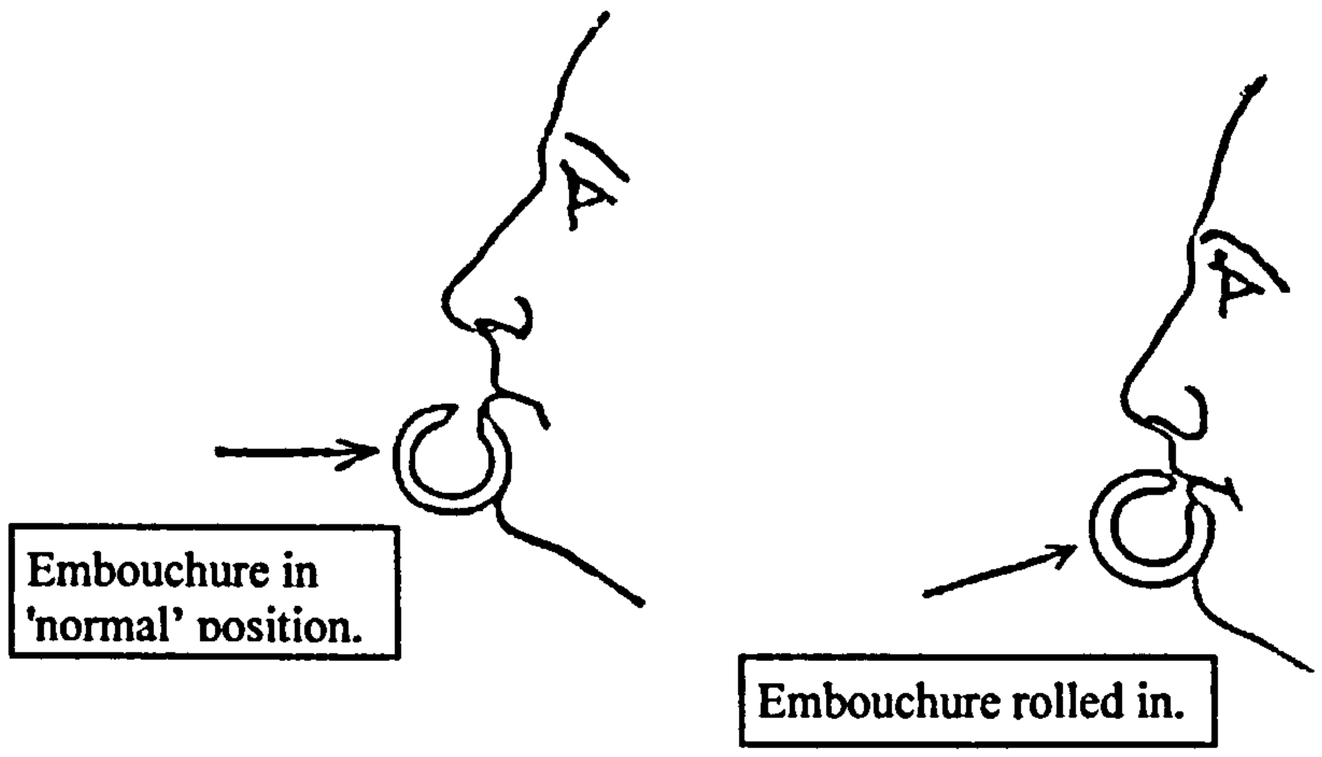

Fig. 1.6

Figures showing the embouchure in a 'normal' position and when it is rolled inwards (from Schwedler *Flöte und Flötenspiel*).[11]

NOTE: When trying to apply the information given in this thesis it should be remembered that different baroque flutes may produce very different results. This can be the case even with the same model of flute made by the same maker.

[11] M. Schwedler, *Flöte und Flötenspiel: Ein Lehrbuch für Flötenbläser* (Leipzig: J.J.Weber, 1923), p.47.

2 FIRST PHASE:Exploration and Investigation

Nothing is accomplished all at once, and it is one of my great maxims ... that nature makes no leaps ... This law of continuity declares that we pass from the small to the great — and the reverse — through the medium, in degree as well as in parts.[12]

My research began with a re-investigation of my own knowledge of music and the flute, coupled with an exploration of information relating these areas that was new to me. I also began the process of learning about and familiarizing myself with birdsong. The intention was to push at the boundaries of knowledge and practice, finding the places where they would yield new territory. There were two objectives:

i to develop a new, avian-inspired, sonic vocabulary,

ii to give the new vocabulary a context.

The process of assembling this vocabulary required that new techniques to be found and developed. Similarly, with creating a context for that vocabulary, a system for organizing the sonic materials (for example ecosonic scales, etc.) had to be found and developed from an abstract system into a usable language – at this stage of the research there was no intention to create a completely new musical system and a new technique for playing the flute. The initial decisions about what material to explore were based first of all on the need to explore possibilities of sound on the flute, and on the experience of musical languages and systems.

It was not known at the start of this research exactly what techniques would be explored except that extended techniques and atonalities would be the first areas of investigation. Neither was it decided that the research would proceed in stages until it became apparent in each particular area of exploration that there was a finite amount of ground to be covered, and that for the process to continue, I would have to investigate a new area. In addition, each area of investigation suggested ideas for deepening the exploratory process thus leading to a further two stages of research, i.e., the exploration of microtones and the process of mapping all possible ways of fingering the flute.

Just as each of the four stages was self-defining so was the period of research into which they fell as a group, and which defined them as belonging to a distinct phase of the research process. What distinguished the two phases were particular modes of thought concerned with searching for and evaluating, materials. The second phase was tightly

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[12] Gottfried Wilhelm von Leibniz, quoted in R.G.H. Siu, *The Portable Dragon: The Western Man's Guide to the I Ching*, (Massachusetts: The MIT Press, 1979).

focused on a totally new and personal area of musical development rather than on constantly looking outward to other, established modes of music making. The transition towards this second phase is clearly marked by the process of mapping the flute.

The movement through the four stages of the first phase was largely based on the decision as to whether a particular technique or musical system would be usable or not. This decision depended on considerations of how such a technique or system could be used to relocate birdsong on the flute as part of an improvisational language. This placed limitations of difficulty (awkwardness is possibly a more appropriate word) on any technical aspect that was likely to form a major part of an improvisational language based on birdsong: such a language required facility of execution. It did not matter how difficult individual and isolated techniques were, as in the case of a number of extended techniques; but it was important that a large part of the fingering technique of a particular musical system was not too complex, which would have been the case, for example, with the technique and system required for using a 43 note microtone scale as a basis for improvisation.

These considerations, by which I measured what would and would not work, were not immediately apparent and only became so during the progression through the four stages. They were part of the process of unfolding and opening up to new modes of thought and approach that grew out of the problems posed and the possible solutions presented, by each stage in this first phase of research.

2.1 Extended techniques

'The breath of the universe,' continued Tsech'i, 'is called wind. At times, it is inactive. But when active, all crevices resound to its blast. ... Caves and dells of hill and forest, hollows in huge trees of many a span in girth - some are like nostrils, and some are like mouths, and others like ears, beam-sockets, goblets, mortars, like pools and puddles. And the wind goes rushing through them like swirling torrents or singing arrows, bellowing, sousing, trilling, wailing, roaring, purling, whistling in front and echoing behind ...'[13]

2.1.1 Introduction

Extended techniques include practices that lie outside the conventional, classical use of the instrument. They include techniques such as circular breathing, multiphonics, percussive sounds and flutter tonguing; although in the case of flutter tonguing, its long and common use has become established as a conventional technique. Bearing this in mind, it might be

[13] L. Yutang, *The Wisdom of Laotse* (London: Michael Joseph, 1958), p.139.

more accurate to define extended techniques as those which require an extension of the player's command of the instrument beyond the ability to play with standard fingerings, tone production, intonation and articulation, and to the limits of highest and lowest notes accepted as normal rather than extreme.

With regard to the baroque flute, there are isolated instances of contemporary composers and players who have applied the extended techniques developed on the Boehm flute to the baroque instrument, but currently their work remains unknown to the music world at large.[14] Certainly there are no published instructional materials in the public domain, or even a body of shared experience, specifically concerning the performance of extended techniques on the baroque flute, as there are with the Boehm flute. Thus, where research on extended techniques was conducted from written materials on the flute, those materials were either from 20th/21st centuries and related to the Boehm flute or, when they concerned the baroque flute, they were from the 18th/19th centuries.

2.1.2 Aims

The aim of researching extended techniques was to develop an extensive body of sound materials as potential constituents of a sonic vocabulary. It seemed possible at this stage of research that an improvisational language might consist of bird-like sounds largely made up of extended techniques, and that these would form an integral part of an improvisational system.

2.1.3 Method of approach

This stage of research had to provide the answer to the question: Which extended techniques are possible on the instrument? A relatively large body of very different extended techniques already exist for the Boehm flute; in addition, there was the possibility of discovering new techniques specifically on the baroque instrument.

To arrive at a satisfactory answer, the following simple working methods were applied:

- Executive ability to perform the technique was acquired through daily practise.
- Once a technique had been acquired it was tested over the entire range of the instrument in order to establish the fullest possible extent of applicability.

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[14] For examples of published works see Hans Martin Linde *Anspielungun* (1988), (Mainz: Schott's Söhne, 1990); and John Thow, *To Invoke the Clouds* (solo and duo versions) (Berkeley, California: Fallen Leaf Press, 1995). The Thow piece uses extended techniques musically and idiomatically, while Linde's work is essentially a study in applying extended techniques to the baroque flute.

- Where techniques could be performed but were difficult, for example, flutter tongue on cross fingered notes in the lowest register, they were given more detailed attention.
- Greater attention was also given to those extended fingering techniques that were more than usually difficult but appeared to be worth the effort of acquiring.

Although the literature on extended techniques is not extensive, it too needed investigating to check that there were not techniques that either I did not know or about which I could learn more. Part of this check on the literature included a re-examination of historical sources in case there were techniques that had not been considered. A paraphrase of the notes I made when starting this stage of research includes the following observations:

The process of finding and working with extended techniques requires the exploration of all possibilities through research, application, observation, assessment and development. A methodical approach is needed towards both the instrument and the development of technique. At the start of this approach there are just two objectives, i.e., to seek out what is possible on the instrument and learn the physical techniques needed to make it possible. As the process of learning progresses, one must ask questions about the potential of the technique being explored, such as:

1. Does the technique seem to be feasible on the instrument?
2. Will the technique be usable as music?
3. What are the limitations of the technique?
4. Is the technique equally possible to execute everywhere on the instrument or are there places where it is impossible?
5. If it is easier to execute in some registers than others – how can the technique be improved in the registers where it is more difficult?
6. If it is a finger technique – can it be executed with equal facility by every finger and if not, what kind of exercises will strengthen the weaker fingers?

2.1.4 Assembling techniques

Summary of the techniques investigated

- Airstream use
    - Circular breathing
    - Intensity and timbre changes

- Fingering
    - Cluster fingering
    - Flutter fingering
    - Flinger slides
    - Nightingale beats
- Harmonics
- Multiphonics
- Percussion and air sounds
    - Key clicks
    - Tongue and air sounds
- Pitch bending
    - Finger slides
    - Rotating the flute
- Tonguing
    - Ballistic tonguing
    - Flutter tonguing
    - Percussive tonguing
- Uvular flutter
- Vibrato
    - Breath vibrato
    - Finger vibrato
    - Rotating the flute
- Vocalizing while playing
- Whistle tones

Sources of techniques

Techniques were assembled using several different approaches:

1. Personal knowledge, experience and practice of contemporary and historical performance practice.
2. Further investigation of historical and contemporary music and sources on technique.
3. Explorations of the flute specifically to find new techniques, for example, flutter fingering, cluster fingerings and ballistic tonguing.

Ideas from birdsong

A number of extended techniques were suggested by avian songs and calls,[15] and it is the ideas and general descriptions relating birdsong to flute playing that are given in this section. The performance of these techniques on the flute is treated in greater detail in section **2.1.5** below):

1. **Ballistic tonguing and cluster fingering**

   Both these techniques were considered in response to the volubility of some birdsong, robin song in particular. The rapidity with which birds can articulate notes and change pitch creates an extraordinary sense of freedom. My response to this was to work tongue and fingers as rapidly as possible without attempting to exercise the slightest element of control. The tonguing is called 'ballistic' because the most primitive movement responses are allowed to take precedence over conscious control.[16]

2. **Circular breathing**

   While many birds sing in short phrases[17] there are some notable exceptions, in particular the song of the skylark. The beauty of this song lies in the way it cascades from the sky in an apparently inexhaustible, unbroken flow of effortless, rippling sound.

   Other examples of this apparently unending flow of sound are the dawn and evening choruses. This feeling of superabundance is an aspect of what I was looking for in circular breathing, the ability to create a sense of inexhaustibility.

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[15] For a definition of songs and calls that is generally accepted, although subject to many exceptions, see C.K Catchpole, *Vocal Communication in Birds*, Institute of Biology's Studies in Biology 115, (London: Edward Arnold, 1979), p.11. 'As a general rule, *songs* are long, more complex in structure and produced by males in the breeding season, whereas *calls* are short, simple and produced by both sexes throughout the year', (my underlining). The difference between songs and calls is really not that easy to define as many songs either include or are made up exclusively of calls, for example, the tawny owl and the cuckoo; in some birds, the robin for example, not only do both sexes sing but they also sing almost throughout the year; and there are other species in which male and female paired birds coordinate their song (see **4.1.2**, Duetting).

[16] 'Unlike movements controlled by the cerebellum, those associated with the basal ganglia cannot be changed once they have been initiated. These 'ballistic' movements resemble a cannonball exploding out of a cannon mouth: once started it cannot be stopped and its trajectory cannot be modified ...'. From S. Greenfield, *The Human Brain: A Guided Tour* (London: Phoenix, 1998), p.49.

[17] See C.Hartshorne, *Born to Sing: an Interpretation and World Survey of Bird Song* (Bloomington and London: Indiana University Press, 1973), p.88: 'The majority of patterns are well under four seconds, and many are under two seconds. One of the shortest patterns is $^{2}/_{5}$ second, and constitutes the entire song of Henslow's Sparrow.'

3. **Dynamic inflection**

There is a constant effect of dynamic inflection or volume-change in the songs of many birds, not only because of intensity shifts but also because of changes in timbre and consequent carrying-power of the sound. In starling chatter there are dynamic shifts that resemble human conversation. Wren song seems to be produced at a constant high intensity while the dynamics of robin song change constantly, and grow particularly intense when a song duel is taking place. These constantly shifting dynamics resemble Baroque music and are far closer to normal vocal utterance and sonic events in general than the single volume, uninflected dynamics of conventional classical music.

4. **Flutter fingering**

As with ballistic tonguing, flutter fingering was suggested by a particularly characteristic element of some birdsong – the extremely rapid reiteration of a single sounds that is characteristic of robin song. Flutter fingering effectively creates a small and extremely fast pitch-change that more closely translates the sound of some forms of avian tremolo than either a trill or flutter tonguing. It is this element that is often termed a trill by writers on birdsong.[18]

5. **Finger slides**

A more or less strongly perceptible slide or 'glissando' is possibly one of the commonest and most general characteristics of birdsongs and calls: starling song is filled with slides and slides are common in the song of blackbirds. Frequent, short, sometimes almost inaudible pitch 'bends' are, however, present in many avian vocal utterances.[19] The extremely varied and often very subtle incorporation of slides in birdsong provide perfect examples of the absolute necessity for developing a complete grasp of the possibilities of a technique. Small slides between adjacent tones become a matter of course when the ability to slide over the entire instrument is acquired; and large slides can only be effective when well-executed.

6. **Flutter tongue**

Flutter tonguing is the obvious technique for representing the frequently heard buzzing and rattling tones of both songs and calls. While these types of timbres are

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[18] See for example Hartshorne, *Born to Sing*, p.189, and many bird guides. The term 'trill' is used by many writers for both a rapid oscillation between two adjacent sounds and for the reiteration of a single sound.
[19] They give the impression that they are more often placed at the beginnings and ends of individual sound elements than in the middle.

most obvious in sustained sounds such as the calls of tits and finches, they appear briefly in many songs. A brief change of timbre may be more effective in performance than prolonged flutter tonguing.

7. Harmonics and whistle tones

A familiar characteristic of avian vocal production, particularly that which is thought of as most 'musical', is sounds with few or no harmonics. As Catchpole and Slater express it. '*One of the main features of bird song is its pleasant 'tonal' quality... Tonal quality is achieved by the production of 'pure' sounds with a restricted frequency range, relatively free of harmonics or overtones.*'[20] Sounds with few harmonics are flute-like, while the fewer the harmonics the more the sound resembles a whistle.

It was not, however, the obviously flute-like or "whistled"[21] sounds I had in mind when examining whistle tones on the flute, but rather the thin, high-pitched sounds that precedes or closes short phrases of birdsong. The European robin and some thrushes produce this kind of sound, as do some great tits. The limitation of this as a technique is that whistle tones are very quiet, even on the Boehm flute, and on the baroque flute probably almost inaudible.

8. Multiphonics and vocalizing

Multiphonics and vocalizing are suggested by the avian ability to sing different, unrelated pitches simultaneously. Greenewalt first proposed the physical explanation for this ability, which became known as the 'two-voice' theory.[22] The following relates means and effects in birdsong to the flute:

A. Means

i Avian: To produce different sounds simultaneously 'the syrinx has two potential sound sources, one in each bronchus. The sounds are then mixed when fed into the common trachea and higher vocal tract'.

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[20] See C.K. Catchpole & P.J.B. Slater, *Bird Song: Biological themes and variations* (Cambridge University Press, 1995), p.27.
[21] See C.H. Greenewalt, *Bird song: acoustics and physiology* (Washington D.C: Smithsonian Institute Press, 1968): '"Whistled" is intended to characterize a song or call which is substantially free of harmonic content', pp.31-2.
[22] See Catchpole and Slater, *Bird Song: Biological*, pp.23-6, and Greenewalt, *Bird song: acoustics*, pp.55-61.

These sources are two sets of identical tympaniform membranes, under separate control and capable of functioning independently.[23]

ii Flute:

a. Multiphonic fingerings effectively split the single tube of the flute into two tubes with separately vibrating air columns.

b. Vocalizing while sounding notes on the flute creates two distinct sound sources.

B. Effects

i Avian: The simultaneous production of sounds not necessarily harmonically related.[24] (None of the sources I have consulted have discussed the possibility of harmonically unrelated sounds resulting in combination tones, i.e. sum or difference tones. Combination tones would have a marked effect on the complexity of the overall sound and quality of timbre.

ii Flute:

a. Multiphonics produce a combination of both harmonically related and unrelated sounds.

b. Where the analogy to birdsong breaks down is that the multiphonic sounds are only independently controllable to a very small degree, and multiphonic fingerings respond in very varied ways and with very different complexes of tones, i.e. the acoustic 'content' of each fingering is different and possesses a fixed ranged of sonic possibilities with a consequently very limited flexibility

c. Vocalizing while simultaneously producing a sound on the flute is potentially more flexible than multiphonics, since the vocal chords can within the capabilities of the performer, produce any pitch required.

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[23] See Catchpole and Slater, *Bird Song: Biological*, pp.24, and Greenewalt, *Bird song: acoustics*, pp.55 & 179.

[24] See Catchpole and Slater, *Bird Song: Biological*, p.25, and Greenewalt, *Bird song: acoustics*, p.179.

9. **Nightingale beat**

While nightingales produce entire phrases of an element that resembles little explosions of pure tone,[25] the ability to generate sound this way seems to be a basic attribute of the syrinx in general even if it is not exploited by all species. Clarity of attack when initiating a sound on the baroque flute is not as easily achieved as on the Boehm flute, since the sound very readily breaks up when the instrument is strongly articulated. The effect of percussive fingering is to set the air column of the flute vibrating. This seems to create two conditions:

a. The sound is generated more immediately and notes start very cleanly i.e., with minimal initial noise

b. The harmonic content is slightly enriched, creating a more colourful tone.

10. **Percussive sounds**

In considering a full range of means for producing percussive effects, my interest was stimulated not only by the instrumental sounds so concisely summarized by Thielcke;[26] (for example, wing claps, drumming, beak rattling, etc.), but also some of the vocal sounds produced by gamebirds such as the ptarmigan and capercaillie. There are a number of ways percussive sounds can be generated on the flute, for example, by using the fingers to click the key or beat on the holes.

11. **Vibrato**

Regular, periodic fluctuations of pitch and intensity seem to be an integral characteristic of much avian vocal production. As Greenewalt observes, 'A characteristic of bird song, particularly of whistled song, is the extremely rapid repetitive rise and fall, of both amplitude and frequency, found in certain phrases or notes.' He goes on to say that modulation is 'the superposition, on a sound of a given amplitude and frequency, of a modifying process which changes amplitude or frequency or both.'[27] It is clear that the effects produced vary greatly in degree and quality.[28] (It is interesting that various forms of vibrato, treated in a number of different ways and assigned different functions, are often integral to human music-

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[25] Perhaps this is the "Sweet jug" or the "Water bubble" sound one 18th century naturalist gives in a list of names London bird-catchers give to elements of nightingale song as: '*Sweet, Sweet jug, Jug sweet, Water bubble, Pipe rattle, Bell pipe, Scroty, Skeg, Skeg, skeg,* (sic) *Swat swat swaty, Whitlow whitlow whitlow...*' See D. Barrington, 'Experiments and Observations on the Singing of Birds', in *The Philosophical Transactions of the Royal Society of London*, lxiii:xxxi (1773), 249-291, p.280.

[26] G.A. Thielcke, *Bird Sounds* (Ann Arbor: University of Michigan Press, 1975), pp.10-13.

[27] See Greenewalt, *Bird song: acoustics*, pp.88, 101.

[28] See Greenewalt, *Bird song: acoustics*, pp.101-2.

making. The human love of vibrato is an area that would surely merit research). There are a number of ways that vibrato can be generated on the flute for which see **2.1.5** below.

2.1.5 Description of techniques: with comments on sources of technique

Airstream use

Circular breathing

Breath is taken in through the nose while the airstream is maintained by blowing from a reservoir of air held in the mouth, and expelled using the cheeks and lips only[29]. Circular breathing makes it possible to play the flute with a continuous, unbroken flow of sound. (For examples refer to **CD1:8-10 & CD2:11**).

Source: In Western music circular breathing seems only to have been developed in the 20th Century; however it is a traditional (and ancient) technique used by musicians in a number of cultures worldwide, for example, the playing techniques of the Persian end-blown flute, the *nay*, and the Aboriginal Australian *didjeridu* (the name of which is onomatopoeic representing the sound made as the breath is drawn in through the nose).

Intensity and timbre changes

Qualities of intensity and timbre are both controlled by the various ways that the airstream sets the air column vibrating in the flute. Embouchure shape, size and tension, shapes within the mouth, throat and chest, and the use of the diaphragm, all effect changes in the airstream. These physical means control speed, shape, intensity, volume and direction of the airstream. They are utilized in different ways to manage the production of harmonics, multiphonics, slides, cross fingered notes, and changes of timbre.

Examples of the role of airstream management:

1. Harmonics in the middle register can be difficult to locate and require very precise airstream placement and just the right amount of air flow.
2. Cross fingered notes in the lowest register are naturally 'fragile' – the tone breaks up if forced and therefore requires a precisely managed airstream.
3. Notes produced by covering a hole only partially require a gentle flow of air, for this reason finger slides require careful control of the airstream.

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[29] To develop this and other extended techniques I used Robert Dick's *Circular Breathing for the Flutist* (New York: Multiple Breath Music Co., 1987), and *Tone Development through Extended Techniques* (New York: Multiple Breath Music Co., 1986).

4. The notes which combine to produce multiphonic sounds are produced and controlled entirely by a combination of embouchure and airstream intensity.
5. Timbre is governed basically by which octave the flute is played in and on which notes are played within that octave, but further changes in the harmonic content of a note are effected by air speed, volume, intensity and direction modifications. Also, timbre is altered when using flutter tonguing or vibrating the uvula, and when vocalizing while playing.

Fingering

Cluster fingering

A group or cluster of fingers, for example, the first three fingers of the right hand, is moved completely at random and as fast as possible. Like ballistic tonguing, cluster fingerings in the strict sense of the word can hardly be called a technique. On the contrary, they require the release of all technical control; they are purely effect. Cluster fingering works very effectively with ballistic tonguing (see above).
Source: experimentation.

Flutter fingering

Flutter fingering takes advantage of the open holes and the smooth surface of the flute. One or more fingers are slid the rapidly from side to side in contact with the flute while crossing and recrossing one or more of the holes. The complexity of the effect varies according to the number of fingers used. The sound produced is a robin-like tremolo - clear, rapid and bubbling - rather than the alternation between two pitches of a trill. The effect is a brilliant reiteration of sounds characteristic of species of the thrush family. (For examples refer to **CD1:11-14 & CD2:20-1, & 26**).
Source: experimentation.

Finger slides

The fingers are either slid or rolled by degrees on or off one or more holes. Small finger holes, which are characteristic of the baroque flute, allow little room for error making this a more difficult technique than it would be on an instrument with larger holes. Consequently the tone can deteriorate as the slide is being executed and the sound may disappear; and insufficiently graduated finger movements cause sudden rather than smooth pitch changes. In terms of expressive value this is a technique worth the effort of acquiring. (For examples refer to **CD1:5 & CD2:20 & 25**).

Source: suggested as a vocal technique by Monteclair [30] and Tosi,[31] and appears in the flute and voice parts of Monteclair's cantata *Pan et Sirinx*;[32] mentioned later in the 18th century by the German flute player Tromlitz;[33] and used in the 19th century by some flute players. For examples of historical and contemporary use see the examples below in Fig. 2.1.1 (a), (b), & (c).[34]

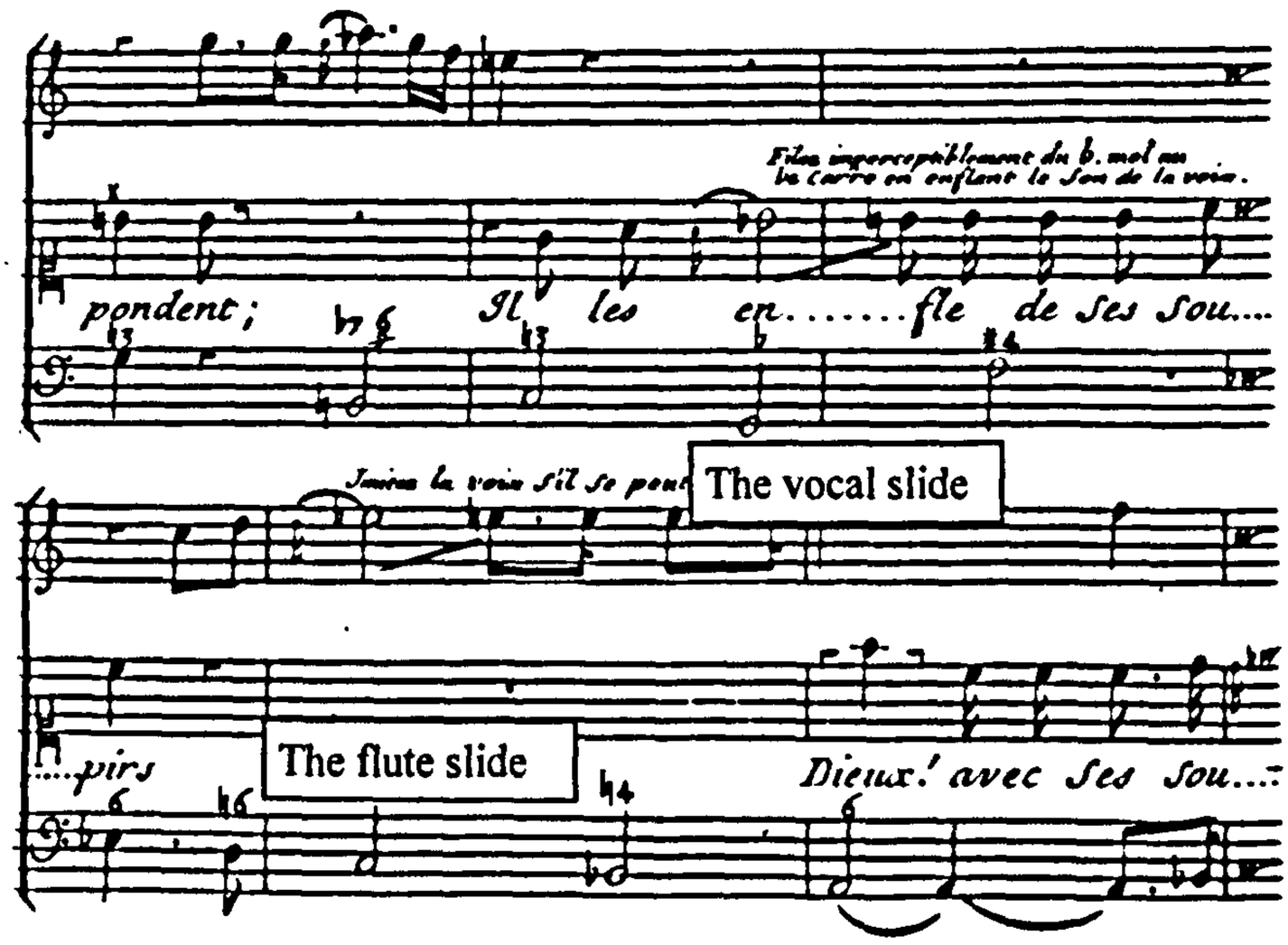
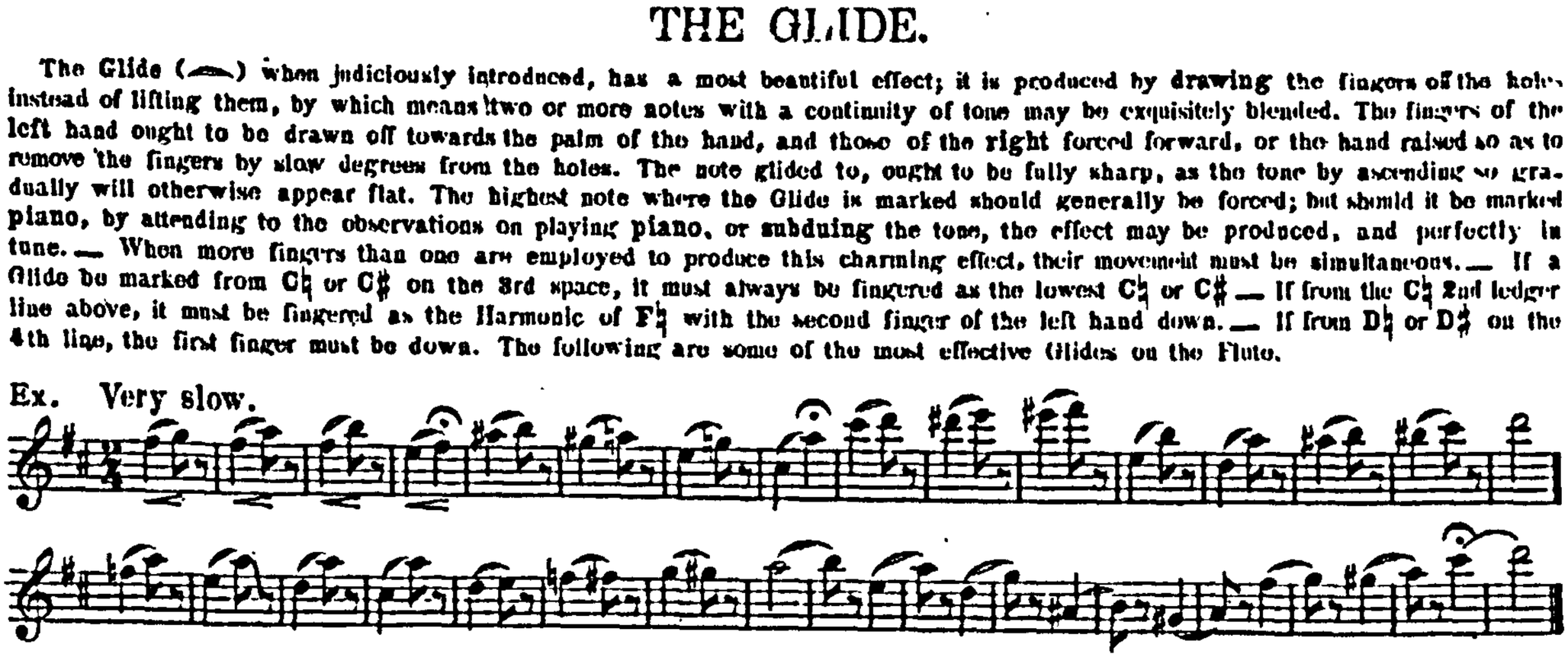



Fig. 2.1.1 (a)


THE GLIDE.

The Glide (⌒) when judiciously introduced, has a most beautiful effect; it is produced by drawing the fingers off the holes instead of lifting them, by which means two or more notes with a continuity of tone may be exquisitely blended. The fingers of the left hand ought to be drawn off towards the palm of the hand, and those of the right forced forward, or the hand raised so as to remove the fingers by slow degrees from the holes. The note glided to, ought to be fully sharp, as the tone by ascending so gradually will otherwise appear flat. The highest note where the Glide is marked should generally be forced; but should it be marked piano, by attending to the observations on playing piano, or subduing the tone, the effect may be produced, and perfectly in tune. — When more fingers than one are employed to produce this charming effect, their movement must be simultaneous. — If a Glide be marked from C♮ or C♯ on the 3rd space, it must always be fingered as the lowest C♮ or C♯ — If from the C♮ 2nd ledger line above, it must be fingered as the Harmonic of F♮ with the second finger of the left hand down. — If from D♮ or D♯ on the 4th line, the first finger must be down. The following are some of the most effective Glides on the Flute.

Ex. Very slow.

Fig. 2.1.1 (b)

[30] M.P. de Monteclair, *Principes de Musique* (Paris, 1736), p.88.
[31] P.F. Tosi, *Observations on the Florid Song...Translated into English By Mr. Galliard* (London: J. Wilcox, 1743; repr. from 2nd edn London: William Reeves, 1967), p.38:§15.
[32] M.P. de Monteclair, *Pan et Sirinx* (Paris, 1716).
[33] J.G. Tromlitz, *The Virtuoso Flute-Player,* trans. A. Powell, (Cambridge University Press, 1991), pp. 234-5, 317-319.
[34] See for example C. Nicholson, *School for the Flute* (London, 1836), p.70.

Fig. 2.1.1 (c)

Examples of sliding or gliding the fingers from: (a) Monteclair's cantata *Pan et Sirinx* (sic), the flute is requested to imitate the voice if possible; (b) the 19th century English virtuoso Charles Nicholson, showing the famous (or notorious, depending on whether you were an admirer or a detractor) 'Nicholson glide'; (c) from John Luther Adams *Songbirdsongs*; (see also the example by John Thow below, Fig. 2.1.5(b)).[35]

Nightingale beats

The fingers are used as in percussive fingering but an upper or lower note is allowed to sound slightly before the percussion. Repeated in sequences it resembles one of the most often characterized elements of nightingale song in art music and is used in this way by Couperin in his harpsichord piece *Le Rossignol en amour*.[36] Used singly as ornaments, it is often found in music of various cultures including China and India, and in Celtic music. Combined with a very clear tongue or breath articulation it produces a liquid, almost 'yodelled' sound. (For examples refer to **CD1:24-25**).

Source: suggested by the cadenza-like passage after the second time bar in the B section of Couperin's *Le Rossignol en amour* (see Fig.2.1.2).

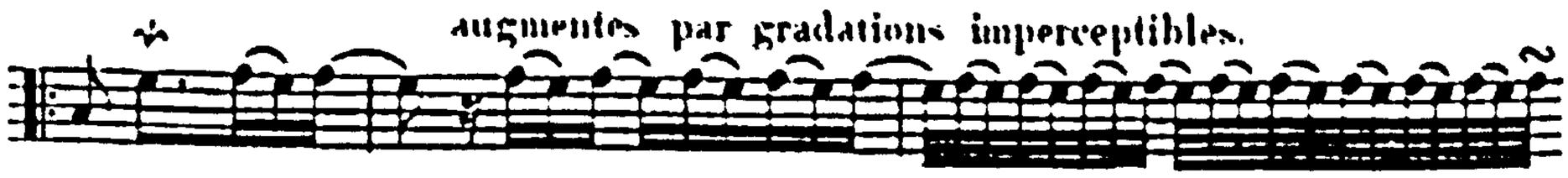


Fig. 2.1.2

The cadenza-like nightingale passage from Couperin's *Le Rossignol en amour*, (from the last five measures of the air).

[35] Michel Pignolet de Montèclair, 'Pan et Sirinx' IV[e] Cantata from *Cantates a une et a deux voix et avec sinfonie Second Livre* (Paris, n.d.), p.44: J. Harrington Young, (ed.), *Nicholson's School for the Flute* (London: Ascherberg, Hopwood & Crew, n.d.), p.32: John Luther Adams, 'Morningfieldsong' from *Songbirdsongs Book I* (Denver, CO: Alry Publications, 1983).

[36] F. Couperin, *Le Rossignol en amour* in *Troisiéme Livre de Piéces de Clavecin* (Paris, 1722).

Harmonics

Harmonics are produced by overblowing a fundamental note in such a way as to isolate a selected tone in the harmonic series making up that note. Above the 3rd partial, harmonics can be very flat on the baroque flute, depending a little on the instrument used.

Source: harmonic fingerings for the baroque flute appear in a Delusse's flute method of 1761 (see Fig.2.1.3).[37]

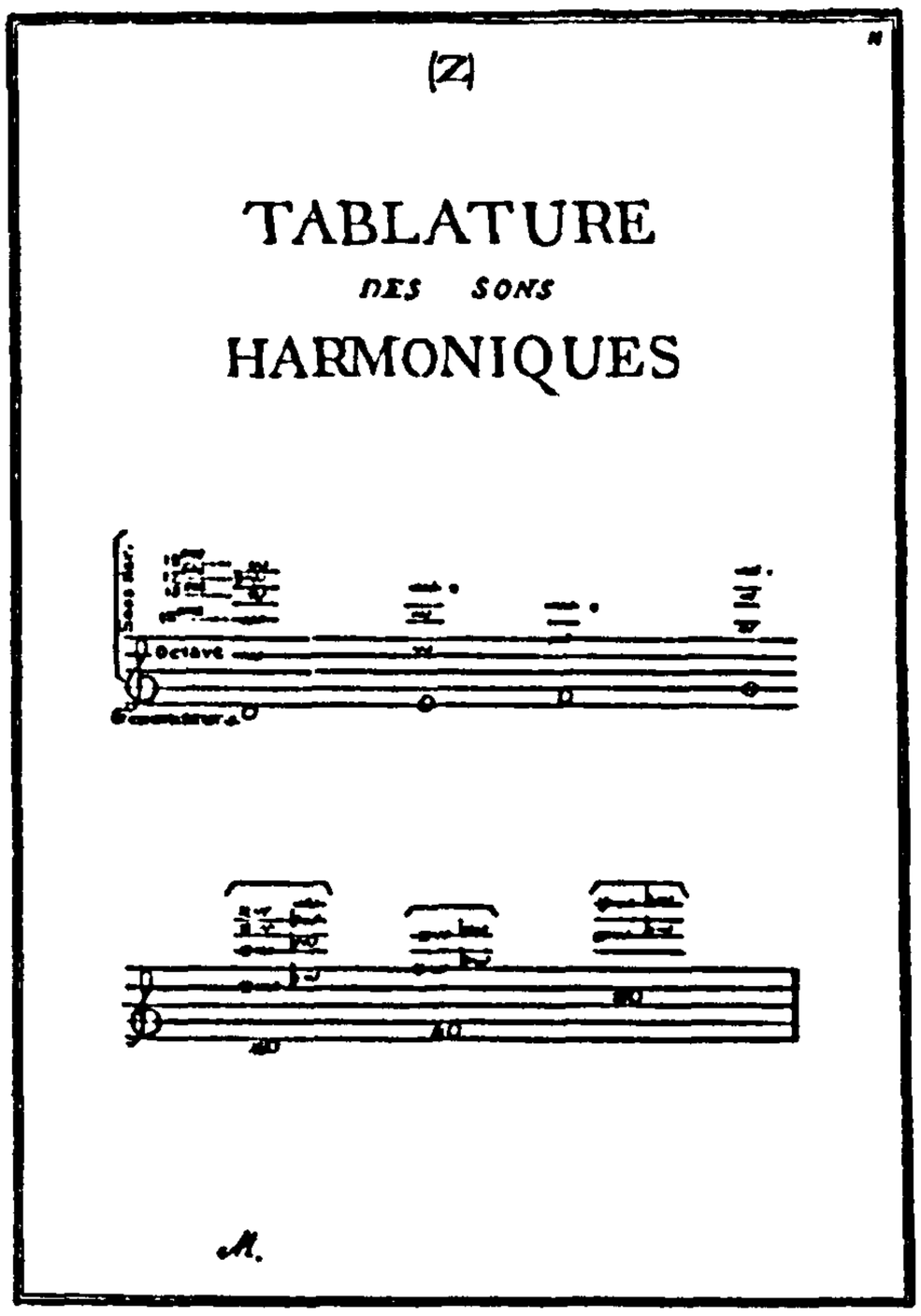


Fig. 2.1.3

The chart of harmonic fingerings from Delusse's *L'art de la flute*.

Multiphonics

The flute is fingered and blown in such a way that a note sounds the fundamental pitch simultaneously, producing one or more higher pitches. The fingerings that enable the production of multiphonics effectively split the flute into two or more tubes.[38] Although the potential number of multiphonics on the baroque flute are fewer than on its modern counterpart, there are several very rewarding groups of fingering which work extremely well, for example Gb, Ab, and Bb in the first register. The limiting factors of the instrument are the relatively small tessitura of from two and a half to three octaves, and the

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[37] See C. Delusse, *L'art de la flûte traversière* (Paris, 1761; Geneva: Minkoff Reprints, 1973), p.11.
[38] See N. Toff, *The Development of the Modern Flute* (New York: Taplinger, 1979), p.220.

simple harmonic structure of its sound.[39] (For examples refer to **CD1:11-14, 31-33, & CD2:7-8, 32, 35, & 39**).

Source: an established 20th Century wind instrument technique. There is evidence for multiphonics being used in the early 19th century.[40]

Percussive and air sounds

Percussive sounds include tongue clicks, the tongue being plunged sharply into the embouchure, the fingers slapping the holes, and flicking the key. The relative thickness of the tube walls and the proportionally small bore and finger holes, do not make the baroque flute a very resonant percussive body. Air sounds include blowing across the embouchure in order to produce more air than pitch sound and blowing directly into the embouchure without producing any pitched sound. (For an example of key clicks refer to **CD2:18**).

Source: These are much used 20th century techniques.

Pitch bending

The pitch can be bent either up or down by sliding the fingers on or off the holes, or by rotating the flute inwards or outwards, and it is also possible by means of breath-intensity variations. (Many of the improvisations on **CD's 2–4** contain brief examples of pitch bends).

Source: These are widespread techniques in flute playing which lend themselves naturally to the instrument.

Tonguing and uvular effects

<u>Ballistic tonguing</u>

Free, uncoordinated actions which consist of the tongue being moved as rapidly as possible while pronouncing (but not vocalizing) the syllables *did'll* on a single pitch, with or without the fingers being moved equally as rapidly. As with cluster fingering (see below), this is not a controlled technique but rather an effect dependent on the release of control. It is also possible, but more difficult, to waggle the tongue horizontally from side to side just behind the lips.

Source: This technique was suggested while experimenting with tonguing effects.

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[39] It is becoming apparent to me as I continue to work on this technique that it probably offers many more possibilities on the baroque flute than I had originally thought.

[40] See Toff, *Development*, p.219.

Flutter tonguing

The tongue is fluttered against the roof of the mouth producing a purring sound or a continuously rolled '*rrrrr*'. It can be a difficult to achieve a satisfactory effect when playing the cross fingered notes in the low register. I first used it in Edward Cowie's *Four Frames in a Row*[41] and subsequently in *Songbirdsongs* by John Luther Adams,[42] and *Chinese Flute Solos* by Jonathan Stock,[43] which I used as exercises. (See Fig.2.1.4 for examples from Cowie and Adams). (For examples refer to **CD1:11-14 & CD2:20-1, 37 & 40).**

Source: a long established technique, first used by Richard Strauss in *Don Quixote* (1896-97).[44]
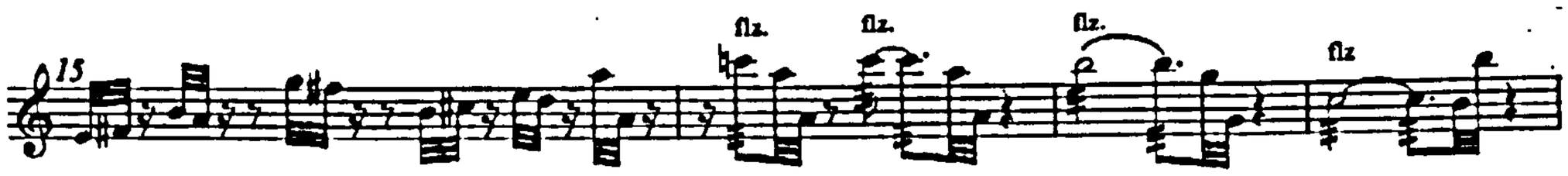
Fig. 2.1.4 (a)

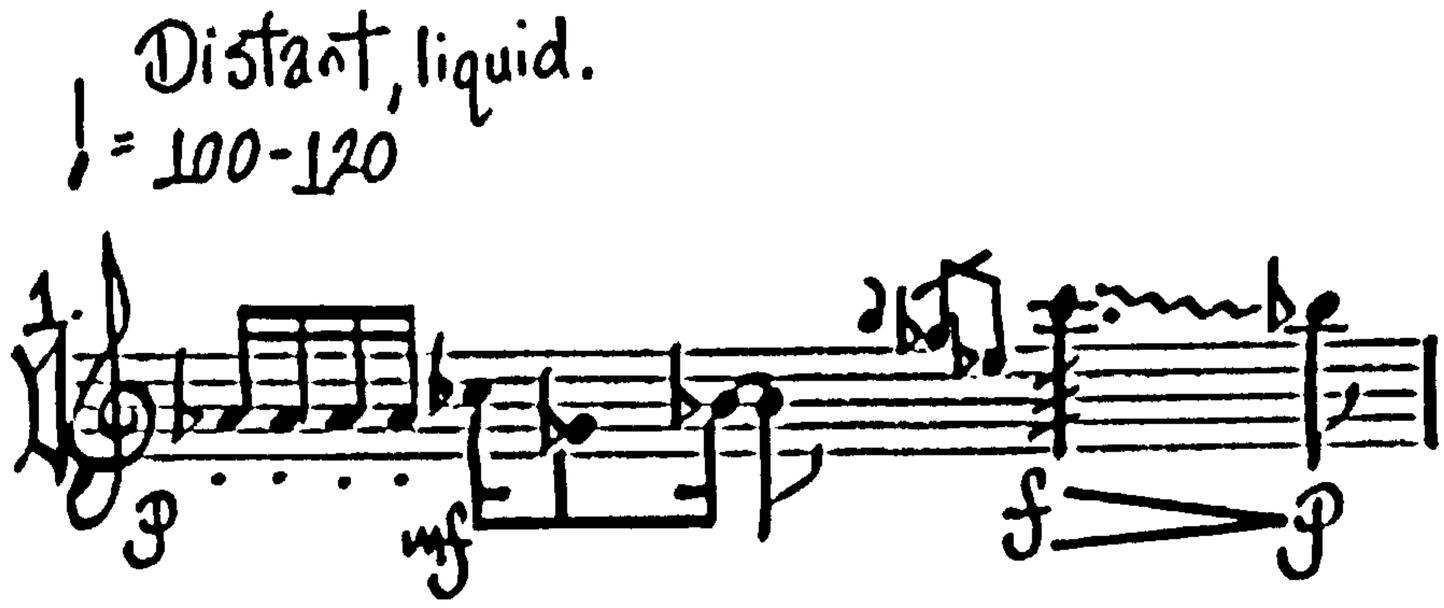

Fig. 2.1.4 (b)

Examples of flutter tonguing from: (a) Edward Cowie's *Four Frames in a Row*, and (b) *Songbirdsongs Book II* by John Luther Adams.[45]

Uvula flutter

The so-called uvula flutter is done by vibrating the uvula and resembles the French '*r*'. It offers greater clarity, causing a minimum of interruption of the airstream, but is a difficult technique to learn.

Source: One of my first flute teachers first showed me this technique before it became fairly common practice. At the time, it seemed to require an almost supernatural ability.

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[41] Edward Cowie, *Four Frames in a Row: Four Cantatas with Four Preludes,* for high voice, flute, gamba and theorbo, (unpublished, 1999-2000).
[42] John Luther Adams, *Songbirdsongs Book I* (Denver, CO: Alry Publications, 1983); *Songbirdsongs Book II* (Fairbanks, AK: Taiga Press, 1983).
[43] J. Stock, *Chinese Flute Solos: A collection of music for the traditional Chinese flute selected and transcribed for performance on the Western transverse flute* (London: Schott, 1994).
[44] N. Toff, *The Flute Book: A Complete Guide for Students and Performers* (Newton Abbot; London: David & Charles, 1985), p.120.
[45] Cowie, *Four Frames*, 'Buttercups', bars16-18; Adams, *Songbirdsongs Book II*, 'Wood Thrush', first bar.

Vibrato

Fluctuations of pitch and intensity can be made by the breath and the fingers. The degree of audibility and type of tone fluctuation depends on the method used. In historical technique, vibrato is used purely for expression and not as a fundamental means of tone production. The following list refers both to the means of producing vibrato and the resulting pitch and intensity fluctuations. (For examples refer to **CD1:11-14 & CD2:20-1, & 26,**).

i Finger: a finger beats on a hole partially closing it, controlling pitch fluctuation by the degree of closure; fluctuation of pitch is in nearly every case downward,[46] there is no perceptible intensity fluctuation in most case.

ii Breath: the speed of the airstream is increased and decreased creating higher and lower pitch and intensity fluctuations; this is vibrato as it is usually understood.

iii Finger and breath methods combined resulting in larger fluctuations of pitch and intensity.

iv Tongue: the tongue is waggled loosely in the mouth making little or no contact with the palate or teeth; there is hardly any audible fluctuation of intensity and no pitch change.

v Vocal chord: the vocal chords are tensed and agitate the airsteam; there is intensity fluctuation (a tremolo) but no pitch change.

vi Flute movement: a] the flute is gently shaken producing a soft tremolo but no pitch fluctuation or b] it is rotated by the left hand thumb away and towards the body creating pitch but no intensity fluctuations.

Source: various, from historical to contemporary. Finger vibrato rather than breath vibrato, was the usual technique advocated for the flute in the 18th and early 19th centuries (see Fig.2.1.5). Rolling the flute appears in the 18th century flute method book of Delusse;[47] vocal chord vibrato is suggested as an imitation of an organ tremulant stop in another 18th Century French source.[48]

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[46] Finger vibrato usually lowers the pitch of the played note, while rolling the flute (depending on the degree of outward and inward rotation), and breath vibrato (depending on the degree of fluctuation in the intensity of the breath), either raises the pitch or both raises and lowers it.

[47] See Delusse, *L'art.*

[48] T. Bordet, *Méthode raisonné pour apprendre la musique d'une façon plus claire et plus precise à laquelle on joint l'éntendue de la flute traversière* (Paris, c.1755).

ON VIBRATION.

Vibration (marked thus ~~~) is an Embellishment deserving the utmost attention of all those who are anxious to become finished performers on the Flute; it ought to resemble the **beats**, or **pulsations** of a Bell, or Glass, which will be found to be slow at first, and as the sound gradually diminishes, so will the Vibrations increase in rapidity. There are three ways of producing this effect,— by the breath — by a tremulous motion of the Flute, and by the Shake.— If by the breath; the moment the note is forced, subdue the tone, and on each succeeding pulsation, let the tone be less vigorous. When the Vibration becomes too rapid to continue the effect with the **breath**, a tremulous motion must be given to the Flute with the **right** hand, the lips being perfectly relaxed, and the tone **subdued to a mere whisper.**— The following is an Example where the Vibration is produced by the breath. At the commencement of the semiquavers, the tremulous motion of the Flute will be requisite.

Ex.

The succeeding Scale of notes, is one in which Vibration is the most effective, although by the aid of the breath and tremulous motion of the Flute, almost every note on the Instrument may be similarly influenced. If will be perceived in the marks of fingering, that to some of the Vibrations it is only requisite in the Shake to cover half the hole, and to others, a much less portion, bringing the finger in contact with the edge only; but this must be regulated by the Ear.

Fig.2.1.5 (a)
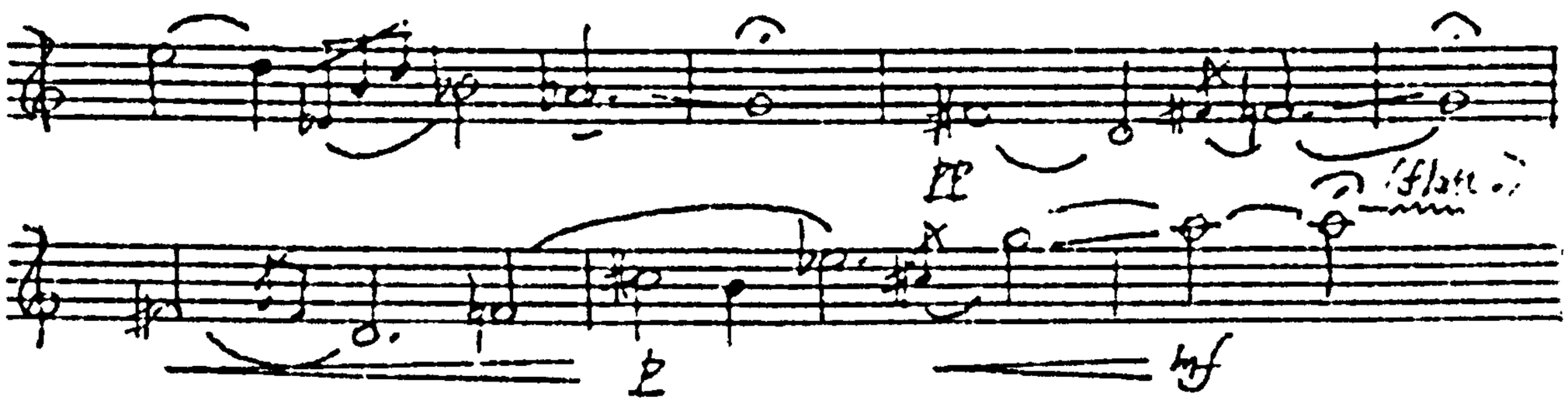
Fig.2.1.5 (b)

(a) 19th century example of vibrato from Nicholson; (b) contemporary example of finger vibrato on the second A (*flatt*) in the last bar of the example from John Thow's *Flute Lure*: (the indication *flatt.* is an abbreviation for *flattement*, the French Baroque term for finger vibrato).[49]

Vocalizing

The voice is used while playing. Depending on the pitch and strength of the vocal sound relative to the played note, the technique can produced a range of effects from a rough, pitched buzz, to the simultaneous sounding of different pitches.

Source: a widespread and ancient technique its most obvious use in Western flute music is in jazz and contemporary music.

Whistle tones

A very gentle airstream is directed towards the embouchure at an angle and intensity that is sufficient to create a whistled harmonic sound from the edge of the hole but not strong enough to set the air column vibrating in the flute. Whistle tones produce harmonics of whatever notes are fingered. Due to the lack of resistance and the relatively 'blunt' edge of a wooden embouchure, whistle tones are extremely quiet on the baroque flute.

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[49] Harrington Young, *Nicholson's*, p.32: John Thow, *Flute Lure (Yuchi)*, unp. ms. n.d.

Source: A standard extended technique and one which I have used for many years as a means of increasing embouchure control and flexibility, particularly when swapping between different flutes.[50]

2.1.6 Application of technique: some possibilities

1. Ballistic tonguing, cluster fingering and finger flutter are appropriate techniques to interpret those oscine species[51] that have voluble song with elements that include warbling, tremolo and 'chatter' (i.e. an outpouring of less obviously pitched or tonal song).
2. Finger slides possibly have the widest application of all, certainly as degrees of glissando are present in the vocalizations of so many orders of birds, not just song birds.
3. Vibrato is relatively common in birdsong.
4. The range of percussive sounds (as distinct from percussively articulated tones produced by fingering) is limited by the sonority of the flute and is probably only suitable as interpretations of those species that produce such sounds vocally.
5. The presence of buzzed sounds and noises is also common to many orders of bird which means that, used flexibly and subtly, multiphonics, vocalization and flutter tongue would not remain isolated special effects but would become incorporated into a general technique. Clearly there are instances where these techniques would be appropriate to an entire improvisation: for example, the song of the skylark.
6. Circular breathing on the other hand can have a specific interpretive function in relation to long unbroken avian vocalizations as well as a generalized interpretive value in the performance of impressionistic improvisations.

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[50] See J. Krell, *Kincaidiana: A Flute Player's Notebook* (Culver City, CA: Trio Associates, 1973), pp.6-7.
[51] Oscine species are those that are commonly referred to as 'songbirds'. Birds are divided into some 28 orders consisting of about 9,845 species, the largest of which, making up almost 60% or 5,900 of the total number, is the Order Passeriformes or 'passerines'. Passerines, also called 'perching birds', are further divided into oscines and sub-oscines. The popular names 'perching birds' and 'songbirds' are not particularly useful descriptive terms, however, as many non-passerines perch – owls, cuckoos and parrots, for example, many oscines are not great singers, while some sub-oscines are; and there are wonderful sounds that are made by many non-passerines. As my research progressed and I became more familiar with bird sounds from beyond the borders of Western Europe and with species other than familiar garden songbirds, I became increasingly aware of the huge variety of vocal and instrumental sounds that are made by the birds of the world of all species. I also began to think in terms of all the sounds made by birds as being 'song' – at least when considering them from a personal, musical point of view; although for the purposes of study, discussion and communication, I separate sounds into the usual categories of songs, calls and instrumental sounds.

2.1.7 Summary

The investigation of extended techniques differed in a number of ways from the other three stages of the first phase:

1. It was an investigation into sound materials as constituents of a sonic vocabulary and not an investigation into a potential systematic language. It depended on the development of a systematic language to contextualize any elements of vocabulary that were assembled. For this reason, work on extended techniques ran continuously with the other three investigative stages of the first phase.
2. Many of the techniques explored had not been established as possible on the baroque flute, and in most cases had probably not previously been investigated. Consequently there were no existing models to prove that they were feasible. Some techniques required a considerable amount of time simply to acquire a sufficient grasp to evaluate whether they would be possible on the baroque flute. A particular example of this is circular breathing. The embouchure of the baroque flute offers very little resistance to the airstream, but whether it offered too little resistance for circular breathing to be possible could not be ascertained until a sufficient command of the technique was acquired.
3. At this stage of the research, it seemed reasonable to hypothesize that an improvisational language based on birdsong might consist largely of bird-like sounds, many, if not most of which, would be created using extended techniques. In this respect, research into extended techniques was only a distinct stage of investigation as long as it seemed to offer this outcome. It became evident, however, that sounds developed outside the context of a musical language can exist only as abstract sonic objects, and not as elements of a vocabulary. Such sounds only acquire meanings, and the status of a vocabulary, when they are embedded in a musical language and serve to extend its expressive possibilities, like ornamentation in historical music.

2.1.8 Conclusions

Extended techniques are a sonic resource analogous to ornamentation in baroque music. As with baroque ornamentation they can greatly extend the expressive vocabulary but unlike baroque ornamentation they seem in general to be arbitrary and not essential to the musical systems in which they are placed. Most contemporary music does not need extended techniques in the way that 18th and 19th century compositions needed ornamentation to generate expressive value. By this, I mean not just the addition of ornaments as figures, but

also the manner in which one performs them; not only the large scale embellishment of entire movements, but also the small scale use of ornaments focused on a single note - a turned trill for example. One has only to look at the extremely bare compositions of many Italian Baroque opera arias, or the slow movements of hundreds of 18th Italian sonatas, to realize just how essential ornamentation was. Equally one has only to listen to a few movements of French Baroque music, Couperin for example, to realize how essential it is for the performer not just to know what small ornaments are what, but also how to perform them with the correct expression.

The manner of performing the ornaments is covered in almost as much detail in the best historical method books as the explanation of the ornaments themselves. Ornaments such as the appoggiatura, were rarely notated in Baroque music, but they were regarded as essential to expressive performance. In order to maintain the full expressive value of appoggiaturas, they also need to be played with a particular dynamic shape, i.e., in a way that is different from a written note. Apart from the appoggiatura, however, there are many ornaments that were regarded as essential, for example, turns, different kinds of trill, and trill-preparations and terminations; the messa di voce (the graduated crescendo and diminuendo of a long sustained note); the addition of different speeds and types of vibrato, and the use of contrasted dynamics. The ornament list is long, while the techniques for performing them are as important as the ornaments themselves, which is a fact far too often ignored by performers, and almost always overlooked by writers on the subject.

It is worth remembering that one of the contemporary criticisms of Bach was that he wrote his music with all the ornaments in them, and that the apparently monumental quality of his music, which is a feature of many 20th century interpretations, arises from the misinterpretation of elaborate ornamentation as if it is the solid substance of the composition. Clearly Bach had very specific ideas about the expression of his work, but in ornamenting the music of Vivaldi or Marcello, as he does in his keyboard concertos BWV973 & 974 amongst others, he was only doing what composers usually expected the performer to do, i.e., to flesh out the bare bones of their music by ornamenting as skilfully as possible and realizing its expressive potential. Telemann shows just how much a simple melody can grow in expressive stature in his *Sonate Metodiche*, op. 13, in which he presents the first movements in both plain and ornamented versions. On the other hand Corelli retained his status as a 'classical' composer throughout the 18th century, partly because of the quality of his unornamented slow movements.

It is comparatively easy to understand how baroque ornaments relate to the expressive meaning of baroque compositions and how they function in a performance context, but the same does not seem to be true of extended techniques. There are some flute players, for example, Robert Dick and Ian Anderson (perhaps best remembered from the rock group Jethro Tull), for whom extended techniques are integrated into their music making, but they are exceptions which prove the rule, extended techniques are not essential.

This does not mean, however, that extended techniques may not be appropriate for increasing the expressive range of improvisations based on avian sounds. Bird vocalizations across all species present the musician with a wealth of sonic material.[52] This material includes vocal and instrumental sounds (i.e. made by beak, feathers or wings) such as clicks, booms, rattles, buzzes, drumming, squeaks, squeals, complex simultaneous sounds, and so on; the possibilities seem to be endless.

Although a usable vocabulary of extended techniques was not established it became clear that the baroque flute offered a much greater range of possibilities than its technologically simple construction might suggest. This exploratory stage demonstrated that the baroque flute could be played successfully in a number of non-traditional ways, using new fingering techniques and methods of sound production. The discovery of technical possibilities was a vital factor leading to the successful outcome of this research, while continued attempts at applying particular techniques, for example flutter fingering, has led to insights as to how they might function musically.

2.2 Atonal explorations in Slonimsky's *Thesaurus*

2.2.1 Introduction

This was the first stage of research to focus specifically on finding a system on which to base improvisations. Atonality seemed to be the most fruitful field for exploring the possibilities of developing a successful system for improvisation. Such a system would provide the necessary context for a vocabulary of extended techniques, integrating them into an improvisational language.

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[52] See for example: Thielcke, *Bird Sounds,* pp.10-26; and A.L. Turnbull, *Bird Music* (London: Faber & Faber, 1943), p.19.

2.2.2 Choice of source and materials

Atonality.

The reason for exploring atonal rather than tonal systems was based on the following assumptions:

1. Key systems structured around a tonal centre would bias the emphasis of improvisations towards the requirements of tonally based key structures; and they would push the improviser towards working within the framework of existing melodic parameters. Inevitably, this would divert the improviser's attention from a relatively unconditional response to avian song to a response that fitted an existing musical system.
2. The more equal structures of atonal scales, and the pitch relationships they generated, would offer possibilities of a freer more open response.

Slonimsky's *Thesaurus*.

Slonimsky's *Thesaurus of Scales and Melodic Patterns,*[53] was chosen because of its encyclopaedic comprehensiveness. This monumental compilation of atonal scales was intended to serve as a resource for composers in search of new materials and as such, it was an ideal resource for improvisation.[54] The *Thesaurus* offered several advantages:

1. It contained a very wide range of materials in a very concise form.
2. The abstract presentation of materials allowed exploration without the constraint of being directed towards a particular compositional technique.
3. Because the underlying structures of the scales explored were both simple and reiterative, improvisations could be created using very small vocabularies of pitches.

2.2.3 Method of practise/approach

Scale construction

Slonimsky's scales are based on elaborations of the intervals within octaves divided into two or more equal parts. In the simplest of these, which is the two part division, the octave is divided into a tritone (see Fig.2.2.1 (a)). Scales are generated by subdivision of these intervals into subsystems of equal and symmetrically ordered intervals. For example, each of the first four scales based on the tritone are constructed from the interpolation of one note placed at successively larger intervals from the three notes comprising the basic division of the octave (see Fig.2.2.1 (a)). Further scales are generated with yet smaller

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[53] N. Slonimsky, *Thesaurus of Scales and Melodic Patterns* (New York: Schirmer Books, 1947).
[54] See Slonimsky, *Thesaurus*, p.1.

equal subdivisions of intervals within the octave. These interval divisions range in number from two to twelve parts, and span the compass of one to eleven octaves.

Focus of practise

Slonimsky's methods of construction generate 1,329 scales,[55] melodic patterns and intervals, many of which either exceeding the technical resources of the flute, or offering more complexity than was useful at this stage of research. Thus, the scales that were chosen for exploration were those of the simplest construction and fewest notes.

2.2.4 Exercises and improvisation studies

Scales studied were those of one octave divided equally into one, two, three, four and six parts (the latter being the whole tone scale). The scales and formulaic melodic patterns devised by Slonimsky provided sufficient material to explore its potential usefulness without the necessity of additional exercises (see Fig.2.2.1). Each scale was explored in all available pitches and registers of the flute. Short improvisational studies were also used to gain a more musical insight. (Examples based on Slonimsky are on **CD1:27-30**).

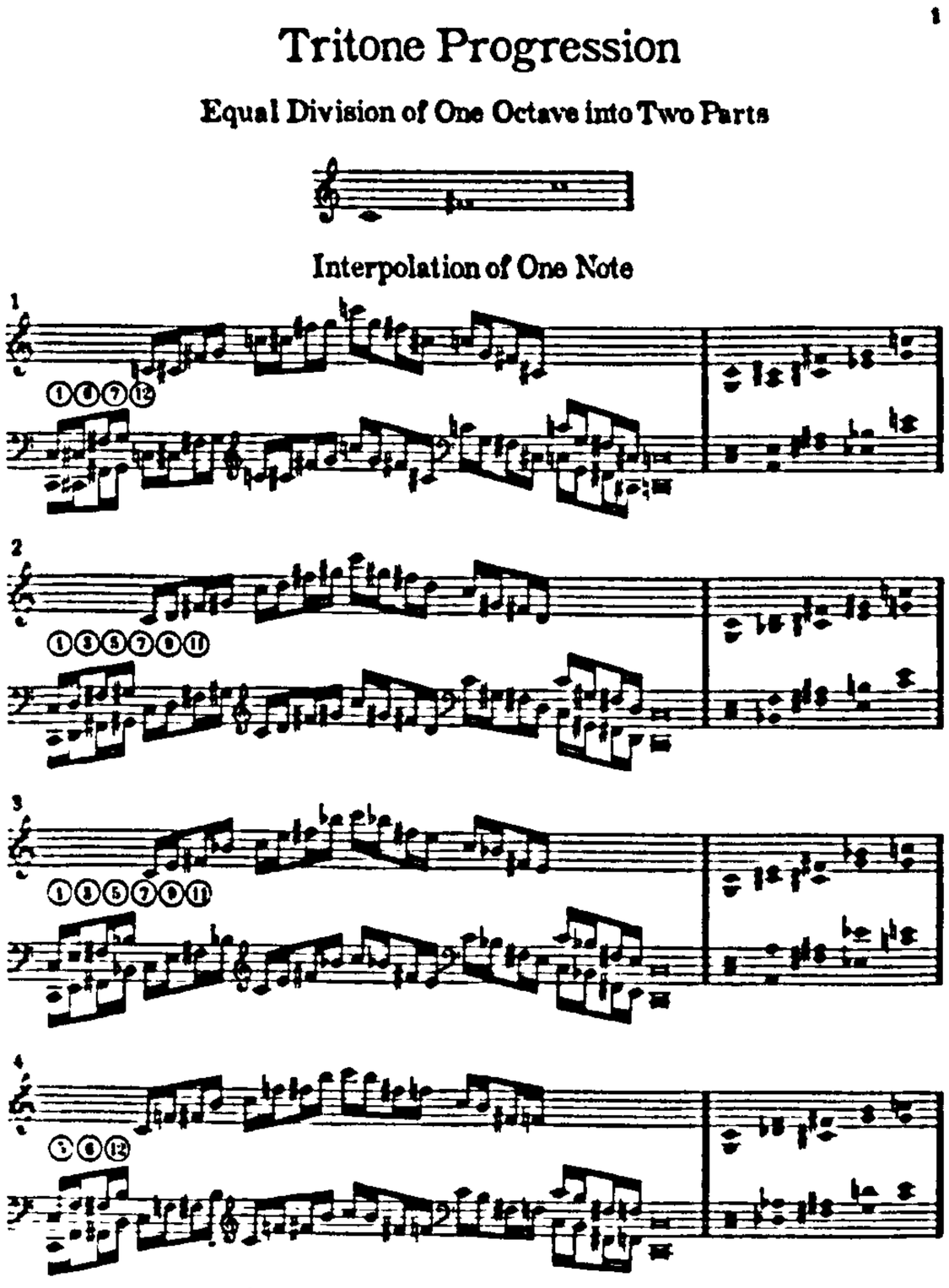

Fig. 2.2.1(a)

[55] This is the total numbered: there are in addition, several hundred progressions derived from these particular scales and patterns.

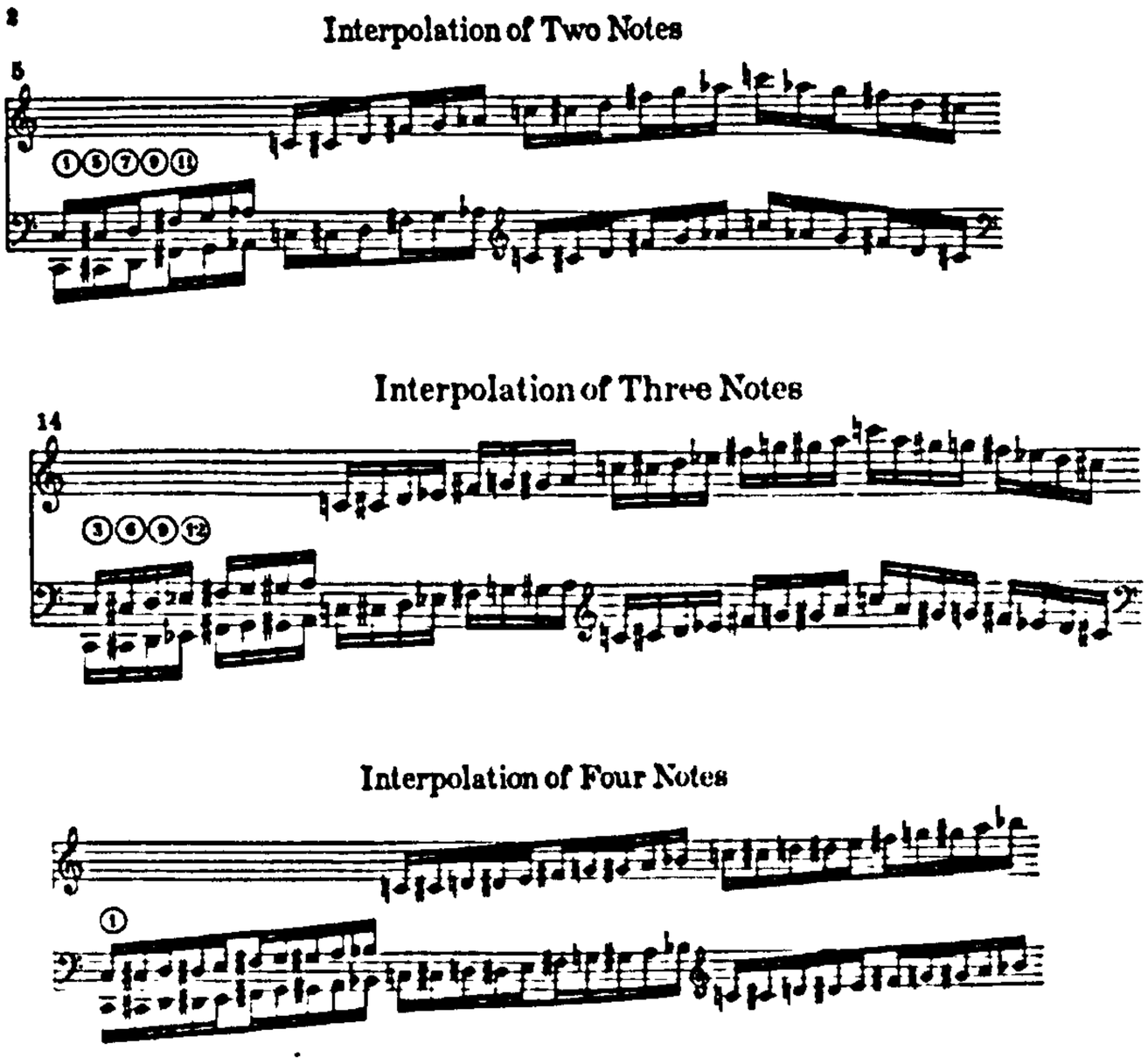

Fig. 2.2.1(b)

Examples of scale progressions with interpolations of (a) one, and (b) interpolations of two, three and four notes based on the tritone progression C-F#-C, (from Slonimsky's *Thesaurus*).

2.2.5 Summary

Much of the material in Slonimsky's *Thesaurus* far exceeds the technical demands of the music for which the baroque flute was conceived and designed. The density and juxtaposition of accidentals often lie very awkwardly on the instrument, moving from one complex cross-fingering to another and requiring extremes of adjustment of pitch and tone. Such difficulties would not be problematic or detrimental in composed music because technical problems can be resolved before the performance; but they presented the following problems for the improvisational aims of this research:

1. Facility while improvising could only be achieved through a selective use of the materials but the result of this selectivity would be to limit the range of what is possible on the instrument.
2. The selective use of material would also constrain the potential range of interpretive responses to birdsong. It would put limitations in place before the limits of creative and instrumental possibilities had been fully explored and mapped.

Satisfactory musical results were more difficult to achieve than had been anticipated, and not only because of awkward technical demands. While atonality, in particular the whole tone scale, did seem to offer greater freedom for improvisation than any tonal system, it became apparent that it did not carry any less stylistic impedimenta than tonality. It was relatively easy to make an 'avian' style of music but it seemed to consist only of stylistic habits. The knowledge that there was a great deal more to both the potential of the flute and the substance of birdsong, suggested that atonality was not going to produce an ideal solution. Neither did it appear to offer a solution to the question of creating a context for an extended techniques vocabulary. It did, however, point to new directions which are discussed in the following conclusions.

2.2.6 Conclusions

While atonality may make it possible to translate the inflections of avian song more effectively than tonal music, this investigation did not produce convincing evidence that it would produce either an effective system or a satisfactory improvisational language. In trying to relate the materials of Slonimsky's *Thesaurus* to my response when listening to birdsong, I became aware that the distance between what I was hearing as song and what I was producing as music was growing wider. Unlike the tonal to microtonal flexibility of avian song, atonality alone was too rigidly predictable. The problem was that the semitone as the smallest division of the octave was too large.

It was now clear that one of the apparent advantages of atonality over tonality, i.e., the possibility of using augmented and diminished intervals to suggest wider and narrower "out-of-tune" intervals, was not enough to justify continuing this stage of research. Insight acquired during the exploration of Slonimsky's scales led to the realization that using any system with the semitone as the smallest interval was too restricting. Greater flexibility in interval width was needed.

This suggested an investigation of a system based on intervals smaller than a semitone: i.e., quartertones. Such a system would satisfy the need for flexibility in interval width, and would without doubt come closer to a characteristic of the songs of many avian species. Equally important, it would mean that the characteristic flexibility of the baroque flute could be more fully realized and its potential more fully explored.

In conclusion, it also became evident that the technique required for playing atonal scales on the baroque flute is not ideally suited to the high degree of fluency and agility required for creating an improvised music based on avian song. The time needed to gain sufficient facility did not balance favourably against the potential musical results. Furthermore, the size and complexity of physical movements required for rapid playing of large numbers of complex cross-fingerings, accompanied by necessary adjustments for tone and intonation, did not suggest an ideal technique for improvisations based on birdsong.

2.3 Microtonal explorations

But to say that particular shadings of pitch are essential in a particular kind of musical context is not to say that those shadings are best described in terms of some sort of microtonal scale... Hypothetical precision justifying ancient quantification schemes by invoking modern ones, however, merely constrains the flexible realities of intonation and expression without in any way accounting for them.[56]

2.3.1 Introduction

The practical focus of the research into microtones was on quartertones while smaller divisions of the octave were given theoretical consideration but were not subjected to physical exploration.

2.3.2 Aims

The aim of the microtonal[57] explorations was to investigate means of playing with pitches and intervals that might more closely translate birdsong into music. Messiaen's solution had been to enlarge the scale of intervals in his compositions by transforming microtonal intervals into semitones: '*All* (intervals) *are enlarged but the proportions remain identical, It is an exact transposition of what I heard, but on a more human scale.*'[58] The human ear, however, can very well appreciate much smaller intervals than a semitone and it appeared to me that one of the reasons human beings appreciate birds so much is because of the nuances of pitch in their songs. These subtleties were persuasive arguments for not following Messiaen's path:

1. The results of the previous explorations of atonality had not provided the expressive intervals that had been looked for.
2. While on the one hand the baroque flute seemed too limited in range to achieve the degree of microtone-into-semitone translation that Messiaen could apply, on the

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[56] *New Grove I*, s.v. 'India: Tonal systems', §II:1, iv (d).
[57] The term microtonal is used to cover all intervals smaller than a semitone.
[58] Quoted by Patricia Althaparro-Minck in liner note to Olivier Messiaen, *Catalogue d'oiseaux. Petites esquisses d'oiseaux.* 1997. Compact disc. Naxos. 8.553532-4.

other, it possessed characteristics of pitch flexibility unachievable on any of the more mechanically developed instruments that Messiaen used, for example a Boehm flute.

3. If, as seemed increasingly possible, microtonal intervals (including those that were virtually inaudible), were far more important factors than I had realized in the effect that birdsong has on me, then the characteristics of the baroque flute made it feasible to develop a more avian sounding pitch vocabulary in order to test this possibility.

4. Finally, the problem of creating an improvisational technique in which microtonal intervals could be transposed spontaneously to the equivalent tones and semitones seemed insuperable.

As this stage of research progressed, it became clear that quartertones had considerable potential, consequently consideration was then given to developing a larger microtonal vocabulary using yet smaller intervals. This work however, because of reasons that became apparent only after it was started, was not pursued beyond theoretical consideration and was not explored practically. The reasons for this are explained below in **2.3.4** and **2.3.5.**

2.3.3 Source of quartertone fingerings

Information and fingering of quartertones on the baroque flute came from a single source: a French flute method book of 1761.[59] This 18th century instruction book contains three pages of information on quarter-tones. It begins with a page of explanation (EXPLICATION), followed by a fingering chart for a quartertone scale (see Fig.2.3.1), and closes with a melody and bass line, AIR A LA GRECQUE (called in the explanation 'un petit ESSAI'), to demonstrate the context and expressive use of quartertones.

[59] C. Delusse, *L'art de la flûte traversière* (Paris, 1761; Geneva: Minkoff Reprints, 1973).

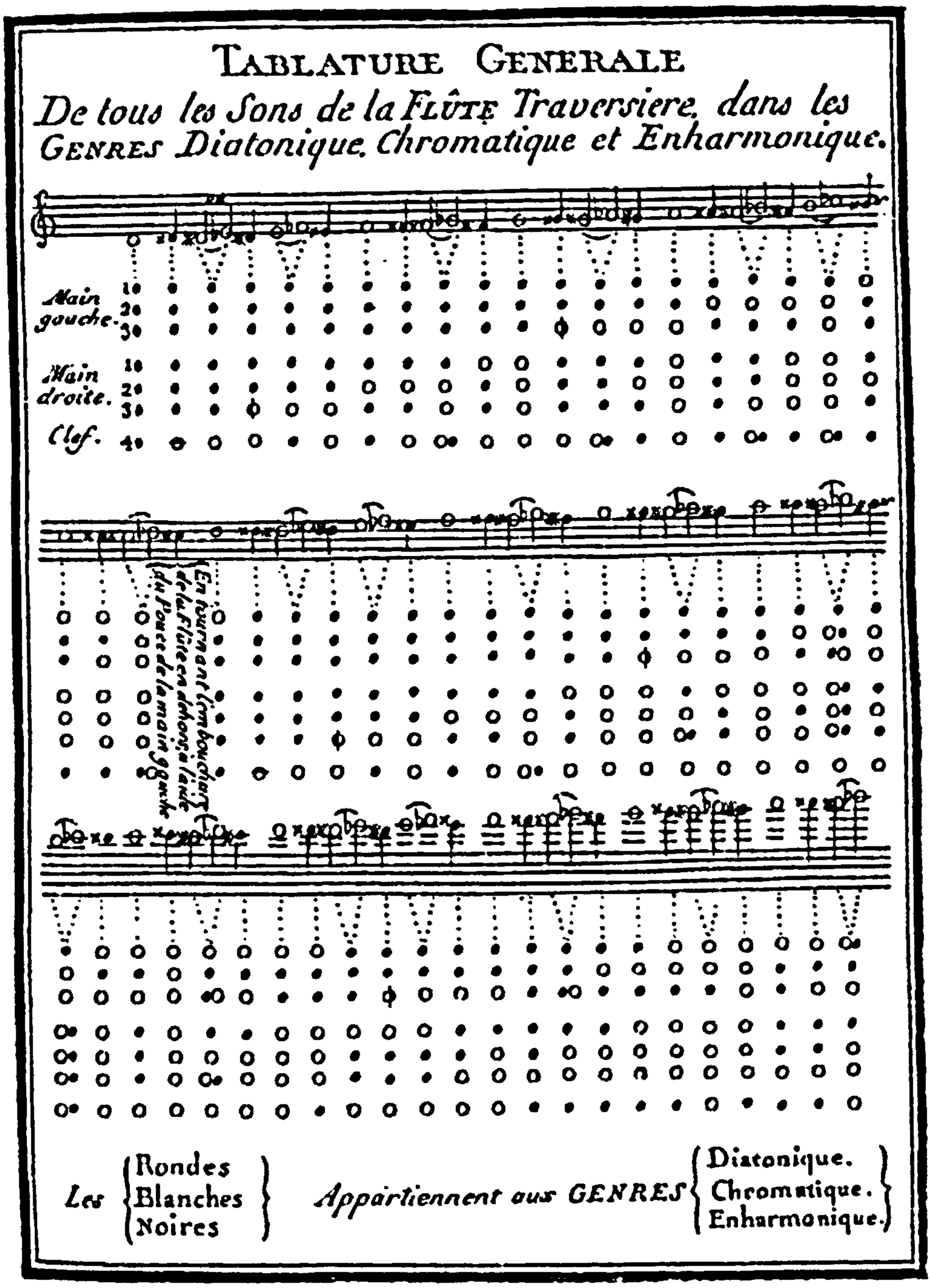

Fig.2.3.1

The quartertone scale from *L'art de la flute* by Delusse.

Delusse[60] opens his explanation by saying that: *'The Tablature* (i.e., fingering chart) *offers all the sounds possible on the instrument in the three genres of music, diatonic, chromatic and enharmonic, that is to say, in all successions of sounds proceeding in intervals of tones, semi-tones, and quartertones.'* (La Tablature offer tous les sons possibles à l'Instrument, dans les trios Genres de musique, qu'on appelle Diatonique, Chromatique, et

[60] It is possible that Delusse did not contribute this section of his method but that it was added to the book by the publisher. See E.R. Reilly & J. Solum, 'De Lusse, Buffardin, and an eighteenth-century quarter tone piece', *Historical Performance*, (Spring 1992), 19-23.

Enharmonique, c'est à dire, dans une succession de sons qui proéde par Intervalles de Tons, de Demi-tons er de Quarts-de-tons.)[61]

Further remarks by Delusse make it clear that this work was regarded as experimental model that was open to revision and development.

2.3.4 Exercises and improvisation studies

To develop the techniques of quartertone playing, I adapted a collection of repetitive, highly detailed chromatic scale exercises from a book appropriately called *Mind your fingers.*[62]

Studies in the form of short scale passages and experiments in interval size were used to find ways in which they might work in the context of improvisation. Interval studies were based on the concept of making conventional intervals either narrower or wider. The focus of these was on creating short phrases similar to great tit song, for example. (An example of quartertone scale exercises is given on **CD1:4**).

2.3.5 Quartertone techniques

Quartertones and other microtones on the baroque flute are produced using one of five different technical means either singly or in combination. These techniques involve the fingers (see 1, 2, and 3 below), the relationship of the flute embouchure to the lips (see 4 below), and physiological controls (see 5 below):

1. Pitch is raised or lowered by employing more or fewer fingers than are used in a standard fingering. This modifies the length of the air column within the flute and functions in the same way as cross-fingerings when they are used to obtain chromatic alterations.

2. Partially rather than fully, stopping a hole lowers the pitch in proportion to the amount the hole is covered, i.e., the more the finger covers a hole the lower the pitch. This technique with the finger in contact with the flute, which is known as 'half-holing', is the principal means for producing microtones between G -G# in the first two registers but it can be used as a method for lowering the pitch of all notes with the exception of D and D#/Eb in the lower two registers.

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[61] See. Delusse, *L'art.*
[62] Moshe Aron Epstein, *Mind Your Fingers* (Frankfurt, Zimmermann, 1999).

3. 'Shading' works on the same principle as half-holing in that it reduces the amount of air escaping from a hole without closing it completely. The essential difference is that a shading finger is held over a hole without making contact with the flute, and the nearer the finger is to the hole, the lower the pitch. This technique is applicable to all notes except D in the first two registers. To play D in the lowest register all the holes are closed, and although a hole is open for D in the middle register it is used simply to allow the note to speak more reliably and closing it makes no audible difference to the pitch. (Between D-D#/Eb in the first two registers the shading is done by partially lowering the key).

4. Modifying the angle and distance of the airstream between the lips and the edge of the flute embouchure hole allows the pitch to be raised or lowered. In rolling the flute inwards or outwards on its horizontal axis the air strikes the edge of the embouchure hole at a more or less acute angle while at the same time the lips cover or uncover the hole to a greater or lesser degree. This technique is essential for playing the quartertones between E-F in the first two registers, and C#-D in the first register. When using the D fingering, the flute is rotated inwards, while for the C# fingering, it is rolled outwards (see Fig.1.6).

5. The most fundamental technique for producing microtones is that which lies within the musician's body; it is the physiological control of the airstream. Production, support, shaping, volume, intensity, propulsion and direction of the air, are all controlled by the muscles of the player's body in using the diaphragm and ribcage, and shaping the throat, mouth, soft palate, tongue and lips, in order to modify the speed, volume and intensity of the airstream. Through these various means, the airstream can be used to raise or lower the pitch of any given note. For example a faster, less intense airstream resulting from the lips being more open and the breath projected more quickly and more horizontally across the embouchure, will raise the pitch; conversely reducing the speed and intensity of the airstream while directing it more vertically into the embouchure will lower the pitch. Physiological techniques are applicable to all methods of producing microtones and are fundamental to the overall technique for playing the instrument.

When the tempo is rapid, then it can be more efficient to combine two or more of the techniques given above. Combined techniques can be performed with smaller physical

movements than when used singly, giving the player greater flexibility and economy of control. For example, the quartertones between G–G#, D–D# and D#–E in the first two registers are produced by half-holing (see 2 above), but with some modification of airstream speed and angle one can more precisely control pitch and tone colour (see 4 and 5 above).

2.3.6 Microtonal speculations

The greater expressive flexibility of intervals resulting from the use of quartertones was encouraging. It suggested that the use of a scale system made up of still smaller microtonal intervals might provide an even more satisfactory solution. Consequently, I began a preliminary and theoretical investigation into the potential of such a system. The main focus of this investigation was the body of theory and the 43 note scale developed by Harry Partch (see Fig.2.3.2).[63]

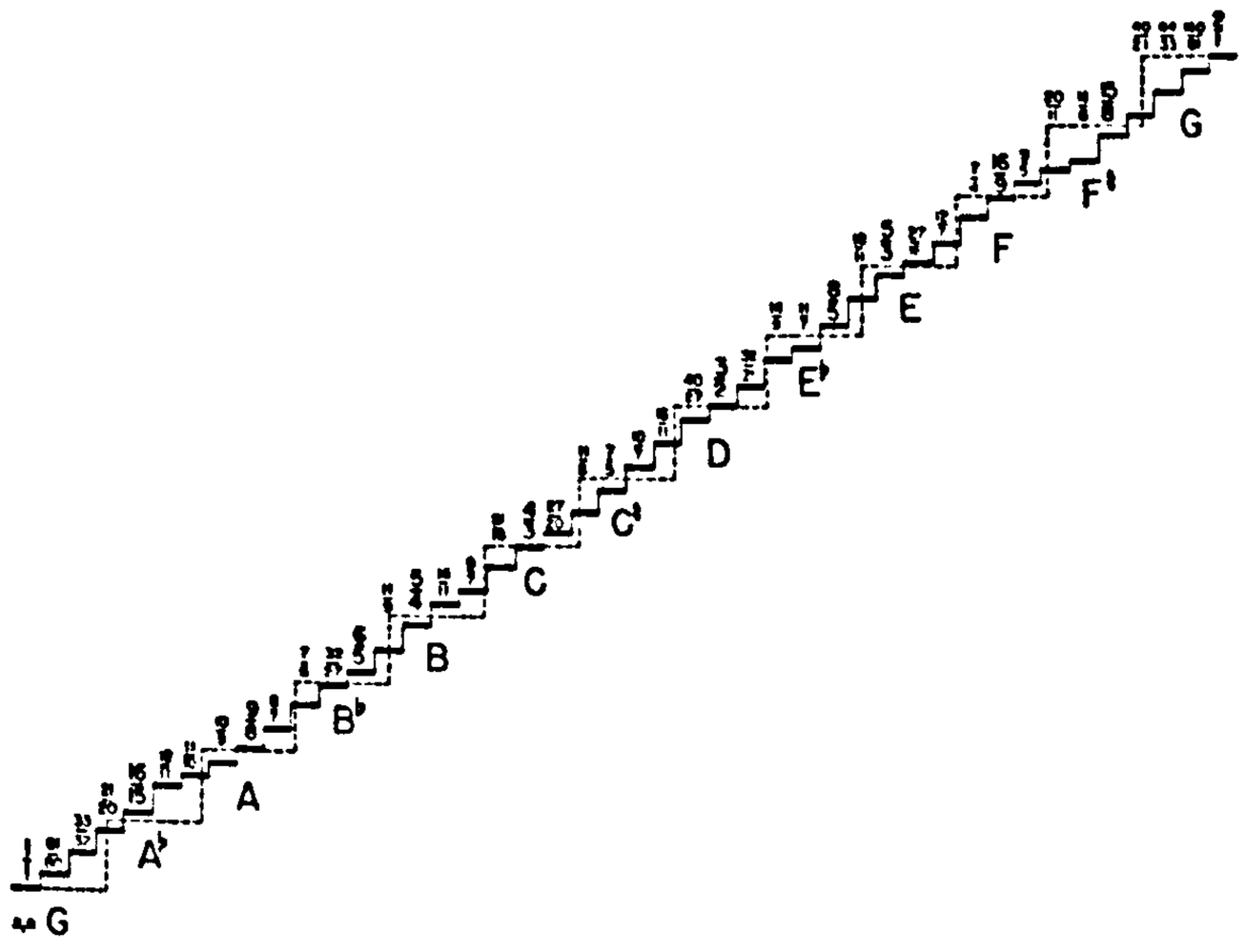

Fig. 2.3.2

The 43 note scale of Harry Partch.[64]

It did not take long, however, to see from Partch's theories and from other writings on microtonal scales that this line of exploration would not result in a practicable system. Two

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[63] See H. Partch, *Genesis of a Music: An Account of a Creative Work, its Roots and its Fulfillments* 2nd edn (New York: Da Capo Paperback, 1979), pp.133-4.

[64] Partch, *Genesis,* p.134.

factors were becoming apparent during the investigation of Partch's theory, arising from the continuing exploration of quartertones:

1. Some of the physical techniques required to play quartertones with facility were proving to be very difficult to acquire, i.e., adjusting how much the key was raised or lowered between D-Eb; executing half-hole fingerings between G#-G, and Eb-E; inward/outward rotations of the flute between C#-D. The problem was not the technical difficulty in itself, given sufficient time most techniques can be acquired, but time and the question of facility were significant factors in testing the potential of all the materials explored in this research.

2. In addition to the factor of physical technique, there was also a fundamental musical element which needed to be addressed. Exploratory studies and exercises with quartertones were not progressing towards the creation of an improvisational system and it was becoming increasingly obvious that they were unlikely to do so. While quartertones, used as expressive effects, contributed towards a musical vocabulary, quartertone scales had neither the closed-system coherence of atonal scales nor the gravitational and relational coherence of tonality. It seemed to be musically impossible to think beyond quartertones being anything more than potentially expressive extensions of semitones, and as such, completely dependent on them for a scale of reference.

Combining these factors, and comparing them to the greatly increased complexities of Partch's 43 note microtonal scale, was a persuasive argument for curtailing this exploration of theories and not attempting to pursue them into a realm of practice.

2.3.7 Summary and conclusion

The exploration of quartertones brought my research closer to one of the distinctive qualities of avian song, the ability to produce small pitch inflections that are common to many species. It was to build on this result that the investigation was extended into microtonal systems which further subdivided the octave.

At the same time however, conversations concerning the systematic use of microtones with two composers both of whom employed altered tunings, suggested that this would not necessarily produce the result I was hoping for. Both composers gave good reasons for regarding the value of microtonality as being limited to purely expressive values within a tonal or atonal system, but not of use systematically.

Edward Cowie, who uses nuances of pitch to great expressive effect in his music, suggested playing 'almost unisons' a microtone apart, rather than attempting to play in a microtonal system. In fact, as mentioned in **2.3.3**, it was only within these kinds of terms that I could approach them. To produce a microtonal interval, it was necessary to think of it first in relation to a conventional interval.

The American composer John Thow, also reserves microtones for purely expressive use even when, as he has done, composing specifically for a quartertone system flute. He made the point that although the human ear can easily hear very small pitch changes, such differences in pitch are retained in the memory for only a short time.

The only way in which I succeeded in treating microtones with relative spontaneity was in short scale passages as an expressive effect. Played rapidly on the baroque flute, such passages produce a sound like trickling water to many, although to a few people, sounded 'slimy'. The reason for focusing on these short, rapid scales was that sequences could be chosen to avoid the musical and technical problems outlined in **2.3.5**.

Apart from these constraints, there was a fundamental question still to be resolved. To be effective, microtones seem largely dependent on a semitone division of the octave. Without the presence of easily recognized intervals around which they can orbit, there are no expressive values. Thus, while microtones can function expressively as variations of a tonal or atonal scale, improvisations based purely on microtones tax the memories of player and listener with too many possibilities of pitch and interval relationships.[65]

As stated in **2.3.5** above, a microtonal scale, whether divided by 43 notes or quartertones, appeared to offer no systematic basis for creating improvisations with a solo melody instrument. The musical and physical complexities of microtonalities were greater than those of atonalities, which left the question of creating an improvisational system to be answered by a further stage of investigation.

The significant outcome of this stage of research, however, was not the failure to resolve the problem of developing an improvisational system. Most importantly, it resulted in a fundamental change in my thinking and approach to the ways and means in which sound

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[65] Obviously this is not the view of those composers or listeners who are dedicated to microtonal composition.

could be produced on the flute. Being able to play a greatly increased range of pitches and intervals led to the idea of developing a new and potentially even more responsive vocabulary. The fingerings and other technical means used to produce microtones equally provoked a more open approach to the flute and how it might be played. These ideas would be pursued through an open exploration of the sounds produced by every possible fingering on the flute; ignoring the constraints of all '*genres*' of music, whether '*Diatonique*', '*Chromatique*', or '*Enharmonique*'.

2.4 Mapping the Flute

Result is a thing of the past. If you are concerned with results no vital action exists because the present is not known. Motivation and process are the important things.[66]

2.4.1 Introduction

Combining the six finger holes and the key produces 128 different fingering permutations on the baroque flute. The objective, in this final stage of the first research phase, was to map out the possibilities of these 128 fingerings and to discover what range of sounds could be made with them.

Two further objectives in mapping the flute were to explore the possibilities touched on in section **2.3.2** of Microtonal Explorations. The possibilities proposed in that section were that microtonal intervals, including those that were virtually inaudible, were far more important factors in the effect of birdsong on the hearer than I had previously realized; and that a more open exploration of the characteristics of the flute might bring it closer to an avian sounding pitch vocabulary.

The investigations of the three previous stages resulted in three conclusions:

1. Systems, in which pitch and size of intervals were fixed, could not adequately convey the flexibility of avian pitch and interval systems.
2. Systems which involved sequences of complex fingering could not provide an essential avian quality, i.e., the ability to produce very fast, light sounds.
3. Systems that were developed for specific types of musical composition can be used for avian-inspired music, but in using them the musician must greatly modify his response to birdsong to fit the demands of the system. A process of modification was not regarded as being appropriate to the goals of this research. The goal was to

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[66] Toshi Ichiyanagi quoted by T. Takemitsu, 'Nature and Music' in Rothenburg, D. & M. Ulvaeus, (eds), *The Book of Music & Nature* (Connecticut: Wesleyan University Press, 2001), p.188.

become more absorbed in birdsong and to allow that absorption to act as a transformation process on my perception of music. Absorption shows both the usefulness and also the limitations of pre-existent techniques (for example Messiaen and Cowie) when attempting to perform in an avian manner.

These conclusions suggested that it was necessary to adopt a completely different approach that would as far as possible be uninfluenced by previous knowledge. Everything known or presumed, about music and flute playing (apart from fundamental playing technique), would be ignored and the flute would be explored simply as a device on which one can make sounds. Consequently, the only significant facts to be considered were:

1. The flute is a tube pierced by eight holes; the uppermost hole or embouchure, is for generating a vibrating air column.
2. The properties of the air column are established by opening and closing with the fingers, six holes and a seventh hole covered by a key, thus changing its length.
3. The sounds, which are generated by the vibrating air column and altered by the fingering, are further modified by the way the air is put into the embouchure.
4. Different sounds are produced depending on the number and combination of holes that are open and closed, on whether they are nearer or farther away from the embouchure hole, and on the angle, speed, intensity and shape of the airstream as it is directed into the tube.

2.4.2 Method of practise

In order to investigate the potential range of sounds for each separate fingering, different sound production techniques were applied, for example, changing the angle of the airstream by rotating the flute inwards and outwards; increasing or decreasing the intensity of the airstream through changing the pressure of the lips; increasing or decreasing the volume of the airstream. These techniques were used to acquire the following information, namely:

1. The sound a fingering produced in the lowest register of the flute;
2. the sounds fingerings produced in the higher registers. (The use of the word octave is avoided because many fingerings do not produce octaves);
3. the multiphonics that a fingering might produce; and
4. the characteristic colours and dynamic range of the sounds produced by the fingerings.

2.4.3 Description of technical means employed

The technical means used in this investigation were much the same as those used in the production and control of microtones, they included the following:

1. Modifying the angle and distance of the airstream between the lips and the edge of the flute embouchure hole which allowed the pitch to be raised or lowered. In rolling the flute inwards or outwards on its horizontal axis the air strikes the edge of the embouchure hole at a more or less acute angle while at the same time the lips cover or uncover the hole to a greater or lesser degree. This technique is essential for playing the quartertones between E-F in the first two registers, and C#-D in the first register. When using the D fingering the flute is rotated inwards conversely for the C# fingering it is rolled outwards (see Fig.1.6).
2. Physiological control of the airstream as a fundamental technique, and as it is in producing microtones and extended techniques. The diaphragm, ribcage, throat, mouth, soft palate, tongue and lips, are all means of modifying the speed, volume and intensity of the airstream, and consequently of manipulating, pitch, intensity and timbre.

2.4.4 Recording of information

Numerous notes were made which recorded only basic details of fingering and approximate pitch, an example is given in Fig. 2.4.1. Recording in greater detail was regarded as counter-productive as what was to be required was merely an overall concept of sonic possibilities, particularly as many of the fingerings produced ambiguous or unstable pitches and timbre. It was considered that without much deeper investigation premature conclusions might be more misleading than useful. (I had found this to be the case when, in the 1970's before I began playing the baroque flute, I tried working from Bruno Bartolozzi's *New Sounds for Woodwinds*,[67] but found that the details given for many of the fingerings either bore no resemblance to the results given on the page, or they produced no result at all). In addition, because it was impossible to know what to do with the information, it was difficult to know how best to order it on the page in a way that was useful. In fact all the fingerings without the key are represented in the following chapter, Table 3.1.

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[67] Bartolozzi, B., *New Sounds for Woodwind*, trans, and ed., R. Smith-Brindle (Oxford University Press, 1967).

FINGER COMBINATIONS 1

WITHOUT KEY

No fingers

`- - - - - - -` C#1: C#2–: D2–: G#3

One finger

`1 - - - - -` B1/2:G3+
`- 2 - - - -` C1+:B+:C1–:E3–:B3
`- - 3 - - -` C#1:D3:G#3;
`- - - 4 - -` C#1:C#3+:D3:G3#
`- - - - 5 -` C1#:C#2+:A#3
`- - - - - 6` C#1/3.G#3+

Two fingers

`1 2 - - - -` A1/2:E3–:G#3–
`1 - 3 - - -` B1–:Bb2:G3:C3[hard]
`1 - - 4 - -` B1;A#2+:G3
`1 - - - 5 -` B1+:B2:G3
`1 - - - - 6` B1: B2&C2:G3+/G#3–
`- 2 3 - - -` C1:A2[hard]:D&D#3
`- 2 - 4 - -` C1+/C#1–:D3–:G3:Bb3
`- 2 - - 5 -` C#1:E3:A#3
`- 2 - - - 6` C#1:E3
`- - 3 4 - -` C#1:C#2+:D3–:G#3.B3–
`- - 3 - 5 -` C#1:E3:A#3
`- - 3 - - 6` C#1+:D#3.G#3+
`- - - 4 5 -` C#1/2:A#3
`- - - 4 - 6` C#1/2+:G#3
`- - - - 5 6` C#1/2:A#3

Three fingers

`1 2 3 - - -` G1/2/3:D3
`1 2 - 4 - -` A1:A2–:F#3.B–3
`1 2 - - 5 -` A1:A2:E3:A#3
`1 2 - - - 6` A1:A2.E3–G#3–
`1 - 3 4 - -` B1–:C#2:G3
`1 - 3 - 5 -` B1:A#2+:D#3:G3:C3
`1 - 3 - - 6` B1:A#2:D#3:G#–3
`1 - - 4 5 -` B1; C2–:G3–
`1 - - 4 - 6` B1:C2–:G3–
`1 - - - 5 6` B1:B2+:C2–:G3
`- 2 3 4 - -` C1:C#2:A#3
`- 2 3 - 5 -` C1:D#3:A3+
`- 2 3 - - 6` C1:D#3–:A3/B3
`- 2 - 4 5 -` C1+:C3+:C#3–:A#3
`- 2 - 4 - 6` C1+:C#1–:C2 & D#3:A#3+
`- 2 - - 5 6` C1+:C#1–:C2.E3–:A#3
`- - 3 4 5 -` C#1/2:A3+/A#3–
`- - 3 4 - 6` C#1:D3+:G#3
`- - 3 - 5 6` C#1:D#3:A3+/A#3–
`- - - 4 5 6` C#1/2:A#3

Four fingers

`1 2 3 4 - -` F#1/2/3:A#3
`1 2 3 - 5 -` G1/2/3:D#3
`1 2 3 - - 6` G1/2:D3+/D#3–G+
`1 2 - 4 5 -` A1:B2:F#3:A#3
`1 2 - 4 - 6` A1:G#2:D#3:F#3+:G3–:A#3+
`1 2 - - 5 6` A1:A#2/3:E3–
`1 - 3 4 5 -` A#1:B2+F#3+
`1 - 3 4 - 6` A#1+:B1–:C2–:G3–
`1 - 3 - 5 6` B1/2–:D#3:G3
`1 - - 4 5 6` B1:B2+:F#3+
`- 2 3 4 5 -` B1:C2&D#3:A3
`- 2 3 4 - 6` C1–:D3:A#3
`- 2 3 - 5 6` C1:D3+:A3+
`- 2 - 4 5 6` C1:C2–&D#3:A#3–
`- - 3 4 5 6` C1/2&D3+:A3+

Five fingers

`1 2 3 4 5 -` E1/2:B2–:F#3–:A3+
`1 2 3 4 - 6` F1/2+:D3.F#3:A#3
`1 2 3 - 5 6` F#1+:Gb1–:F#2–:D+3.G3
`1 2 - 4 5 6` G#1:A#2–:F#3–:A#3–
`1 - 3 4 5 6` A1+:A#1–:A#2+B2–:D3+:F#3+:A3
`- 2 3 4 5 6` D2/3:A3

Six fingers

`1 2 3 4 5 6` D1/2/3:A2/3

WITH KEY

plus key

‖G#3+

plus key

‖B1/2
‖C1+:B+:C2–:D3+:Eb3–
‖C#1; D+3; G#+3;
‖C#1:D–3:A3–
‖C#1:D3:A3
‖C#1/3:A3–

plus key

‖A1/2:D#3+:B3
‖B1:Bb2.D3+:D#3–:G#3
‖B1:B–2:D3–: F#+/G3–
‖B1/2:F#3+/G#3+
‖B1/2:G#3
‖C1:D3:A3
‖C#1–:D3:A#3/Bb3–
‖C#1:D3:A&B3 [hard]
‖C#1:B2+:D#3–:A3–
‖C#1:D3:A3–
‖C#1–:D3:F3
‖C#1–:D3+:A3–
‖C#1/2+:C#3+:D3–:A3–
‖C#1:C#2+:G#3+
‖C#1/2+:A3–

plus key

‖G1/2; D3:G#3
‖A1:G#+:A2–:F3:B3
‖A1:A2:F3
‖A1:A2:F3–:G#3
‖B1–:C#2:G#3
‖B1–:A#2+:C#2+:D3–:G#3
‖B1:A#2:D3:G#3–
‖B1:C2:F#3
‖B1:C#2:G3+
‖B1:C2:G#3
‖C1:C#2+:D3–:A#3+
‖C1:D3–:G#3+:A3–
‖C1.D3:G#3+
‖C+2; C#2; F3; B–3
‖C1+:C#1–:C#2+B3
‖C+:C#1/2–:E3+:B3–
‖C#1:C#2+A3–
‖C#1:C#2+:D3–:G#3
‖C#1/2:G#3+/A3–
‖C#1/2:G#3

plus key

‖F#1/2:F#3–C#2
‖G1/2:C#2+:E3+G#3
‖G1/2:D3:G#3–
‖A1:B2+:F3–:A#3+:B3–
‖A1:G#2.E3+:F3–:B3–
‖A1:G#2+:E3:G#3
‖A#1:C2–:G#3–
‖A#1+/B1–:C2+:G3+
‖B1–:C2–:G#3–
‖B1:B2+:G3+
‖B1:C#3–:E3+:A#3
‖C1–:C#3+A#3+
‖C1:D#3:G#3+
‖C1/2:E3:A#3+
‖C1+:C#2-:G#3

plus key

‖E1/2+:E3.B2+:G#3:A#+3
‖F1/2+:C2+:G3:A#3+
‖F#1/2+:D#3:G#3–
‖G#1:A#2–:E3–:A#3+
‖A#1:B2+:G3+
‖D#2/3:A#3

plus key

‖D#1/2/3:A#2:G3

* The numerals beside the pitch letter designate the register, i.e., B1/2 = B in the 1st and 2nd registers of the flute.

* A plus sign [+] indicates that a note is sharp to a greater or lesser degree, e.g., G3+ = a sharp G in the 3rd register.

* A minus sign [–] indicates that a note is flat to a greater or lesser degree, e.g., C3– = a flat C in the 3rd register.

* An ampersand between notes, e.g., C2&B2, indicates a fingering where one can switch between the two pitches in a manner resembling a lip trill on a brass instrument; this is done by controlling the intensity and direction of the air-stream.

* Adjacent notes such C#2+:D3– indicate that the pitch can be shifted more or less easily within the given range.

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* Adjacent notes such C#2+:D3– indicate that the pitch can be shifted more or less easily within the given range.

Fig. 2.4.1

One of a number of charts made when mapping the fingerings of the flute.

2.4.5. Summary of Results

It became apparent that a number of fingerings produce sounds with instabilities that allow the pitch to be raised or lowered with very little change in the way the sound is produced. A few fingerings produce two pitches that are only a tone apart and it is possible to alternate more or less rapidly between them. The sensation when playing this way is somewhat like the effect of a yodel. It should be noted that these kinds of instability will differ from one flute to another.

In a number of instances, different fingerings produce no audible change in pitch or sound quality, but as stated in the Introduction (see **2.4.1** above), one of the aims in mapping the flute was to explore the possibilities raised in section **2.3.2** of Microtonal Explorations. Consequently, it was treated as a matter of fact that all changes in fingering result in changes of sound, which no matter how small, are registered in the brain.

The exploration progressed through all fingering combinations as shown in Fig. 2.4.1. Pitches were recorded as variants of the dominant pitch of the conventional fingering around which a group of fingerings centred. Given that many of the fingerings produce rather unstable sounds that can be raised or lowered in pitch with very little effort, the sounds produced by any given fingering were regarded as representative rather than definitive. This was a situation reminiscent of Delusse's comments on the quartertone scale. (See section **2.3.3** under Microtonal Explorations).

2.4.6 Conclusions

Mapping the flute produced some very useful results but these were results that raised more questions than answers while suggesting no resolutions. During the mapping process a very large number of sounds were discovered with adjacent fingerings producing degrees in pitch variation from inaudible to large. The sounds also possessed a wide range of different characteristics of tone, stability, and strength. Some fingerings produced multiphonic sounds relatively easily but collectively the 128 fingerings did not suggest a means for integrating extended techniques.

There had been no expectations when starting this stage of research that it would produce a system, and by the end, no apparent way of relating sounds systematically one to another had presented itself.

In fact the 128 fingerings appeared to present even less possibility for a systematically coherent language than a 43 note microtonal scale. What was revealed was that the flute possessed a considerably greater range of potential resources than those arising when the instrument was played with a baroque technique.

The mapping process also gave support to the possibilities proposed in section **2.3.2** of Microtonal Explorations regarding a) the effects of virtually inaudible microtonal intervals in birdsong on the hearer; and b) that the fullest use of the characteristics of the flute would bring it closer to the possibility of creating an avian vocabulary.

The practical outcomes of mapping the flute brought the first phase of research to a close with a possible answer, but it was an answer that posed a question. The possible answer lay in the potential for using the 128 fingerings, which appeared to present an exciting and potentially usable body of sonic resources. If this was the case, however, the question was: Could these resources of 128 fingerings, and the sounds they produced, be developed into a notated system suitable for both composer and improviser alike?

3 SECOND PHASE:Ecosonic Solutions – Keys from the Past

Emptiness is greatness. It is like the bird who sings spontaneously and identifies with the universe.[68]

3.1 Introduction

The process of investigation and exploration that made up the first research phase resulted in a radically redefined set of conceptions and principles. These redefinitions made it possible to pursue the second phase of research on a totally different basis, which included:

1. opening up new ways of a) approaching the flute and b) thinking about creating a musical language informed by avian song;
2. deciding that established musical knowledge and ways of playing an instrument would no longer be shaping factors in the directions and outcomes of research, i.e., in as far as possible future work would be conducted 'innocently'.

Thus, the ground had been prepared for creating a system that was a response to birdsong:

1. unmediated by the demands of an existing form of music;
2. played with an instrument responsive to breath and fingers; and
3. unmediated by the necessities of a previously established technique or existing technical practices.

3.2 The unfolding of a system

The process that led to the creation of this new system was set in motion by a brief conversation with the eminent theoretical biologist, Brian Goodwin. Brian Goodwin is also an accomplished amateur pianist and the conversation was about the possible significance of silence for conveying information in birdsong and of its obvious significance in the performance of human music. Silence is potently expressive in all forms of human communication and a fundamental element of expression in unaccompanied performance on the flute. Up to this time, however, I had not conceived a role for silence in shaping improvisations, nor was it clear to me how it could be used. What was certain was that silence would have to be an integral part of an improvisatory form, it could not be added like a condiment.

3.2.1 Silence and emptiness

With the intention of finding analogies for the use of silence in improvisation, I decided to research the role of emptiness in Chinese painting.[69] This decision was guided by more

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[68] Quoted in F. Cheng, *Empty and Full: The Language of Chinese Painting* (Boston: Shambala, 1994), p.44.

persuasive considerations than sidestepping musical writings on silence. I was already aware that there are ancient, highly developed Chinese techniques for the use of emptiness in painting, which moreover, link art and spirituality with nature; and I wished to explore material that fell within the bounds of my current knowledge. Emptiness is pivotal to the way the Chinese perceive the universe. In addition to its role in philosophy and religion, the concepts of emptiness pervades the realms of painting, poetry, music and theatre, the physiology of the human body, military science and martial arts, and 'the art of cooking'.[70]

3.2.2 *I Ching* symbolism

The insight that materialized was not directly concerned with silence however, but related to the *I Ching*; a work that was fundamental to traditional Chinese thought. This book, which is familiar to many in the West, is a work of Taoist and Confucian philosophy.[71]The *I Ching* expounds the meaning of 64 symbols, called *gua* in Chinese but usually translated as 'hexagrams', (see Fig.3.1).[72] Each hexagram consists of six lines (*yao*), arranged horizontally, one above the other. There are two kinds of line, broken (- -) and unbroken (—).

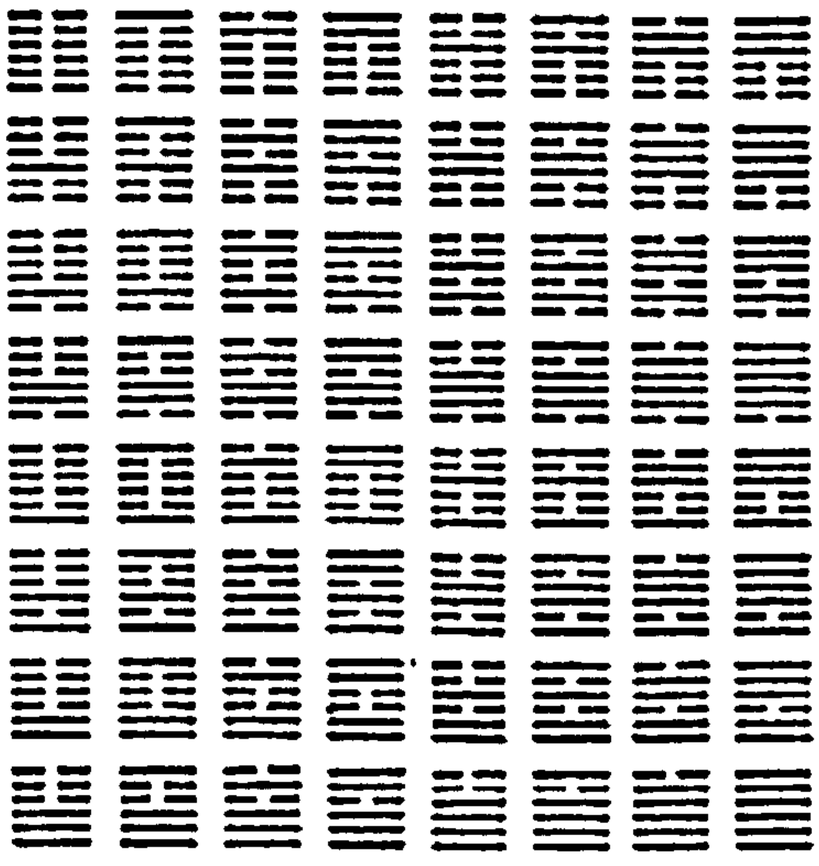

Fig.3.1

The Fu Xi arrangement of the 64 *I Ching* hexagrams (after Huang).[73]

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[69] Sources consulted were: L. Yutang, *The Chinese Theory of Art: Translations from the Masters of Chinese Art* (London: Heinemann, 1967), which includes an anthology of writings by Chinese painters; and F. Cheng, *Empty and Full* (Boston: Shambala, 1994).

[70] See Chang, *Empty and Full*, p. 35.

[71] Sources consulted were: A. Huang, *The Numerology of the I Ching: A Sourcebook of Symbols, Structures, and Traditional Wisdom* (Vermont: Inner Traditions, 2000), p.43; J.F. Yan, J.F., *DNA and the I Ching: The Tao of Life* (Berkeley: California, North Atlantic Books, 1991), pp.110-113; and M. Schönberger, *The I Ching and The Genetic Code: The Hidden Key to Life*, trans. D.Q.Stephenson, (Santa Fe: Aurora Press, 1992), pp.59-61.

[72] A number of different translations of the *I Ching*, which contained information about the structure and arrangements of hexagrams, were also consulted; these are listed in the bibliography.

[73] A Huang, *The Numerology of the I Ching: A Sourcebook of Symbols, Structures, and Traditional Wisdom* (Vermont: Inner Traditions, 2000), p.51.

The 64 hexagrams, which consist of all possible combinations of the broken and unbroken lines, are similar in appearance to some 18th century flute fingering charts (see Fig.3.2). A further similarity to flute fingering charts is that each hexagram is made up of a combination of two sets of three lines or trigrams, thus resembling the positioning of each hand on the upper and lower joints of the flute. This presented the ideal analogy for ordering the 128 fingerings into 64 fingerings of the open holes without the key, and 64 fingerings with the key.

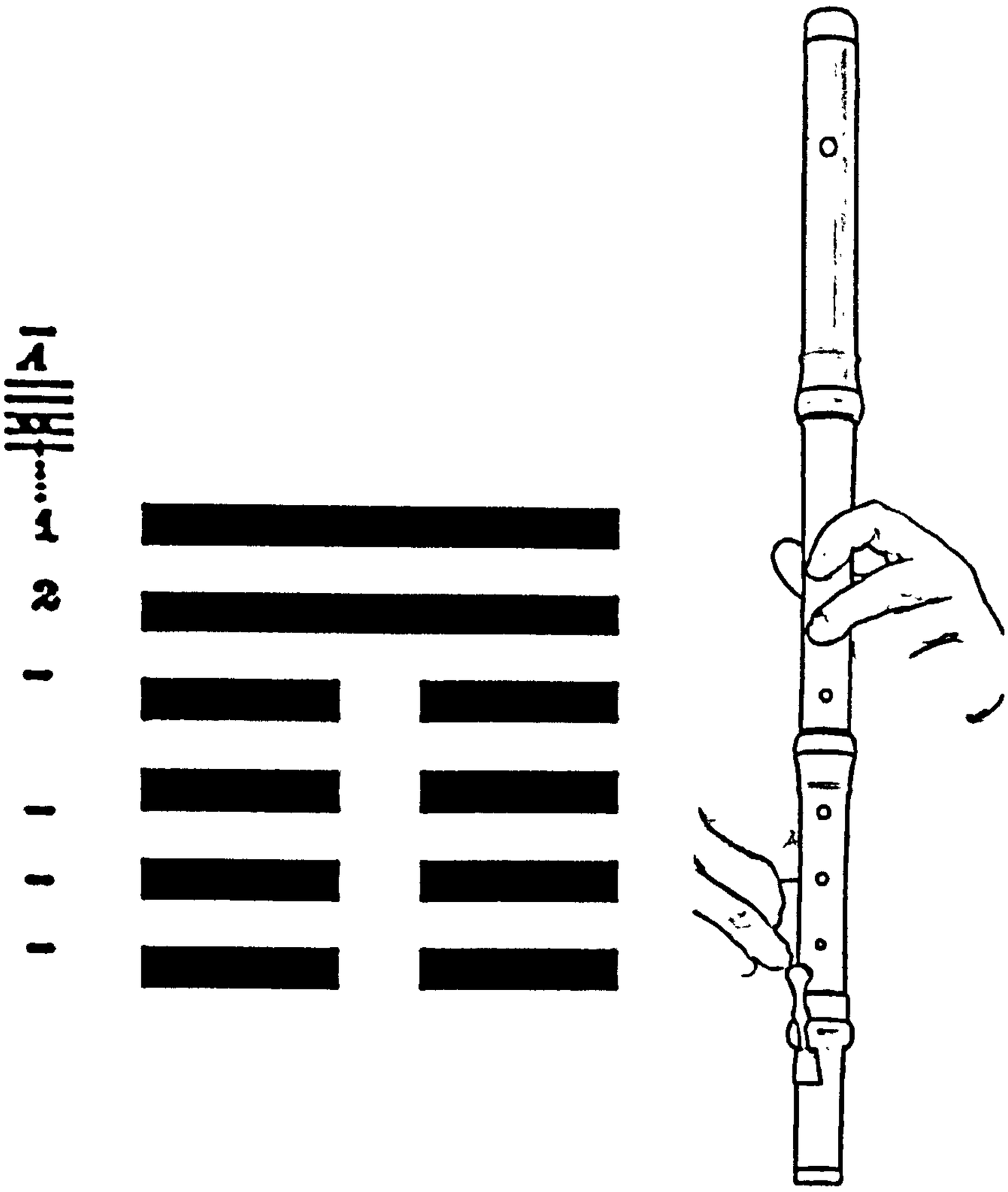

Fig. 3.2

Hexagram 20 from the *I Ching* compared to the fingering of A on the flute, as notated by Quantz.[74]

3.2.3 The *I Ching* and the baroque flute - analogies

The analogies between the *I Ching* hexagrams and the baroque flute can be summarised as follows:

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[74] Quantz, J.J. *On Playing the Flute*, trans. E.R. Reilly, 2nd edn (London: Faber and Faber, 1985), p.42.

1. The six lines represent the six finger holes of the flute. (The baroque flute is fundamentally a six-holed instrument, to which the key was added in the late 17th century to obtain the chromatic notes that cannot be produced with only six holes. In some 18th century fingering charts the key is indicated only when it is required).
2. The broken (- -) and unbroken (—) lines represent respectively the open and closed finger holes.
3. The 64 permutations of broken and unbroken lines represent all possible configurations of open and closed holes of the flute not including the key. (It became apparent that it is not necessary to make the key part of the system; it can easily be introduced when it is needed for extending the sonic resources).

3.2.4 A fingering chart not a system

What the hexagram sequence in the *I Ching* did not suggest was a practicable system. Simply treated as representing patterns of fingering, the hexagrams were, in many cases more awkward to play than atonal sequences. However, a potential direction of development seemed to lie in another characteristic of *I Ching* hexagrams.

Each hexagram develops through movement and change. Broken lines change into unbroken lines, and are regarded as moving upwards through the hexagram, progressing from the bottom line to the top. Although this suggested the idea that individual fingers could be moved progressively, it did not suggest a systematic basis for using them in the context of each hexagram. It also did not resolve the more difficult problem of creating a relationship between each of the potential fingering patterns and the sounds they produced.

3.2.5 Fu Xi + Leibniz = the ecosonic system

The problem was solved, and the last link in this progression of ideas was provided by two very different sources – one originating 5000 years ago in ancient China, the other in late 17th/early 18th century Europe.

The Chinese source was an arrangement of the *I Ching* hexagrams attributed to the semi-mythical figure Fu Xi (BCE 3000). The European source was the system of binary arithmetic invented by the German philosopher/mathematician Leibniz.[75] Remarkably, the

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[75] Gottfried Wilhelm Leibniz (1646-1716), invented a calculus (independently of Newton) and symbolic logic, and was an early investigator of probability. He was sent a copy of Fu Xi's arrangement of the *I Ching* symbols by a missionary friend, which he discussed in relation to his own work in 'Two Letters on the Binary Number System and Chinese Philosophy', see M. Schönberger, *I Ching*, p.59.

sequences of broken and unbroken lines in the Fu Xi sequence, and of 'zeros' and 'ones' in the binary arithmetic of Leibniz, are exact parallels, (see Fig. 3.3 & Table 3.1 below).

What the Fu Xi sequence suggested was a system for organizing and employing 64 patterns of fingering, i.e., using all the fingering permutations possible on the flute excluding the use of the key. Leibniz's binary code suggested a division in the function of fingers, using some fingers to execute fast fluid movements at the same time as other fingers were held in static patterns.

As a result of this conjunction between Fu Xi and Leibniz, I was able to completely re-orientate my approach to playing the flute and to making music. I have named the result the **ecosonic system**. The choice of the term ecosonic was based on the characteristics of sounds and the way they were shaped within a sonic environment.

3.3 Description of the ecosonic system

The ecosonic system can be broken down into six elements:

1. The 'Super-row': which is the fundamental and largest scale of organization – the system at the level of macrocosm.
2. 'Finger-rows': which organize the system at the level of microcosm.
3. & 4. 'Fixed-fingerings' and 'moving-fingers': which are the components of the finger-rows.
5. 'Key-sounds': which refer to those sounds produced by the fixed-fingerings.
6. 'Microsonic vocabularies': which refer to the sounds generated by each moving-finger as a distinct unit.

3.3.1 Organization of the Super-row

The ecosonic system is organized in a super-row of 64 fingering patterns. These can be represented graphically in a rearrangement of the Fu Xi square in which the super-row sequence begins at the bottom right hand corner (see Fig.3.3), or as a binary arithmetic sequence from zero to 63 (see Table.3.1).

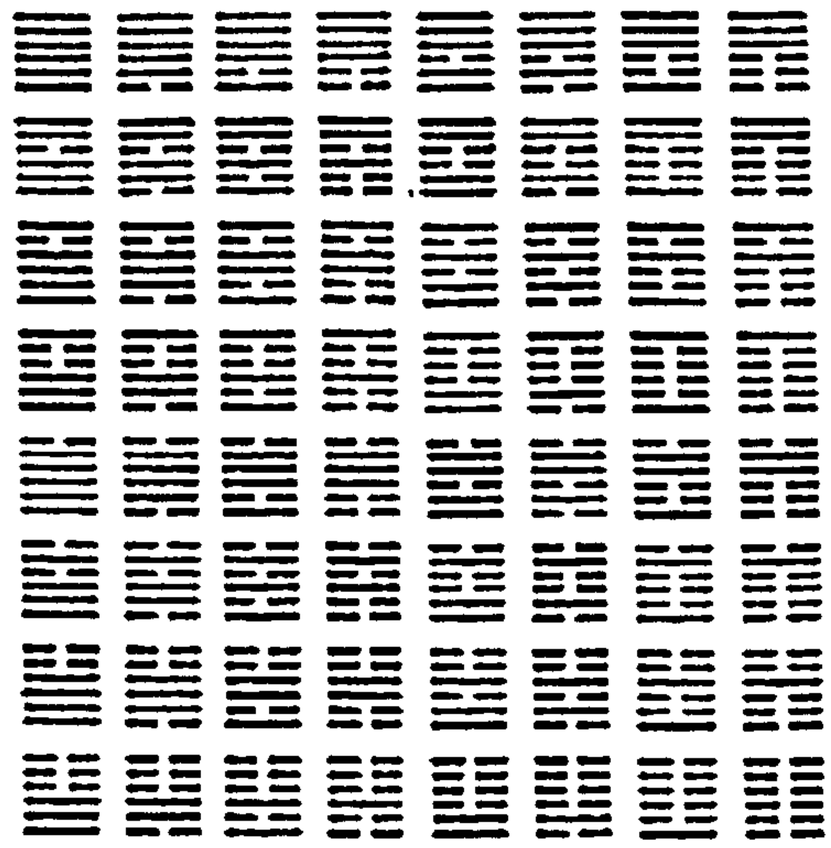

Fig.3.3

The Fu Xi square rearranged to represent the 64 fingering patterns of the super-row.

000.000	001.000	010.000	011.000	100.000	101.000	110.000	111.000
000.001	001.001	010.001	011.001	100.001	101.001	110.001	111.001
000.010	001.010	010.010	011.010	100.010	101.010	110.010	111.010
000.011	001.011	010.011	011.011	100.011	101.011	110.011	111.011
000.100	001.100	010.100	011.100	100.100	101.100	110.100	111.100
000.101	001.101	010.101	011.101	100.101	101.101	110.101	111.101
000.110	001.110	010.110	011.110	100.110	101.110	110.110	111.110
000.111	001.111	010.111	011.111	100.111	101.111	110.111	111.111

Table 3.1

The super-row as the binary arithmetic sequence zero to 63.

The super-row is the 'macroscale' of the system from which all ecosonic fingering sequences and patterns are derived. (The single key of the flute is not included in the super-row for reasons which will be discussed in **3.3.7**).

The super-row represents the moving-fingers and fixed-fingerings both combined and separately in the following different but complementary ways, namely:

1. In all possible patterns of moving-fingers.
2. In all possible patterns of fixed-fingerings.
3. In all combinations of moving-fingers with fixed-fingerings.

The decision to start the super-row from the lower end of the flute was taken only after some experimentation. If the Fu Xi sequence had been followed, the super-row would

have started from the uppermost hole nearest the embouchure, as in conventional flute technique. The most persuasive factor in reversing the Fu Xi sequence was that it produced large interval changes that were too regular and too frequent, rather than prolonged progressions of notes in which the pitch shifted by very small intervals. Thus, the super-row sequence progresses in finger-rows that consist of a much more subtle series of changes of pitch, timbre and dynamics. The super-row should be understood as having the same relationship to ecosonic performance as scales have to the creation of tonal music. The principal sounds of the super-row are given on **CD1.34**. Depending on whether they belong to fixed-fingerings or moving-fingers, these notes are either keysounds or microsonic vocabularies.

3.3.2 Fixed-fingerings and moving-fingers

The ecosonic system on the flute[76] requires a division of finger action and function. Actions and functions are divided between the six fingers of the left and right hands. The seventh finger, i.e., the little finger of the right hand which operates the single key, was found to be unnecessary for the formal organization of the system.

The fingers are engaged in two actions:

1. Three fingers are held in a static pattern of either open or closed, or open and closed holes: and are designated as 'fixed-fingerings'.
2. Three fingers are free moving and are designated as 'moving-fingers'.

The combination of fixed-fingerings and moving-fingers, used in an improvisation, is called a 'finger-row'. (For examples of finger-rows see **4.7** Examples of notated improvisations and corresponding recordings on **CD3:7, 8, 10, 14, & 17**).

Fixed-fingerings and moving-fingers in a finger-row have two functions:

1. Fixed-fingerings generate the 'keysounds', i.e., the sounds that form the basis of a finger-row.
2. Moving-fingers generate the 'microsonic vocabularies', i.e., the vocabularies of sound produced by the movement of each finger individually.

Keysounds and microsonic vocabularies are identical in sound, the principal difference being that keysounds remain fixed throughout an improvisation while microsonic vocabularies are constantly changing. Examples of the component tones of keysounds and

[76] It is envisaged that the system will be transferable to other instruments.

microsonic vocabularies can be heard on **CD1:31-33**, *Multiphonics on 8, 24 and 33*, and **CD1:34**, *Super-row in three registers*.

The assignment of actions to the fingers takes place before an improvisation, first deciding on the fixed-fingering and then selecting the moving-fingers.

3.3.3 Finger-rows

The super-row as given in Table 3.1 above is divided into eight horizontal and eight vertical rows. Each of these rows represents a fundamental sequence of fingerings called a finger-row. Finger-rows can be any group of eight fingerings in which a pattern of three moving-fingers is combined with a fixed-fingering pattern, for example see Table 3.2.

101.010
101.011
101.110
101.111
111.010
111.011
111.110
111.111

Table 3.2

An example of a finger-row with the fixed-fingering pattern 101.010 combined with the moving-finger pattern 010.101 (the moving-finger sequence is shown in bold type).

3.3.4 Super-row and finger-row characteristics

There are two fundamental aspects of the ecosonic system:

1. Moving-fingers and fixed-fingering patterns are not governed by the production of precise pitches and pitch relationships.
2. The progression of moving-fingers in the super-row sequence starts from the 'wrong' end of the instrument, i.e., with the hole furthest from the embouchure.

The super-row, and finger-rows generated from it, are not intended for playing the flute in a way that systematically controls the length of the vibrating air column.

Thus, instead of closing the holes of the flute tube from the finger nearest the embouchure in graduated steps (a little like panpipes) to make a series of progressively shorter tubes, ecosonic technique frequently divides the tube simultaneously into several short partitions, consequently splitting the air column and setting up harmonic irregularities.

For this reason, a single movement of one finger may produce considerable change whilst the movement of three fingers may result in virtually no audible change at all. The result is governed by the fixed-fingering pattern and the position of the moving-fingers in relation to that pattern.

There are three possible changes in sound in terms of pitch, volume and timbre, which may be produced by the moving-fingers:

1. No audible change.
2. A barely audible change.
3. A clearly audible change from very small to large.

Playing the super-row in sequence from zero to 63 in the lowest register gives a series of 63 irregular microtonal changes (i.e., many changes are barely audible while a few move in semitone and tone jumps), in an iterative pattern of fingering. If these microtonal changes are compared to fixed pitches, they can be considered as orbiting around the notes of a chromatic scale as it descends in a slightly arched trajectory from $C\#_4$ through a brief rise to D_5, and back down to D_4, i.e., C#→C→B→D→B→A#→A→G# →G→F#→ F→E→D. The sounds of many ecosonic fingerings are quite unstable and can easily be raised or lowered in pitch, thus ecosonic notes should be thought of in terms of approximate rather than precise pitch.

In comparison with conventional technique on the baroque flute, if a diatonic sequence is played starting with all holes open (i.e., 'zero' (0) in ecosonic technique), moving one finger at a time, the seven tones and semitones of a descending D major diatonic scale are produced, i.e., C#→B→A→G→F#→E→D (see Fig. 3.4).

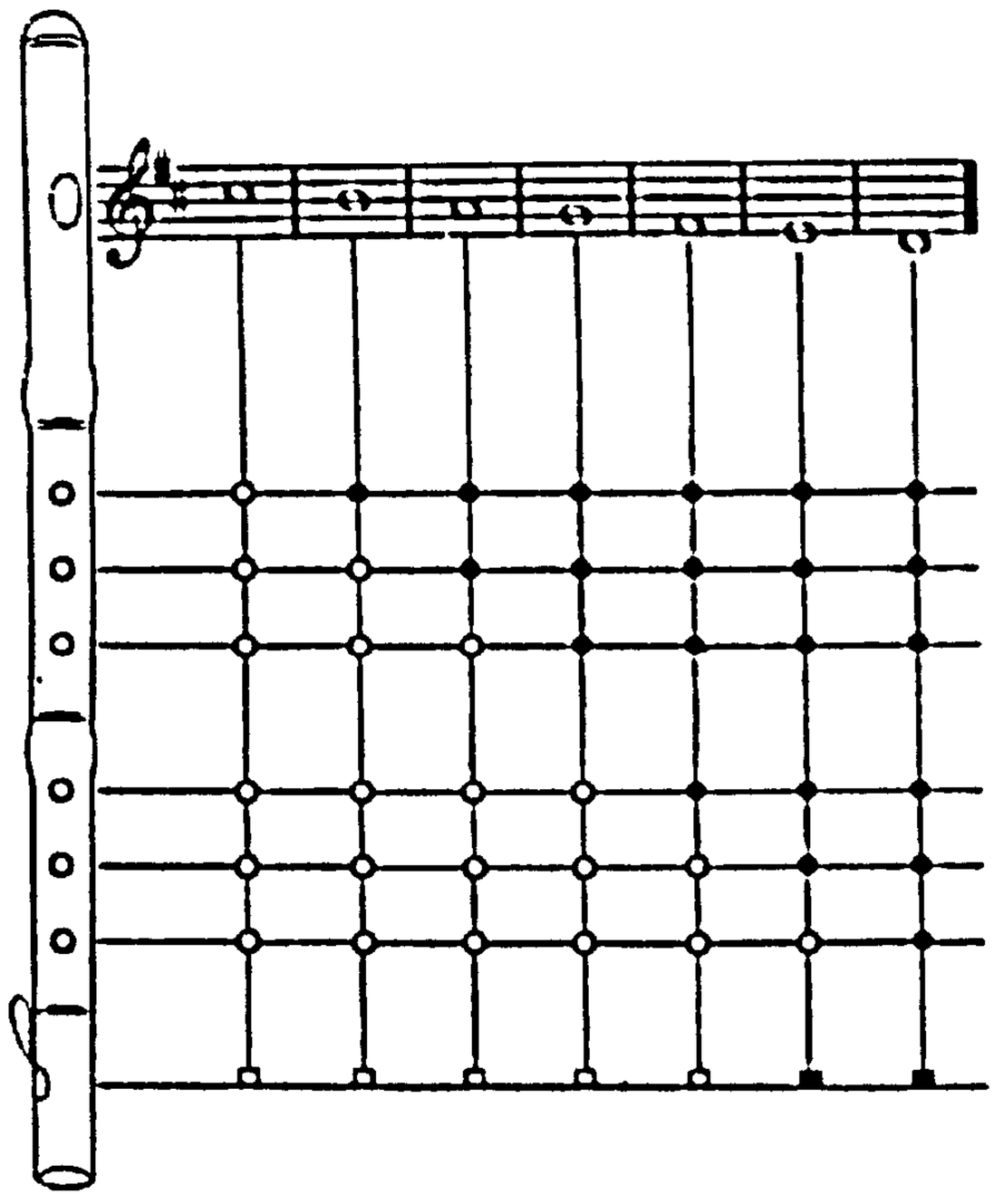

Fig. 3.4

The fingering of the diatonic scale of D major starting from C#. (From Tulou).[77]

3.3.5 Fixed-fingerings:action and function

Action

The action of fixed-fingerings is to hold a fixed pattern throughout an improvisation. A fixed-fingering pattern is made up of a maximum of three fingers and a minimum of no fingers, i.e:

a. Either one, two or three holes are closed.

or

b. No holes are closed.

The three fingers are selected either from the right or left hands, or a combination from both hands (see Tables 3.3 and 3.4). The little finger of the right hand is not usually included in this selection but may be added by the performers as a random element (see **3.3.7**). Since there must always be three moving-fingers, only 43 fixed-fingering patterns (shown in Tables 3.3 and 3.4) out of the 64 patterns in the Fu Xi sequence, are used in

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[77] J.L. Tulou, *Méthode de Flûte Progressive at Raisonnée*, Op.100 (London, Brussels & Leipzig: Schott, c.1835), p.11.

most improvisations: (but not all, see for example under **3.3.6 Other variations in moving-finger sequences**, point 4, and Table 3.9).

Left hand	Right hand
000.000	000.000
001.000	000.001
010.000	000.010
011.000	000.011
100.000	000.100
101.000	000.101
110.000	000.110
111.000	000.111

Table 3.3

Fixed-fingerings in left hand and right hand.

001.001	010.001	011.001	100.001	101.001	110.001
001.010	010.010	011.010	100.010	101.010	110.010
001.011	010.011	011.100	100.011	101.100	110.100
001.100	010.100		100.100		
001.101	010.101		100.101		
001.110	010.110		100.110		

Table 3.4

Fixed-fingerings in both hands.

Functions

1. The function of fixed-fingerings is to provide the keysounds of a finger-row.
2. Keysounds remain constant throughout an improvisation.
3. The keysounds establish the sonic environment of each improvisation, shaping the characteristics and the relationships of sounds produced by the three moving-fingers.

3.3.6 Moving-fingers:action and function

Actions

- The three moving-fingers move around the static pattern of the fixed-fingerings.
- There are always three moving-fingers.
- The three fingers are selected either from the right or left hands, or from a combination of fingers in both hands.
- The same three fingers are used throughout an improvisation.
- The little finger of the right hand may be added at random by the performers, the reason being that the six holes form the basis of an integrated system. The key is therefore assigned the role of a wild card (see 3.3.7).

- All 64 patterns in the Fu Xi sequence can be represented as patterns of moving-fingers in conjunction with fixed-fingerings.

During improvisations, the playing order of the moving-fingers is usually free, and decided spontaneously by the individual musician rather than played in a particular sequence or sequences decided before the improvisation is started. (Technical exercises, studies and general technique, however, are best acquired by working methodically with variations of binary arithmetic sequences).

The fundamental, scale-like actions of moving-fingers follow the sequential regularities of the super-row, i.e, the binary arithmetic sequence. For example, sequences in the left and right hands, and sequences between hands are illustrated in Tables 3.5 and 3.6.

Left hand	Right hand
000.000	000.**000**
001.000	000.**001**
010.000	000.**010**
011.000	000.**011**
100.000	000.**100**
101.000	000.**101**
110.000	000.**110**
111.000	000.**111**

Table 3.5

Moving-finger sequences in left and right hands (moving-fingers are in bold type).

Left to right	Right to left
000.000	000.000
100.000	000.**010**
000.**001**	000.**100**
100.**001**	000.**110**
000.**010**	**001**.000
100.**010**	**001**.**010**
000.**011**	**001**.**100**
100.**011**	**001**.**110**

Table 3.6

Examples of moving-finger sequence progressing from left to right, and from right to left hands.

In the performance of improvisations, moving-fingers very often progress around a fixed-fingering pattern, for example: two separate moving-finger sequences (in bold type) are given below in Table 3.7, played on fixed-fingerings of a) 101.010 and b) 001.101:

a) 101.010	b) 001.101
101.010	**001.101**
101.011	**001.111**
101.110	**011.101**
101.111	**011.111**
111.010	**101.101**
111.011	**101.111**
111.110	**111.101**
111.111	**111.111**

Table 3.7

Moving-finger sequence on fixed-fingering patterns.

Other variations in moving-finger sequences

The following variations can be applied to the actions of moving-fingers so that they can be played:

1. in a sequence progressing from left to right towards the foot joint instead of towards the embouchure; for example, a moving-finger sequence on fixed-fingering 010.011 (see Table 3.8a);
2. starting with closed holes and raising the fingers instead of lowering them, and progressing either from the right to the left; for example, a moving-finger sequence on fixed-fingering 001.101 (see Table 3.8b);

or

3. from left to right; for example, a moving-finger sequence on fixed-fingering 010.011 (see Table 3.8c);

a) left to right	b) right to left	c) left to right
010.011	**111.111**	**111.111**
110.011	**111.101**	**011.111**
011.011	**101.111**	**110.111**
111.011	**101.101**	**010.111**
010.111	**011.111**	**111.011**
110.111	**011.101**	**011.011**
011.111	**001.111**	**110.011**
111.111	**001.101**	**010.011**

Table 3.8

Moving-finger sequences (in bold type): a) moving from left to right: b) from closed holes moving right to left: c) from closed holes moving left to right.

4. in a finger-row in which all six fingers are designated as moving and which can either be treated freely using any and all the fingerings of the super-row (see Table. 3.1);

or

the fingers are only ever moved individually with never more than one closing a hole at a time (see Table 3.9).

000.000
000.001
000.010
000.100
001.000
010.000
100.000
010.000
001.000
000.100
000.010
000.001
000.000

Table 3.9

A finger-row of six moving-fingers, each finger closing one hole at a time.

Functions

Each moving-finger functions as an individual unit of a finger-row, and the sounds produced by each moving-finger constitute an individual microsonic vocabulary.

Microsonic vocabularies are so-called because, unlike conventional fingerings, many ecosonic fingerings do not produce notes in a regular harmonic series, i.e., progressing from the fundamental sound to the octave and the fifth, etc., but instead produce an irregular series of apparently unrelated sounds that may possess distinctively different qualities of timbre. One fingering, for example, produces a rising series of sounds roughly equivalent to the pitches $C_5 \rightarrow D_5 \rightarrow C_6 \rightarrow D_6 \rightarrow A_7$. (For examples of microsonic vocabularies refer to **CD1:31-33**).

The microsonic vocabularies produced by each moving-finger are changed by the sonic environment created by the fixed-fingering keysounds and by the changing combinations of the other moving-fingers.

3.3.7 The actions and functions of the little finger of the right hand

The seventh finger, i.e., the little finger of the right hand, which operates the single key of the flute, may either be used as part of a fixed-fingering, as a moving-finger, or not at all. Its action can be decided formally just before an improvisation or informally when the improvisation is in progress. The action of this finger is therefore random: it may act as a fixed part of the system but is more often used spontaneously, and it is only recorded when it is used to particular effect.

3.3.8 Using fewer or more than three moving-fingers

Although three moving-fingers produce the most satisfactory range of material for improvisations, this does not prevent the use of more or fewer moving-fingers. In one antiphonal form of improvisation, all six fingers are moving one at a time and there is no fixed-fingering, i.e., there is never more than one hole closed at any one time (see Table 3.9).

3.3.9 Summary of characteristics of sound and interval related to fingering order

Irregularities of pitch, volume and timbre are characteristic of the ecosonic system and can change unpredictably from one sound to the next. The sequence of moving-fingers and number of fingers used in a finger row are not predictive of either pitch or timbre. The variety and unpredictability of these irregularities are essential elements in performers' sonic vocabulary and are not altered unless it is expressively appropriate to do so or it is required in the context of a particular improvisation. Ecosonic intervals produced in the sequential flow of sounds of a finger-row, can vary from barely audible microtonal

changes to leaps wider than a tone. All 64 fingerings of the super-row, played in the first register, will only span an octave, in conventional terms.

Such expressive alterations will arise from the natural characteristics of finger-rows and the irregular harmonic make up of the microsonic vocabularies of many fingerings, which for example, lend themselves naturally (although not necessarily easily), to the use of extended and other techniques. Harmonically irregular sounds are potentially suitable for the production of multiphonics, while the system of moving-fingers makes flutter fingering and nightingale beats accessible in many places on the instrument and relatively easy to execute. Various forms of vibrato are extremely effective in some finger-rows, as are other extended techniques such as flutter tonguing. There are examples of these techniques on **CD1:5, & 8-14** (finger glides, circular breathing and flutter fingering); and **CD2:7, 8, 11, & 20-37** (circular breathing, various forms of vibrato, flutter tonguing, glides, unstable notes, and multiphonics).

3.4 Graphic, musical and verbal communication and notation of ecosonic fingering

There are two practical ways in which ecosonic fingerings can be verbally communicated and graphically notated for the purposes of conveying and recording details of improvisation, i.e:

1. In binary arithmetic code.
2. In decimal figures.

I Ching hexagrams are not an ideal notational form for recording the details of improvisations. Although the hexagrams have a graphic quality that is good for conveying the patterns of closed and open holes, they take up a relatively large amount of space on the page, and they take more time to notate than either binary or decimal figures.

3.4.1 Binary arithmetic notation

Notating in binary code is the simplest way of indicating fingering patterns graphically. For example:

- **II:101.000→101.001→101.010→101.011→101.100→101.101→101.110→ 101.111→101.110→101.101→101.100→101.011→101.010→101.001:II**^{x2}

indicates that the left hand holds the fixed-fingering pattern 101.000 on which the right hand moving-finger sequence (in bold print) is constructed (see Fig. 3.5 for the orientation

of binary fingering to the flute). The two sets of vertical lines followed and preceded by a colon, i.e., II: and :II^{x2} – indicate that this sequence is repeated twice: no figure after the second set of vertical lines would indicate the sequence would be repeated as many times either as necessary or as desired. If it is necessary to record the use of the single key of the flute, it can be indicated by the letter 'k', for example, 010.110k (see Fig.3.5).

000 . 001 (k)

Fig. 3.5

Example of binary code in relation to ecosonic fingering on the flute (the number of the fingering shown is 1).

3.4.2 Decimal notation and spoken communication

The simplest and most direct way to communicate verbally which patterns of moving-fingers and fixed-fingerings are closing holes, is by referring to them using the decimal number for the hole that each finger closes in the binary system: i.e., each of the six holes of the flute is named after the decimal number equivalent to its position in the binary code sequence (see Fig. 3.6).

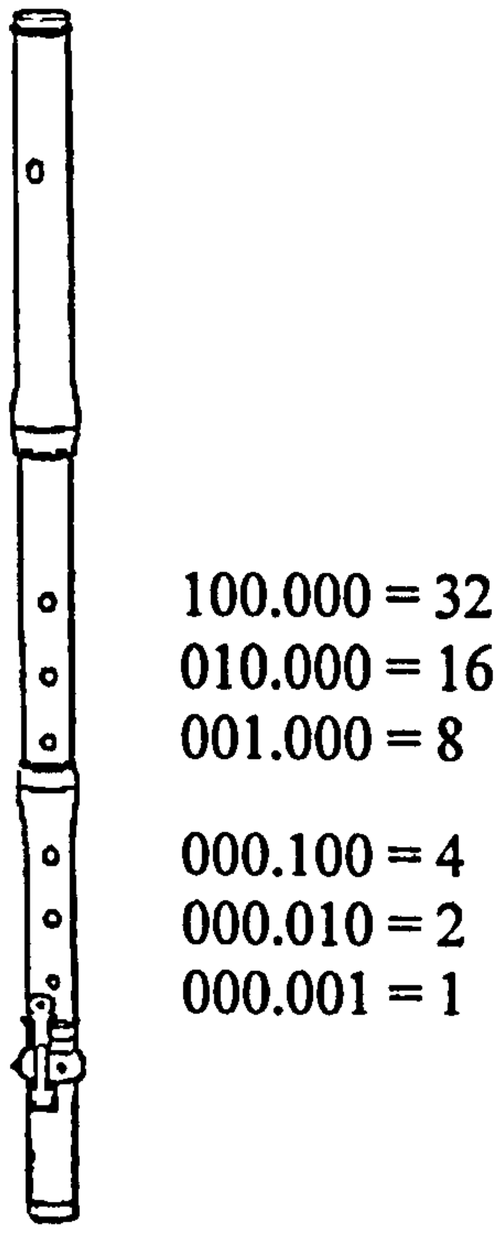

Fig.3.6

The decimal number equivalents to the position of the holes in the binary code sequence, i.e.:

1. The third finger of the right hand is referred to as 1 (000.001) and covers the hole nearest to the key.
2. The middle finger of the right hand is 2 (000.010).
3. The right hand index finger is 4 (000.100).
4. The third finger of the left hand is 8 (001.000).
5. The left hand middle finger is 16 (010.000).
6. The left hand index finger is 32 (100.000) and covers the hole nearest the embouchure.

To give a further example – the spoken communication: '*Use moving-fingers 1, 2 and 4 on fixed-fingering 8 and 32, and repeat twice*', signifies a finger-row in which all three moving-fingers are in the right hand, while the left hand fixed-fingerings close holes under the third (8) and index fingers (32), i.e:

- **II:101.000→000.001→101.010→101.011→101.100→101.101→101.110→ 101.111→101.110→101.101→101.100→101.011→101.010→000.001:II^{x2}**

There are occasions when it is easier and clearer to write decimal figures as sums equivalent to each of the patterns in the binary arithmetic sequence of a finger-row. For example, the sequence given in the previous paragraph could be written as:

- Moving-fingers play II:0→1→2→3→4 →5→6→7→6→5→4→3→2→1:II on fixed-fingerings 8 and 32

  Or for two performers playing in alternation as:
- $^{1st\ voice}/_{2nd\ voice}$ II: $^{0}_{0}\,^{1}_{1}\,^{2}_{2}\,^{3}_{3}\,^{4}_{4}\,^{5}_{5}\,^{6}_{6}\,^{7}_{7}\,^{6}_{6}\,^{5}_{5}\,^{4}_{4}\,^{3}_{3}\,^{2}_{2}\,^{1}_{1}$:II played on 8,and 32.

In practice, performers find it easy to combine the assignment of decimal numerals to moving-fingers with the decimal sum equivalents of fixed-fingerings, although naturally this can be extremely unclear as a method for conveying written information.

3.4.3 Music notation

Until further research is undertaken in collaboration with composers, and a body of working knowledge is acquired, it is premature to draw conclusions about the most satisfactory way of notating ecosonic sounds. Quite possibly, the standard notation for microtonal pitch adjustment could be used with, where needed, additional fingering indications in binary code notation and written instructions.

3.5 Summary

Avian sounds are as varied as the birds that make them, and this research began with the attempt to capture and translate the characteristics of birdsong into a vocabulary of sounds with the means to develop them into an improvisational language; and it proceeded through exploration of extended techniques, atonality, microtonality and the 128 fingerings of the flute.

One can find avian song characteristics relating to timbre, articulation, pitch, rhythm, phrasing, temporal organization (i.e., durations of sound and silence), and dynamic range, listed in many writings on birdsong. There are, however, (possibly) universal qualities of song that are not listed in books but which I identified as essential and which I determined would form the essence of avian-inspired, improvisational techniques and forms.

Thus, the ecosonic system did not develop so much from research into the means for translating the characteristic quantities of avian sounds, as to evolve through the attempts to translate the qualities of birdsong into music. These qualities belong to the way songs and other avian sounds are delivered. Collectively, they are more often to be found as qualities of speech than of music. They include:

1. flexibility
2. fluency
3. freedom
4. facility
5. volubility
6. variety
7. contrast
8. spontaneity
9. unpredictablility

Some birds sing melodies, scales and arpeggios almost as if they have been trained in music college, while others produce songs either so simple or so complex; so noisy or high pitched; so brief or so repetitive that they seem to have little in common with human musicality. In some significant ways, however, song always resembles the production of human speech. As an early 20th century student of birdsong observed:

> '*the songs of English birds depend far less on tone than on resonance and rhythm...In most cases the modulations involved are no greater and no more constant than the modulations employed in vocal utterance generally. Indeed,*

> *during the last year when I was studying the Garden Warbler's songs, I happened to hear a lecture by a well-known Italian lady whose voice in its modulations and flow of rich varied consonants reproduced the Garden Warbler's song to perfection. Similarly, the modulations involved in the Hedge Warbler's song are almost inevitably reproduced by any one who will quickly but distinctly recite such a triple-timed line as 'He promised to buy me a bunch of blue ribbons to tie up my bonnie brown hair."*[78]

It is not, however, the acknowledgement of the modulations or the resonances and rhythms as speech-like which are as important as the implications of the qualities that give rise to them. The sounds of speech carry the spontaneous, audible expressions of the smallest movements of the speakers muscles as they tense and relax in tune with his/her thoughts and feelings.

There are few forms of music in which such immediacy has an essential role: '*Western musical culture is essentially a 'score culture''*.[79] In translating birdsong into the musical languages with which we are familiar, we may successfully translate avian melodic, textural and rhythmic forms, but we lose the range of expressive speech-like qualities that make the songs what they are.

The ecosonic system evolved out of the need to create an improvisational language that could convey the musical character of birdsong through its speech-like qualities. For this to be possible it needed:

1. a large and varied vocabulary of pitches and intervals that could unfold unpredictably but not unintelligibly;
2. a wide and varied range in timbre and dynamics;
3. to be a system that was not linked to traditional and existing musical systems either by adaptation or subversion;
4. to have a simple and efficient fingering technique that would allow the performer to improvise with great speed, freedom and fluency;
5. to be immediately responsive to the smallest interior muscle movements of the improviser, allowing the immediate, spontaneous expression of sensations, thoughts and feelings.

The first phase of research revealed that while extended techniques, atonality, microtonality, and the 128 flute fingerings might be appropriate for some characteristics of

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[78] W. Garstang, *Songs of the Birds*, new edn (London: The Bodley Head, 1935), p.13-14.
[79] C. Deliége, 'Pour une sémantique selon Rameau', quoted in R. Monelle, *Linguistics and Semiotics in Music* (Switzerland: Harwood Academic Publishers, 1992), p. 114.

birdsong, none of them were appropriate for expressing the qualities song as listed in the third paragraph of this section..

Atonality

As in tonal music, atonal scales are constructed from an octave divided into twelve pitches; but unlike tonal scales, some of these scales can be treated as simple, self-contained systems (for example, the whole tone scale). Atonal scales, structured on reiterated patterns of pitch relationship, were investigated in Nicolas Slonimsky's encyclopaedic *Thesaurus* [80] for their potential as improvisational systems, but they were found to be too limiting in ranges of pitch and interval, and to require clumsy fingering techniques. The parameters of whole and half-tone pitches were found to be too rigid and to offer insufficient variety of pitch inflection. This was of course inherent in the system as the intervals between pitches could never be more or less than a semitone. The materials of the simplest scales (for example, Slonimsky's 'Equal Division of One Octave into Two Parts: Interpolation of One Note')[81], while sometimes offering a degree of technical facility and improvisational freedom, were at the same time too limited and offered little contrast and variety. The more complex of Slonimsky's scale systems did offer greater variety of materials, but these were accompanied by an increase in technical difficulty and a further loss of facility, while failing to provide a solution to the problems of accessing a much richer vocabulary of pitch tunings and interval inflections.

Research into atonality revealed the advantages of a system of sound-relationships built on reiterated patterns, and it demonstrated the need for a greater range of pitch tunings and interval inflections. It also offered the insight that musical knowledge could be disadvantageous; that the power of what is known could limit the ability to respond to what is heard and felt. In this respect it was impossible not to judge my experiments with atonality in terms of the music I knew and the music I 'knew' I should be making. A preoccupying question was: How does one attempt to create improvisations based on birdsong on the baroque flute against a background knowledge of, for example, the great avian-inspired music of Messiaen, without being shaped and shaken by that knowledge? There was an element of absurdity in it, but it began to lead me towards the conception of the qualities of delivery listed above, some of which atonal scales hinted at without fulfilling.

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[80] N. Slonimsky, *Thesaurus of Scales and Melodic Patterns* (New York: Schirmer Books, 1947).
[81] See Slonimsky, *Thesaurus*, p.1.

Microtonality

Microtonalities, such as the 24 note quarter tone scale of Delusse and the 43 note scale of Harry Partch, appeared to offer two advantages over atonality:

1. A microtonal system could provide a far more adequate representation of the range of pitches and intervals heard in avian song.
2. Microtonal music did not form part of my knowledge base and consequently seemed likely to offer a greater freedom of response to birdsong.

Microtonality brought a further set of problems, however, in addition to those that had been encountered with atonality:

1. The first problem was an absolute loss of freedom and spontaneity – I could only hear microtonal intervals as deriving from intervals based on the semitone.
2. The second problem was one of system: microtonalities lack the fundamental simplicity of all tonal systems built on whole and half tones, and larger divisions of an octave. There was no satisfactory way of developing a microtonal system for an improvisational language. Not only that, but in order to improvise with such a system it required the acquisition of an aural knowledge that equalled that of tonal or atonal scales, of all the pitches and interval relationships within a microtonal scale.
3. The third problem, as with atonality, was that of fingering technique – but on an increased scale of difficulty. The technique required for the quartertone fingering system was formidable, and in a few instances almost impossible to execute. It was apparent that the technical complexities of improvising with a 24 or 43 note scale would only allow the musical potential of microtonality to be exploited in a most limited way.

Microtonality revealed, however, that greatly enriched possibilities in pitches and intervals would be most effective in creating some of the qualities of variety and flexibility for shaping melodic lines. It also demonstrated both the advantage of not being encumbered by prior musical knowledge, and the disadvantage of ignorance, as shown by the problems I found in thinking in quarter tones when attempting to use them for improvisation. Most importantly it shifted my conceptions of what constituted legitimate as opposed to illegitimate forms of music and musical materials.

Finally, research into microtonality demonstrated the problems of complexity through excess: from the excess of over- complex fingering to the excess of sonic materials. Without the structure of a system that was either too limited or too technically complex to be compatible with the improvisational qualities I was seeking, the materials of microtonal scales offered no accessible patterns of relationship except between adjacent microtones.

Extended techniques

The greatest advances in researching the potential of extended techniques were gained through approaching the baroque flute in a completely new way. This was of fundamental importance in shaping the concept and achieving the quality of freedom needed as a vital part of improvisation. Although the extreme development of technical ability, and my thinking about extended techniques was a deliberate strategy, the advantages gained from this stage of research were difficult to assess at the time.

Extended techniques without an improvisational language in which to place them are nothing other than sound objects with no clear value or function: they are quantities without qualities. Most extended techniques are by definition difficult, and require a compelling reason for using valuable time and energy, first of all to acquire them and secondly to learn to use them effectively. Many techniques are extremely difficult (although not impossible) to play freely and fluently on the baroque flute; but it is impossible to play any of them spontaneously except in the context of a language in which they can become natural elements of the improvisational vocabulary. In the context of such an improvisational language, extended techniques however, may not only offer variety and contrast but may also allow the performer to translate avian characteristics very truthfully.

Mapping the flute

Mapping the 128 fingerings of the flute was aimed at exceeding the limitations encountered in the preceding three stages and in some degree, it was both an extension of and a reaction to, the results of earlier research. When the mapping was being undertaken, it appeared that it might be an exercise merely of idle curiosity and possibly of little value. Although it further enlarged my knowledge of the flute, it was not apparent that the material generated could be treated systematically, nor that a sonic language could be created from it. The simple techniques of many of the fingerings, however, and the range of sounds they generated, presented the potential for producing all the qualities that, by this

stage of the research process, had been identified as essential elements of an improvisational language, i.e., flexibility, fluency, freedom, facility, volubility, variety, contrast, spontaneity and unpredictability.

Mapping the 128 fingerings was the last stage in breaking down the conceptual barriers to adopting a new approach to the flute and to developing the qualities that I had identified as essential. These conceptual barriers had separated "right" from "wrong" fingering, "accurate" from "inaccurate" pitch, "good" from "bad" sound, and "correct" from "incorrect" ways of playing. What took their place finally were simple questions: 'What needs to be done? What does this do? Is this effective? Does this do what is needed?' At this point the foundations for the ecosonic system were completed.

In order to achieve the necessary speech-like qualities, simplicity of fingering technique had to be an essential characteristic of the ecosonic system. Unlike conventional flute fingering in which finger movement is determined by the sounds of specific pitches, ecosonic fingering allows the production of sounds and the shaping of melodic lines to be determined by the emotional/physical impulses of the performer, as expressed through the movement of the fingers. Every single finger movement produces a valid sound, contrary to conventional wind instrument technique which requires that nearly every note be produced by a combination of several fingers. These characteristics of the ecosonic system confer on the performer the potential for playing with unmediated expressivity, and with a very high degree of fluency, spontaneity and unpredictability.

In replacing compound fingerings with simple finger movements, the ecosonic system also replaces the complexities and connotations of highly developed musical systems with a simple system of sound making which is relatively free of associations with other forms of music. The performer can create music that arises directly from physical impulses of thought and feeling. These impulses are given direct expression through the breath and fingers without the mediation of a knowledge base built on other systems of music making. The result is a form of music that more closely resembles human vocal expression and, if the sounds made by birds are shaped by impulses that parallel those of humans (which I assume they are), more closely translates from birdsong.

4 THE ECOSONIC SYSTEM IN PRACTICE

Dialogue is the interactive medium in which the products of heurism are tested. Sounds are placed: placed in contrast to, in parallel to, in imitation of, in respect of, without regard to, other sounds. Minds struggle, coalesce, defer or acquiesce. Inner debate meets outer debate. Instant decisions dictate the immediate direction of the music. But more thorough observations can later impose their own logic on subsequent proceedings. Only cowardice can cancel the validity of non-action.[82]

4.1 Introduction

This chapter summarizes the exercises, strategies and practice used to explore ideas, technique and forms for solo and duo improvisations. The treatment of ecosonic material here is intended to give a representative picture of the system, the strategies that were used for developing form and structure through modelling and duration; details of exercises that demonstrate the sequential basis for moving-finger patterns; and examples of solo and duetting improvisations.

4.1.1 Solo Improvisations

Early solo improvisations focused on the exploration of some extended techniques, on the development of two models of song – those of the song thrush and the European robin, and on short (usually one minute) improvisations as the means for shaping improvisations. Three technical approaches were adopted for this work:

i strictly defined finger-rows;

ii finger-rows which began quite strictly but were then allowed to change;

iii free fingering in which finger-rows were not defined at all.

It was found that it was difficult to develop material effectively and arrive at a balance in the length of improvisations. They were often too long – some were too long and rambling while others were too long and repetitive; these were problems typified by the robin and song thrush models respectively. At that point of the research, musically effective solo improvisation on the baroque flute appeared to be a difficult undertaking.

Later improvisations explored models of song such as that of the tropical boubou (*Laniarius aethiopicus*), which provided a very beautiful model for improvisations based on a rhythmic pulse. (An example of tropical boubous duetting is given on **CD 4:20**).

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[82] E. Prévost *No Sound Is Innocent* (Essex, England: Copula, 1995), p.3.

4.1.2 Duetting

Early technical and improvisation explorations were undertaken as solo work, but birds do not spend their entire lives singing either to or for themselves, nor do they learn how to develop their songs as solitary individuals – that is not unless they are unfortunate enough to be isolated in a cage. After working on exercises to develop moving-finger techniques, gaining a working knowledge of the sounds produced by the finger-rows and exploring forms of solo improvisation, I decided that the most productive way forward was to explore the material on a larger scale with the involvement of a second baroque flute player. This decision grew from the need to gain a broader understanding of ecosonic technique and improvisation, and to find out how it would work in performance with another instrumentalist. This decision was reinforced by the knowledge that some species of birds sing in duet; others sing in chorus. [83]

Birds are described as singing in duet (or 'duetting' as it is often called by ornithologists) when 'more than one individual combines to sing', but the term can include 'all overlapping bouts of sounds between pairs of animals'[84]. What was of interest initially was the song of paired birds that sing either phrases or individual notes so precisely interwoven that they sound as if only a single bird is singing. This effect, i.e., the duetting of two birds sounding as one voice, is known as antiphonal song.[85] It was an area of avian song I was particularly interested in exploring as it provided an ideal model for duo improvisations using two of the same instruments.

Duetting between different species takes place in a variety of ways. Duets can vary in temporal organisation, in the precision of the exchanges, and in the degree of synchronism between them.[86] There are some birds that sing separate songs which complement each other, for example, the spotted morning thrush (*Cichladusa guttata*); others sing finely coordinated antiphonal song in which it is almost impossible to tell the singers apart, for example, the plain wren (*Thryothorus modestus zeledoni*). Examples of plain wren and spotted morning thrush duets are given on **CD 4: 18-19**: see Fig.4.1 for the sonogram of the plain wren recording on **CD 4:18**, which shows how the complete song is divided between the male and female pair.

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[83] See C.K. Catchpole & P.J.B. Slater, *Bird Song: Biological themes and variations* (Cambridge, Cambridge University Press, 1995), pp.173–7.
[84] Catchpole & Slater, *Bird Song*, pp.173 & 174.
[85] E.A. Armstrong, *A Study of Bird Song* (London: Oxford University Press, 1963), p.180.
[86] See M.L. Hall, 'A review of hypotheses for the functions of avian duetting', *Behavioral Ecology and Sociobiology* (2004) 55:415–430.

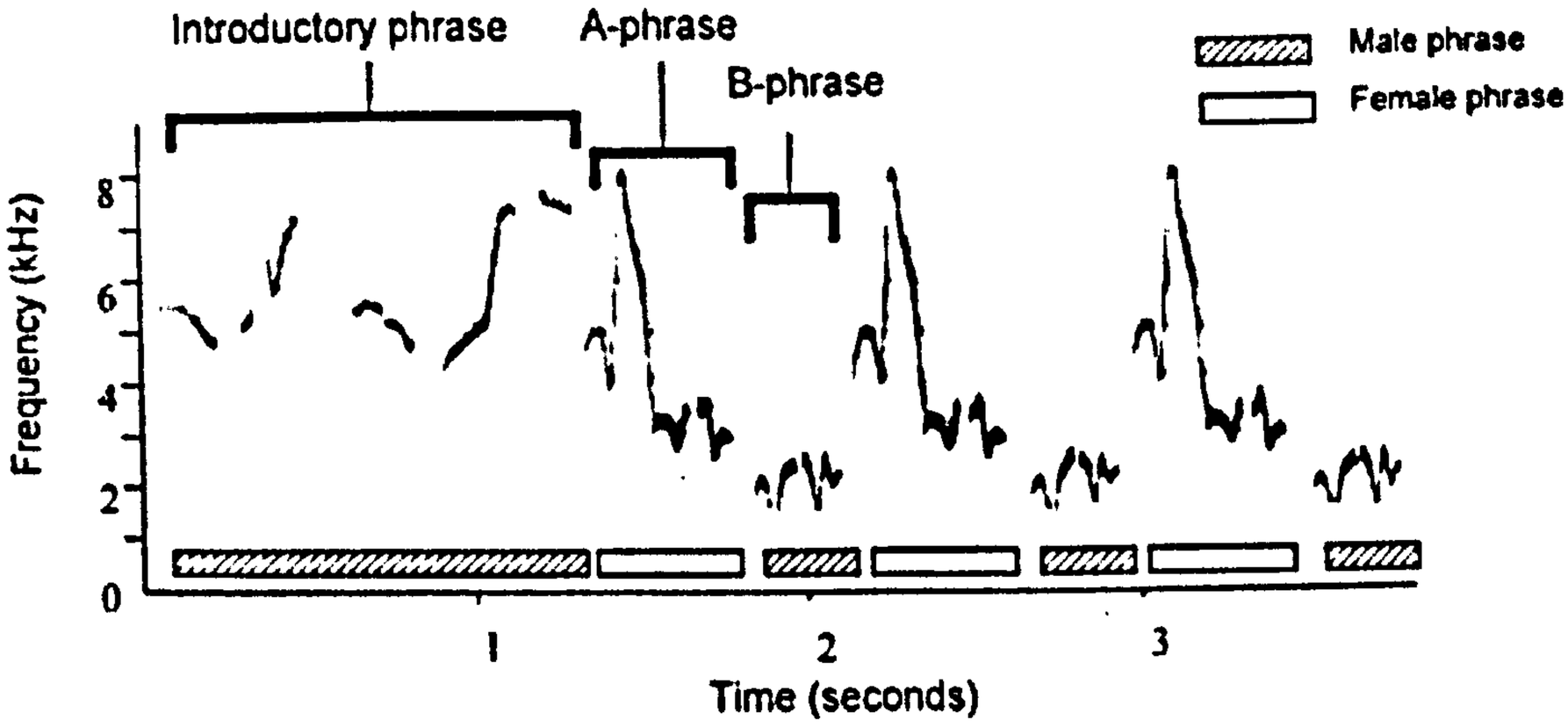

FIGURE 1. Standard duet format of the Plain Wren. A typical duet, initiated by a male introductory (I-) phrase and followed by an antiphonal cycle of female (A-) and male (B-) phrases. Recorded during October 2001 at La Suerte, Costa Rica.

Fig. 4.1

The sonogram of the plain wren recording on CD4:18.[87]

Hearing another musician improvising, made it easier to evaluate the ecosonic system, as the dialogue between two improvisers provided both positive and negative feedback, thus making it easier to evaluate whether and how meaning was being developed in the structure and use of materials. Thus duet improvisations brought significant advantages:

1. It was easier to make an objective evaluation of improvisations and the sonic materials used.
2. Ideas and materials could be tested by the quality of the exchanges between the two players.
3. Structures and models could be developed more effectively.
4. A far greater range of models and structures could be explored.

4.2 Working methods 1: exercises

The process of developing improvisation techniques began with establishing a degree of technical control and gaining knowledge of the production, nature and characteristics of microsonic vocabularies and key-sounds. Technical control was developed through finger exercises and the exploration of sonic materials through studies.

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[87] From N.I Mann, L. Marshall-Ball & P. Slater, 'The complex song duet of the Plain Wren', *The Condor*, (2003), 105:672-682, p.674.

Exercises for moving-fingers[88] had three objectives:

1. To develop a knowledge of sequential patterns of movement.
2. To increase the independence and facility of movement of individual fingers.
3. To explore the microsonic vocabularies and key-sounds in the super-row and in finger-row sequences.

These objectives were achieved through working on sequences that moved forwards, backwards, in inversion (i.e., starting with all holes closed and raising the fingers in sequence rather than lowering them), and in various other sequential permutations of fingering. Finger-rows were explored using finger-rows of moving-fingers and fixed-fingerings, and using finger-rows that consisted solely of moving-fingers with fixed-fingering patterns in which no fingers were down.

4.3. Working methods 2:form and structure

A priority for developing free improvisational practice was to evolve methods for exploring, learning, and using material in a focused way. This was particularly relevant to creating an improvisational language with the ecosonic system in which the microsonic vocabularies could be fully explored. Strategies were required that assisted in structuring the materials and in giving them form.

4.3.1 Form and structure

Once a degree of facility and a working knowledge had been established, I turned my focus onto forms and structures, and the creative aspects of improvisation. There were essential questions that had to be answered about form and structure in the context of free improvisation with the ecosonic system, i.e.:

1. How could ecosonic sounds and technique be used to create form and structure?
2. Could form and structure have any meaning in terms of free, ecosonic improvisation? Or did they contradict the concept of 'free' improvisation?

The solutions came with the development of improvisations and an increasing understanding of how to use the ecosonic system effectively. They took the form of more strongly developed concepts of the finger-row – with its fixed-fingerings and key-sounds,

[88] NOTE: It should be recalled that moving-fingers act individually like the fingers of a keyboard or string player, unlike conventional wind instrument technique in which several fingers are required at a time to produce most notes.

and moving-fingers and microsonic vocabularies – and of the use of rhythm, simplicity and silence.

4.3.2 The meaning of structure

Structure refers to the sonic materials and the way they are used and related within an improvisation. For example: the sonic materials of an improvisation modelled on the tropical boubou (see **4.4.2** below) consist of simple, mostly flute-like sounds, structured on a rhythmic pulse and performed with syncopated notes and silences (for example *Tropical Boubou solo improv* – **CD 2:44**).

4.3.3 The meaning of form

Form in ecosonic improvisation refers to:

1. Duration and the way that duration effects the materials and structure. For example, an antiphonal duet is structured out of single sounds or small sound groups, which are played in strict alternation; depending on whether the duration of the duet is short or long, the structure and the materials must be developed consistently with the brevity or length of the improvisation. If it is decided that an improvisation will be short then it must be performed and developed in such a way that a short improvisation works.
2. The large scale organization of structure. For example: improvisations modelled on the plain wren (see **4.4.2** below) open with one voice attempting to get the other voice to respond, and only when there is a response does the duet begin. (For example *Callsigns 1, 2 & 3* – **CD4: 5, 11, & 16**).

Form and structure are interdependent. The disciplines implicit in employing them may seem to subvert the meaning of free improvisation, but in practice, both form and structure are used as guiding intentions, and as potential shaping factors which are neither compulsory nor to be rigidly followed.

4.4 Working methods 3:models and durations

Existing improvisation styles, such as jazz or classical Indian music, employ sophisticated learning methods that have evolved with the musical languages they use. Adopting the disciplines of jazz might have been applicable to atonality, but there was no apparent application for it in microtonality and even less for the ecosonic system. In addition to these considerations, established improvisational languages such as jazz are built on pitch

and key relationships and were unlikely to answer the needs of an improvisational language based on birdsong.

For want of an established method for developing improvisations, two strategies were adopted, which I projected would assist in developing improvisational forms and structures. These were respectively:

1. modelling, i.e., developing improvisation on specific models.
2. durational, i.e., performing improvisations within specific time limits.

4.4.1 Model and structure

'*For the effort to imitate shows that the workman has only a base and poor conception of the beauty of the reality — else he would know his task to be hopeless, and give it up at once ...*'[89]

Avian sound-making is a most fertile source of models for improvisation. The structures of song differ greatly from species to species. Familiar examples include the repetitive structure of song thrush song in contrast to the (apparently) endless, ever-changing stream of song of the skylark; and the (apparently) leisurely delivery of the blackbird as opposed to the frenetic song of the European robin.

Meaning in birdsong appears to be communicated in widely different ways from one species to another. Elements of communication may include contrasts in pitch or timbre, or variations of temporal organisation. Bird sounds cover an immense range of qualities from which range from flute-like whistles, trills, and warbles, to percussive rattles, harsh chattering, hissing and clicking, and even to mimicry of sounds such as: '*the wingbeats, feather ruffling, bill snapping, and begging calls of other birds ... calls of frogs* (and) *mammals ... human whistles and speech fragments, vehicles, cameras, and musical instruments...*'.[90] Variation of temporal organization can be achieved through rhythmic shaping of single sounds and phrases, speed of delivery and length of phrases, and the length of silences between single sounds, phrases or entire songs.

The practice of creating difference through structure, content and sound characteristics became an increasingly significant element as a model for improvisations. Models were

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[89] J. Ruskin, *The Two Paths*, 'Lecture III' (London: J.M. Dent & Sons, 1859), p.140.
[90] See C. Perrins (ed.), *The New Encyclopedia Of Birds* (Oxford University Press, 2003), .s.v. 'Lyrebirds: Vocal Mimicry in Lyrebirds', p.454

also drawn from a wider circle of avian-related sounds and patterns of behaviours, as well as more abstractly musical ideas. (See under **4.4** below).

Specific examples of exercises, studies and improvisations are given on **CD1:24–26; CD2:1–6 & 13–18**; and **CD3:2 & 3**. A number of extended techniques, however, were suggested by avian models (see **2.1.4**: *Sources of techniques*), including flutter fingering (from robin song), triplets, nightingale beats and "sparrow' triplets (examples given on **CD1:11–25**). In addition, nearly all of the duetting improvisations started out based on specific models such as the plain wren, and generalized models such as antiphonal song, for example: all but the slow improvisations on **CD3** and **CD4** began with avian models.

The diary entry shown in Fig.4.2 is an example of how I observed live song as potential models for improvisational material. This material was intended for development in Edward Cowie's improvisation ensemble SONIC: an ensemble of voice, flute and violin with Cowie on piano, which performed music based on natural sound.

Date: 31/10/01

Place: Gt Maxfield, East Sussex

Time: 17.00-17.30

Weather: crystal clear sky, beautiful sunset, cool, no wind, full moon visible

Pheasants roosting

Pheasants making their roosting calls: one bird would call and the others would answer antiphonally. Sometimes the calls would crescendo to sound-wide symphony of calls. At others the calls would fade to silence. A tawny owl was hooting intermittently all the time, audible through the calls, in the silence a distant flock of jackdaws were audible as a faint, sweet chattering babble. There were also the sounds of other small roosting birds. The antiphonal pheasant calls were perfect as a basis for an improvisational form. ie Instruments would just start with calls crescendo-ing and diminuendo-ing then one instrument would break out into a liquid, spun legato line - night - the instruments alternate in these roles possibly even two could spin a line while at least one maintains the calls. Also, during call intervals and in quiet moments there could be hushed, sweet instrumental chatter.

Fig. 4.2

Examples from observational diary entries recording song material as potential improvisation model.

4.4.2 Duration and form

While modelling offered the means for exploring materials and structures, it did not answer the question adequately of how to manage the forms in which structures could be

developed; the solution to this was provided by improvising within precise durations.[91] Improvising within fixed durations made it possible to understand how form and content related. It assisted in:

1. defining ideas of how structural content related to form;
2. gaining insight into how materials build structure;
3. increasing the understanding of interactions between structure and sonic materials, and duration.

Duration was varied from 15 seconds to five minutes and longer, and was applied to both solo and duet improvisation. Typically, one minute was found to be the most useful duration for solo improvisations. Durations of one minute would occasionally be broken up with untimed, and two or three minute improvisations. The improvisations given as examples on CD1 are nearly all of just under a minute (the loss of a second or so being the result of starting the electric timer).

The advantage of a shorter time span is the degree to which it focuses the attention on how the material is used and shaped. A one minute time limit, however, was frequently found to be too short for duetting. The greater variety of material that two players can use and of the dialogue they can generate, can be better explored in longer durations, although it was also possible to play extremely short improvisations of as little as a quarter of a minute.

In general, because longer time limits raised the awareness of the ebb and flow of idea, they proved useful for learning to develop coherence in both solo and duet performance. Long improvisations can highlight problems of structures degenerating into a series of disconnected climactic points rather than unfolding as a connected flow of ideas. Extremely short improvisations, on the other hand, were used to develop the succinct expression of a single idea with a fast moving structure, (for an example of a 14 second improvisation play *Ballistic 1*, **CD3: 17**).

4.5 Examples of models

Specific models were usually applied respectively to solo and duetting improvisations, although certain models, such as improvisations based on a single technique, could be applied to both. One duetting model, the tropical boubou, could be applied very effectively

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[91] See W.A. Mathieu, *The Listening Book: Discovering Your Own Music* (Boston: Shambala Publications, 1991), p.164.

to solo improvisation because the song has an extraordinarily well-defined, rhythmic pulse and a simple vocal line.

4.5.1 Solo song models and studies

Early models for solo improvisation studies were the song thrush and the European robin. The song thrush was an obvious model for the use of reiterated, short, clearly defined phrases. Examples of thrush model improvisations are given on **CD2:13–18**, and in the opening of **CD2:38**; examples of robin model improvisations on **CD2:1–5**. Tracks 1, 2 and 3 of the robin improvisations also illustrate examples of a finger-row using the fixed-fingering 110.000 or 32 and 16 (48 as it is announced on the recording).

Robin song was chosen for two reasons:

1. It was the one example of live (as opposed to recorded) birdsong that I hear almost every day throughout the year.
2. It represented some of the quintessential qualities of song, which could be summarized as comprising:
    a. varying degrees of complexity and simplicity
    b. contrast of movement, articulation and timbre
    c. rhythmic and dynamic variety
    d. constant variety of material
    e. both vitality and delicacy in delivery of song
    f. volubility and fluency of utterance.
    g. a sense of spontaneity, freedom and unpredictability

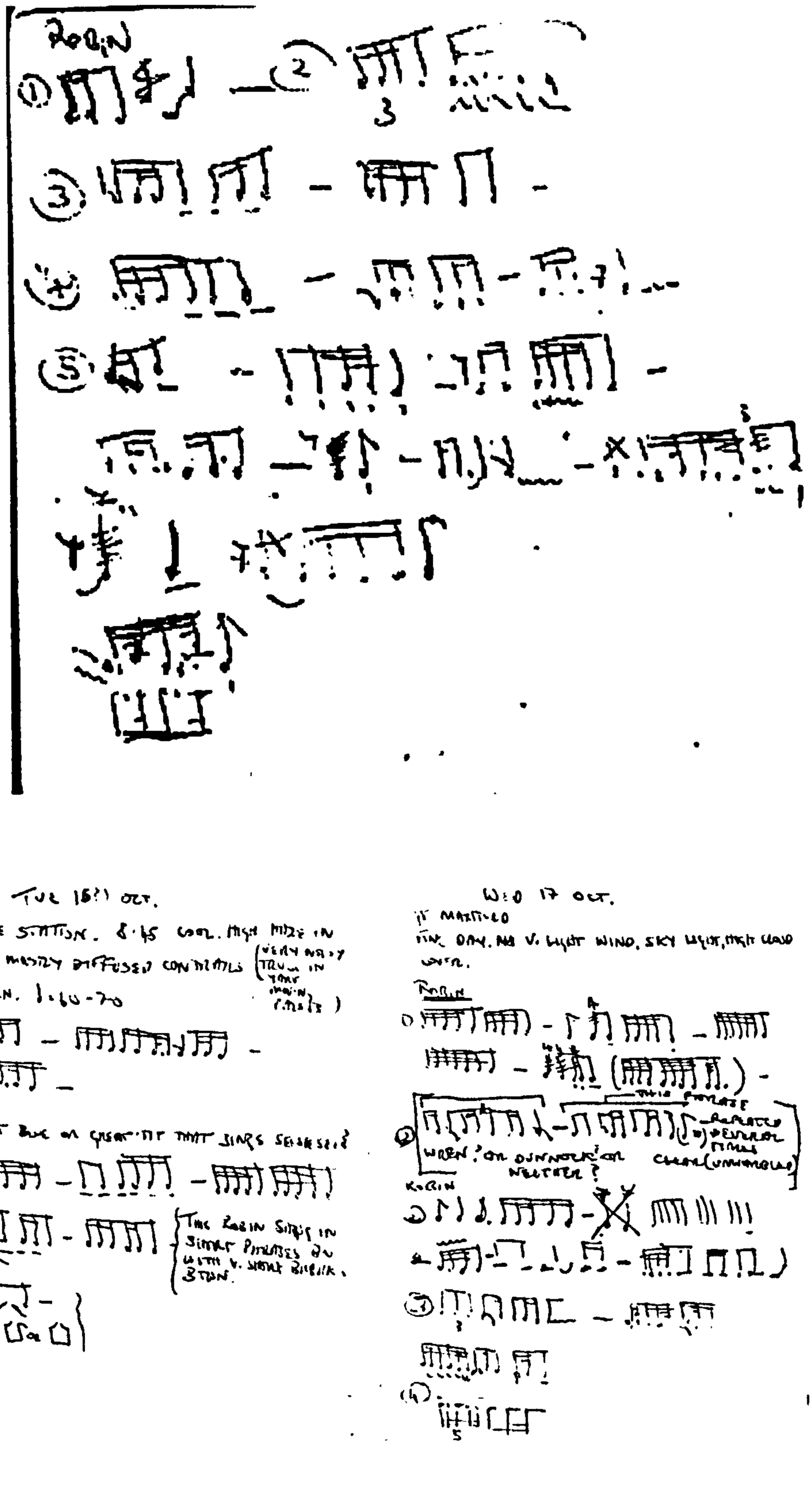

Fig. 4.3

Examples from an observational diary entry transcribing the rhythms of robin song elements. The examples above represent a part of my attempts to find a musical notation system suitable for fieldwork responses to birdsong source.

The tropical boubou, which was primarily a duetting model, also proved to be effective as a solo model with a simple rhythmic pulse and a clear, melodic, vocal line. (An example of solo tropical boubou model is given on **CD2:44**).

Individual improvisations also took the form of studies which explored a range of technical material, for example, focusing on a single technique, a finger row, a particular pattern of fixed or moving fingers, multiphonics, circular breathing, flutter fingerings, vibrato, or a quality of movement, such as playing with long, slow moving sounds, or rhythmic patterns. Examples of this kind of work are given on **CD2:7–8, 11, & 20–42.**

4.5.2 Models for duetting

1. Structural models:
    a. Alternate exchange of sounds, i.e:
        i antiphonal singing (see **4.2** above), for example, the antiphonal songs of the plain wren;
        ii complementary singing of two separate songs such as performed by the spotted morning thrush.
2. Improvising by varying the simultaneity of sounds so that they are synchronized in degrees ranging from partially to completely overlapping, for example,
    a. the tropical boubou mainly sings antiphonally but with some elements of simultaneous sound production.
3. Cooperative or confrontational interaction, for example:
    a. the improvisers contest with each other (the model for this is 'matched countersinging', which is 'a form of coordinated singing' when two birds occupying neighbouring territories sing against each other)[92]
    b. the improvisers exchange sounds as if in a courtship encounter (this was a generalized concept not based on any particular species).
4. The plain wren model, i.e., the male bird initiates the duet but then has to wait for a response from a female before the duet can be performed.[93] If the male gets no response then it keeps attempting to initiate one until it is successful.
5. The bay wren (*Thryothorus nigricapillus*) model is the reverse of the plain wren: it is the female which initiates the duet.[94]

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[92] See Catchpole & Slater, *Bird Song*, p.177.

[94] See P.J.B. Slater, 'Birdsong Repertoires: Their Origins and Use' in N.L. Wallin, B. Merker and S. Brown (eds), *The Origins of Music* (Cambridge, Mass.; London: The MIT Press), pp.49-63.

6. Sound environments:
   a. Avian sound environments, for example, the dawn chorus (**CD4:1, 7 & 13**).
   b. Conceptual sound environments, for example, night sounds (**CD4: 4, 10 & 15**).
   c. Abstract environments, for example:
      i slow, sustained sounds played simultaneously using intervals to generate beats, and difference tones[95] (examples given on **CD3:12**; and **CD4:4, 10, & 15**).
      ii very short rapid, exchanges of sound (examples given on **CD3:13 & 16**).
7. Movement, proximity and spatial modelling, i.e., physical movement was used to explore the reciprocal effects of the improvisational sound model on the improvisers' body orientation and spatial relationship, for example: the two players starting to play at opposite corners of the room and slowly converging on each other in a spiralling floor pattern.

4.6 Examples of notated improvisations

Many exercises and improvisations were recorded on minidisc and on digital video with a written record of the finger-rows used.

Video was found to be particularly helpful in providing a focus of attention for improvisations. Directing the performance to camera served as a stimulus for engagement that would normally be provided by an audience. It is one thing for a musician to practise in solitude but a very different thing to perform in isolation. Performance cannot work as a solitary, undirected and unobserved act, as it is a complex and continuous interaction between performer and audience, between self and others.[96] The process of my research put me in the position of a bird, who when learning to sing, is content to warble to itself in a form of subsong, but must at some point sing overtly, driven by the necessity of communicating with other birds.

4.7 Examples of notated improvisations

The following notations are taken from **CD3** to demonstrate some of the finger-rows on which the improvisations were based. Those improvisations which are notated on two lines or are contained between the signs **II:** and **:II**, retain the same fingering sequence without

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[95] A third tone generated by the difference in frequency between two notes.
[96] It is of course possible to perform for oneself and it can be very satisfying but, like the communicative nature of the avian sounds on which it is based, a musician's work is intended for an audience and it has to be conceived in that context.

changing throughout the improvisation. The initial letters SP and AG represent the flute players Stephen Preston and Amara Guitry.

NOTE: In each case a finger-row sequence usually starts with the key-sound of the fixed-finger, this will either be a zero (0) or binary notation of the fixed-fingering only as in the example of Track 9 below. An exception to this is Track 10, which starts with all the moving-fingers lowered in a closed position. Moving-finger positions are indicated in bold type.

NOTE: In order to show clearly the physical progression of moving-fingers, sequences are laid out in binary code (see Fig. 4.4).

000 . 001

Fig. 4.4

Example of binary code in relation to ecosonic fingering on the flute showing the fingering 1.

Examples of finger-rows from **CD3.**

Track

7 Alternating $_{AG}{}^{SP}$ II:$_{0,1}{}^{2,4}{}_{8,0,1}{}^{2,4}$:II or in binary code:

AG.II: 000.000→000.01→

SP. 000.010→000.100→

AG. 001.000→000.000→000.001→

SP. 000.010→000.100→

AG. 000.000→000.01→

SP. 000.010→000.100→

AG. 001.000→000.000→000.001→

SP. 000.010→000.100→

AG. 000.000→000.01→:II and so on.

This is an alternating or antiphonal sequence on moving-fingers 1, 2, 4, & 8. It was one of many exercises devised to develop a rapid response in improvisations based on the alternate exchange of sounds.

8 Alternating $^{SP}{}_{AG}$ II: $^{0,1}{}_{2,4}{}^{8}{}_{16}{}^{8}{}_{4,2}{}^{1,0,1}$:II. This is the same exercise as above but using moving-fingers 1, 2, 4, 8, & 16. In binary notation it is:

SP. 000.000→000.01→

AG. 000.010→000.100→

SP. 001.000→

AG. 010.000→

SP. 001.000→

AG. 000.100→000.010→

SP. 000.01→000.000→000.01→(repeat) 000.000→000.01→

AG. 000.010→000.100→ and so on.

9 The fixed-fingering is 2 (000.010) with moving-fingers 8 (001.010), 16 (010.010), 32 (100.010). One player moves the fingers in the order 8, 16, 32, while the other plays in reverse 32, 16, 8, i.e.:

AG. **II: 000**.010→**001**.010→**010**.010→**100**.010 :II

SP. **II: 100**.010→**010**.010→**001**.010→**000**.010 :II

10 On fixed-fingering 1 (000.001), with moving-fingers progressing downwards from 57 to 1, timed to one minute, i.e.:

II:57 (111.001) →49 (110.001) →41 (101.001) →33 (100.001) →25 (011.001) → 17 (010.001) →9 (001.001) →1 (000.001)**:II**

14 A sequence on fixed-fingering 0 (000.000), with moving-fingers progressing through 4 (000.100), 8 (001.0 00) and 16 (010.000), timed to 4 minutes; SP repeats the moving-finger sequence in an ostinato style, while AG uses the sequence freely.

17 On fixed-fingering 16 and 32 (110.000), with moving-fingers 2 (110.010), 4 (110.100) and 8 (111.000).

4.8 Trio improvisations

CD3:21-23 are examples of improvisations with two flutes and violin. The process by which these improvisations were generated, using *I Ching* hexagrams, is still being developed.

4.9 Summary

Free improvisation is a form of music-making that, for the performer, must constantly exist in the present and move into the future without premeditation. This makes it extremely vulnerable to all kinds of destructive influences. It depends on immediacy and may be affected by preconception, but at the same it requires technical, thematic and structural preparation. Without the fresh input of ideas, and the ability to execute them, improvisations become increasingly repetitive and trite, governed by habits of muscle movement and hearing. This means that to preserve essential creativity, improvisation must be fuelled by a substrate of disciplines which feed the musical imagination and constantly open up the performer's technical facility.

The balance between discipline and freedom can be heard in the remarkable inventiveness of birdsong. By discipline I mean that for many birds singing is not innate, they have to learn to sing and they must actively acquire their songs. Many species develop a large repertoire of song elements or phrases, and some continue to enlarge their repertoires throughout their lives.

Birds that learn song have to go through progressive stages of learning. The chaffinch, for example, starts with simple chirping notes, moving through progressively more complex and increasingly ordered sound combinations until they develop the full song of their species; but this song varies in dialect in different geographical areas.

The early stages of song are categorized in different degrees of 'subsong'. Historically, it was observed by bird-catchers that birds went through periods when they sang quietly to themselves – practicing their songs. It is not only young birds that produce subsong, but also adult birds can be observed quietly singing to themselves in way that is totally unlike their normal song. Sometimes this song is directed to other birds or even to human beings, but at others it appears that the bird is rehearsing song to itself.

By freedom and inventiveness I mean that many birds rearrange and recombine the individual elements of which their songs are made up. A number of familiar birds, such as chaffinches, robins, blackbirds and thrushes, have repertoires of this sort. Although chaffinches have a small repertoire of about three different types of song they perform this in varied sequences, for example:

AAABBBCCCCCCCCCCCAAAAABBCC...[97]

Another bird with a relatively small number of phrases in its repertoire is the yellow-throated vireo (*Vireo flavifrons*). It has a long continued song consisting usually of less than 10 phrases, of which the following is an example of phrase distribution:
12341234123412341215151515615615615615615615615615613173173171712712734
123123123412341234123412341234 etc.[98]

One only needs to listen and compare the songs of different birds of the same species, for example, blackbirds or song thrushes, to realize how much the song of one bird differs from another, and the extent to which individuals can vary the arrangement of elements in their songs. Individuals of that most famous of songbird species the nightingale might have a repertoire of over 200 song types that are repeated in identical form every time they are sung '*except for the minor point that a particular element may be repeated a variable number of times ...a bird may start off ABCDEF ... and then, perhaps half an hour later, it might sing... BFDE* ... [but] *there is always immediate variety: the same song is not repeated twice.*'[99] Furthermore, not all the songs in the repertoire are sung at any one time and the order within a song group may be changed, as well as the sequence in which the groups are sung.

Another voluble songster, the sedge warbler, has only about 50 different elements, but unlike the nightingale the repertoire is not fixed and the elements are recombined in endless variation.[100] The songs are linked, however, with the final syllables of one song being used as the opening syllables of the next song.[101] Thus we have here a simple element of disciplined form framing an apparently free delivery of song.

In addition there are many birds that spontaneously either freely invent new elements of song, or mimic the sounds made by birds of their own or other species. My own experience of this is in listening to the great tit, a bird which typically, one reads, has a song that can be described as sounding like '*teacher teacher*'. This apparently small vocabulary,

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[97] C.K. Catchpole, & P.J.B. Slater *Bird Song: Biological themes and variations*, (Cambridge, Cambridge University Press. 1995), p.168.
[98] See A.A. Saunders, *A Guide to Bird Songs* (New York: Doubleday, 1951), pp.164-5.
[99] Catchpole and Slater, *Bird Song*, pp.171.
[100] Catchpole and Slater, *Bird Song*, pp.171-2.
[101] Catchpole and Slater, *Bird Song*, pp.172-3.

however, is contradicted by an '*extraordinary variety of calls*'.[102] I have heard birds pick out a single element and play around with it, or even invent an element that is not at all apparent in the song. For example, I have heard one bird repeating a short and most uncharacteristic (to my ears) trilled sound. Rhythmic variants and elaborations of the 'teacher' motif are very common, and it is said that if one hears an unusual song when in woodland, it is usually a great tit that is producing it. One writer very familiar with the songs of great tits, describes them as '*individual inspirations...full of invention*', giving '*excellent*' imitations of the songs of other species such as '*Wagtail, Thrush, Hedge-Sparrow, Blackcap, or whatever takes his fancy for the moment*[103].'

Mimicry plays a large role in the song acquisition of many species. Blackbirds commonly pick up sounds in the environment – a particular bird I heard one year incorporated a neighbour's mobile phone ring into his vocabulary – and starlings are well-known mimics collecting the sounds they hear around them and inserting them into their song repertoires.

The building of song repertoire by birds highlights the question of their inventiveness. One of the most remarkable mimics, the Superb lyrebird (*Menura novaehollandiae*) '*can apparently mimic several different sounds simultaneously. They also often interrupt singing to spontaneously mimic other species' calls that are being given at the time, and engage in countersinging of mimicked vocalizations with neighbouring males.*'[104]

One theory proposed for the astonishing variety of invention in birdsong both with individual birds, and within and across species, is that it is required to counter the danger of monotony and to maintain attention.[105] Even a bird with as small a repertoire as the chiffchaff, is constantly inflecting the pitch, accent and rhythm of its apparently extremely limited song. If inventiveness and the creation of variety is essential, then it makes birdsong even more like human music, and makes improvisation the most appropriate form with which to explore and develop the musical models to be found in avian sound production.

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[102] S. Cramp, K.E.L.Simmons, & C.M.Perrins (eds), *The Birds of the Western Palearctic* (Oxford University Press, 1977-94), s.v. 'Great Tit:Voice'.
[103] L. Howard, *Birds as Individuals*, (London: Collins, 1952), p.203.
[104] Perrins, C., (ed.), *The New Encyclopedia Of Birds* (Oxford University Press, 2003), s.v. 'Lyrebirds'.
[105] C. Hartshorne, *Born to Sing: an Interpretation and World Survey of Bird Song* (Bloomington & London: Indiana University Press, 1973), pp.119-136.

5 SUMMARIES AND REFLECTIONS

... observation of Nature is limitless, whether we make distinctions among the least particles or pursue the whole by following the trail far and wide.[106]

This concluding chapter summarizes processes of thought and areas of investigation that formed a constant background to my research and practice. Although not necessarily being of obvious or immediate relevance, it was intended that they might provide further insights, and serve as an indicator of both what I have acquired and a likely future direction in my work as a performer.

The summary begins with brief outlines of the various fields of enquiry I made relating to visual art, science, ornithology, and music. It then focuses on possible characteristics shared by birds and human beings, including the questions of whether birdsong is related to music and language, and whether avian and human lives share other points of intersection that are embodied in sound, such as basic emotional and territorial drives.

I then discuss what I perceive as the problems of conception, perception and reception in relation to creating music based on birdsong. Following this is a short survey of future directions in which my work will be taken.

The final section, which is added as a coda, reflects not on the ecosonic system itself but on the changes it has effected between myself as a player in relation to the flute as an instrument, concluding that the relationship has been transformed to resemble that of a bird to its syrinx.

5.1. Interdisciplinary thinking: a general outline of areas of research and enquiry

Interdisciplinary enquiry formed a significant part of this research, particularly in its earliest stages when ideas were being formulated. This enquiry was conducted largely through an examination of the literature relating broadly to three areas: music, ornithology, and a more generalized area which covered art and science. What follows is intended to be a general outline of the strands of investigation that went into this approach with some comment on the effects on my research where it was possible to observe them. Specific names and works are mentioned in only a few cases. Details of the books and recordings consulted are listed in the bibliography.

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[106] Goethe, quoted in J. Naydler, *Goethe on Science: An anthology of Goethe's scientific writings* (Edinburgh, Floris Books, 2000), p.36.

The value of interdisciplinary thinking is that it presents one with new and unfamiliar modes of thought and approach. Confining thought exclusively to one's own discipline makes it extremely hard, if not impossible, to see beyond the self-created definitions of that discipline. It is not without significance that new directions have often been taken in both science and art by directing the attention outside the immediate boundaries of a particular discipline, for example, the work of Kandinsky who is regarded as the founder of abstract art (see **5.1.1**).

Art and science formed distinctive strands in my thinking although it is difficult to ascertain how great an influence they asserted on the outcome of my research. I read popular science works relating to physics, in particular quantum theory, chaos theories, theories of form and development in the animate and inanimate world, neurological research on learning and movement, and biological research relating to animal sound-production, learning and communication.

5.1.1 Visual art

My readings in art were largely confined to the early 20th century and the writings of Kandinsky[107] and the *Blaue Reiter* group, which he co-founded with Franz Marc. These documents are immensely inspiring and filled with the most perceptive analyses of the processes involved in thinking about and making art, in particular about the problems of form in relation to content. Kandinsky thought in terms of the synthesis of art and science, and he is concerned with a scientific view of things, and with sound and movement, in relation to art. This approach to synthesis was shared by members of the *Blaue Reiter* group and reflected in their collected writings that made up the *Blaue Reiter Almanac.*[108] Both the *Almanac* and a number of Kandinsky's writings are seminal works on the artistic process and could be read to advantage by artists and scientists.

The results of this enquiry however, are hard to quantify. Inspiration is certainly valuable, particularly at moments when that is all one has. It is likely that the approach to art which I absorbed from these writings was instrumental in shaping key attitudes to the creation of a new technique on the flute. However, prolonged reflection on Kandinsky's theories

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[107] Editions used: Lindsay, K.C. and P. Vergo (eds), *Kandinsky: Complete Writings on Art* (New York: Da Capo Press, 1994); W. Kandinsky, *Concerning the Spiritual in Art*, trans. M.T.H. Sadler (New York: Dover Publications, 1977), and *Point and Line to Plane*, trans. H. Dearstyne (New York: Dover Publications, 1979).
[108] *The Blaue Reiter Almanac: Edited by Wassily Kandinsky and Franz Marc,* New documentary edition edited with an introduction by Klaus Lankheit (New York: Da Capo Press, 1989).

concerning the relationship of point and line to plane appeared not to yield any obvious musical ideas. Although the concept of moving-fingers and microsonic vocabularies, taking shape from fixed-fingerings and key-sounds, could well owe part of its inception to the idea of a plane on which lines and points interacted in visual relationships.

The other area of art into which I did some research was the theoretical writing concerning Chinese painting and the use of emptiness, in a quest to find analogies with silence. The process of following up on this reading led me directly to the resolution of the problems I had wrestled with in the first phase of my research and to laying the foundations of a new technique and musical system.

5.1.2 Science

The effects of the scientific writings are harder to quantify, although it was reading about chaos theory in relation to the natural world, that led to the eventual formulation of this research through intensifying my interest in the natural sound world. Chaos theories have changed and developed considerably in a relatively short period of time, but what was of relevance was that they opened up new ways of thinking about the apparent simplicity of systems that organize both animate and inanimate things. It also focused my attention on the fact that complex forms can be the result of very simple content and processes.

The brains of songbirds are studied for the neural processes involved in song learning. Neurological research has much to tell a musician about the learning process, and performance in relation to physical movement. Most musicians learn to move very small muscles and it is interesting to contemplate that what is usually thought of as training the body is actually training the mind. This throws a completely different perspective on the learning process, in particular on the dangerous myth that the more hours one practices the better one gets.

One concept I found useful was that of ballistic movement – which is movement that is so well learnt that it becomes action unmediated by thought. It is most obvious in professional tennis players when their first serve is usually a ballistic movement. It is not only the phenomenal power of those serves which is interesting but also the lack of conscious control that makes them so devastating. The concept of ballistic movement undoubtedly contributed to the final outcome of my research.

It is difficult to assess whether quantum physics had any effect on my work at all, given that it is such a difficult area to understand even when couched in everyday terms. Recent research into the possible role of quantum mechanics in the functioning of cells, in particular on neural cells does, however, shed some interesting light on the questions of thought processes. In some way, I imagined it tying in rather effectively with a system of fingering that was free enough so that fingers could move ballistically, but at the same time to great effect, subject only to quantum movements within the brain, which were in turn generated by the observations of the body as it moved through different feeling states.

5.1.3 Ornithology

The ornithological literature I researched was, in the main, focused on birdsong. It covered a wide range of writing, from the highly informed amateurs who conducted most of the early research in this area to the popular scientific writing of biologists. Historically the span covered the 18th century to the present. Much of what I read concerned questions of song, its meaning and function. A number of the books attempted to quantify song in terms of its musicality, which was something I found increasingly frustrating as I got better acquainted with the subject.

While the immediate influence of reading about birdsong on my research was not particularly great, the long term influence is of considerable and continuing importance. Obviously I had to acquire a degree of background knowledge about birds, most importantly because it informed the ways I listened to and thought about song. Occasionally I learnt things that were immediately helpful. One of these was Ludwig Koch's recounting Fritz Kreisler's attempt to write song down only to say that it was impossible because of the timbre. Messiaen also commented on the difficulty of transcribing timbre. Birdsong can be most perplexing, sounding different just at the moment one thinks one has grasped it. In general it was certainly useful to have an insight into the learning processes of song, and particularly, to be aware that it many cases it was a neural rather than an instinctive process.

It was also useful, but not essential, to have some idea of the physiological processes of song, although I was never totally convinced that the explanations of the functioning of the syrinx accounted adequately for all the sounds birds can make. This did lead, however, to the understanding of the possible physical means by which birds can produce several

harmonically unrelated sounds at the same time. This had an immediate bearing on my thoughts about multiphonics and vocalizing while playing.

Perhaps what was most useful was sharing in the feeling and intensity of the passion many writers, past and present, have for birdsong. This is not the stamp-collecting, list-ticking enthusiasm of the 'twitcher', but a profound love of the subject that elevates the observer intellectually and spiritually. My own listening experience in respect of birdsong has provided me with an elevated sense of the aesthetic of natural sound in general; birdsong in particular. The invention contained within birdsong (passerines in particular), is prodigious in respect of musical domains such as rhythm, phrase structure, pitch variation/bending and timbral power. Though not the first musician to respond to the sensual power of birdsong, the degree to which I applied a thorough and rigorous study of the structure and effects of birdsong has been central to both a technical and sensual quest for a new music on my instrument.

Notating birdsong

Amongst ornithological writers are those who have devoted many years to recording song in musical or graphic notations, for example, Cheney, Saunders and Garstang.[109] Notating birdsong and finding the means to record my own experiments was something that preoccupied me for some time. Initially I had felt that musical notation, as opposed to any other means, was the only possible solution. To assist in developing concepts of notation, I undertook the study of recorded songs first by drawing what I heard, and later by trying to develop various forms of music notation (see Appendices 1 and 2).

It became apparent from my own notations, however, that what I also discovered in attempting to read the notations of others who had devoted themselves to transcribing song, was that the information of birdsong notation is meaningless to everyone but the notator and even then it is only effective if a reasonably strong memory and knowledge of what has been notated, is retained. After a few weeks of not looking at my own notations, they became as indecipherable to me as were those of every other notator I looked at, whether as graphic signs or as music. Even reading the most remarkable of such musical

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[109] S.P. Cheney, *Wood Notes Wild: Notations of Bird Music* (Boston: Lee and Shepard, 1891); A.A. Saunders, 'Bird Song', *New York State Museum Handbook*, (1929) and *A Guide to Bird Songs* (New York: Doubleday, 1951); and W. Garstang, *Songs of the Birds*, new edn (London: The Bodley Head, 1935).

notations, those made by Sotavalta of the thrush nightingale (*Lusciania luscinia*),[110] do not enable one to play in a way that sounds anything like the living song of the bird.

There are of course other aspects of notation that can be useful, principally those of song structure and phrase repetition, which is how Sotavalta and other have used it. Such information was not used in my research simply because there was no place for that degree of analysis before a sound vocabulary had been established and an improvisational language created and thoroughly mastered.

The knowledge of one aspect of song did prove invaluable and that concerned birds that sing in pairs – *duetting* as it is called by ornithologists. This information proved most productive in the development of improvisations. Not only did duetting with another flute player enable me to get a more objective insight into the system I created and to explore the materials of that system, it also opened up new conceptions of how forms of song and behaviour relating to song could be used in improvisation.

Birdsong as music and language

The question of whether birdsong is music or not is frequently raised and discussed in the literature on avian vocalisation; and to a lesser extent, whether song is proto-language. It was important to me initially that I had some conviction about the nature of birdsong based on scientific evidence, but after having read and pondered the arguments in both ornithological, bioacoustic and music writings, I decided that there was no more a definitive scientific answer any more than there was a satisfactory definition of music.

Birdsong can be shown to conform to most definitions of music, but then one has to consider that the more inclusive the definition of music tries to be, the looser it becomes. My own opinion is that birdsong is undoubtedly a form of music in two ways. First in the objective sense that it has similar origins to human music; and second, that it is also a form of music in the subjective sense in that the sounds of the natural world are music to the ears of many, if not most, human beings - including mine.

One fascinating source on a musical view of the natural world is a 19th century musical writer called Walter Gardiner.[111] Gardiner hears and notates musically, sounds as diverse

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[110] O. Sotavalta, Analysis of the song patterns of two Sprosser Nightingales, *Lusciania luscinia* (L.) in *Ann. Zool. Soc. 'Vanamo'* 17:4 (1956), 1-30.

as the dripping of a tap, the creak of a door, the buzzing of insects, the neighing of a horse, and so on, as well as the more obviously musical sounds made in the world.

The question of birdsong as proto-language, which is raised particularly in research and debate about the origins of music, was one that I had previously contemplated in a different, but I believe, closely related area. There was speculation in 18th century Britain about the relationship between the sounds of speech and music, and there had been attempts to record speech in musical notation. This was an area of speculation that tied in with the musical performance aesthetics of the 18th century through the expression of emotions and conveying meaning through sound alone.

The scientific interest in affective communication both in sound and movement was renewed in the 20th century and it was interesting to see Charles Darwin's virtually forgotten work[112] on the expression of emotion in man and animals appear in reprint on the shelves of high-street book stores. I find the arguments supporting the relationship between music and speech compelling, and consequently I believe that birdsong is related to both the sounds of speech and of music. Undoubtedly this influenced the results of my research.

Sound recordings of birdsong

In connection with research into birdsong, I listened to many recordings of avian sound making. It is hard to evaluate how directly they influenced my musical output. The advantage of recordings is that they can be listened to over and over again, the disadvantage is that they are not really birdsong in the sense of something alive and spontaneous; they are sound objects. The more one listens to them the more they become mere objects, and in my case, less and less inspiring.

A fundamental aspect of birdsong is its immediacy – even in the case of repetitive song. This is one reason why it is such a remarkably appropriate model for improvisation and one of the reasons why improvisation should be such an appropriate way of investigating song. It was for this reason that the songs I heard daily in my immediate environment were so important to me – even though they did not necessarily provide me with usable models.

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[111] Gardiner, W., *The Music of Nature or, An Attempt to Prove that what is Passionate and Pleasing in the Art of Singing, Speaking, and Performing upon Musical Instruments, is derived from the Sounds of the Animated World* (Boston: J.H. Wilkins & R.B.Carter, 1838).

[112] C. Darwin, *The Expression of the Emotions in Man and Animals*, 3rd edn with an intro. and commentaries by P. Ekman (London: HarperCollins, 1998).

What recordings did provide, however, were an awareness of the immense variety of birdsong throughout the world. Recordings enabled me to appreciate just how extraordinary duetting could be, and how close to human music some songs were. At the beginning of my research, I used recordings to develop my response to song by transcribing it graphically. Recordings are also the most easily available means of learning to identify song.

One form of recording, of which I made very little use, was electronic analysis by means of using a sonograph. This was in part because I found the value of a sonograph extremely limited without at the same time being able to hear the song that it recorded. (This is a comment on the state of my knowledge at the time, not on the value of the sonograph). Even if this had not been the case however, I believe that it would not have helped in developing my research since in order to respond to a sonogram, one needs a means with which to respond, and that is precisely what I lacked. In addition, I felt that what I heard with my ears, unaided by analytical information, was more important to my research than detailed scientific visual or aural analysis.

Avian thought and feeling

One other strand of enquiry that linked directly to birdsong was what birds might feel or think. There is speculation on this both in the literature on birdsong and in research conducted into animal behaviour by ethologists. There is a growing body of evidence relating to the thought processes and emotional reactions of animals, which I believe is relevant to the creation of music based on birdsong. If birds and human beings share some common ground in producing sound, then it is possible to approach a music based on birdsong in terms of how the body feels when making certain types of sound. It is important that we understand birds not as being either like or unlike us, but as living creatures with which we humans have fundamental ways of behaving in common. We owe the living world not just our scientific attention but also the serious engagement of our artistic attention.

5.1.4 Music

The range of musical works and literature investigated in the process of this research was relatively confined and was increasingly abandoned as the work progressed. The reasons are quite simply that it became apparent that the area being researched was not covered by

any existing practice in any existing field of music: this included historical and contemporary mainstream composition, improvisational genres, and biomusicology.

The most detailed area of reference for my musical outlook was provided by a knowledge of the writing and repertoire of the late 17th to early 19th centuries, i.e., the period spanning high Baroque, Classical and early Romantic music. I reinvestigated both the historical repertoire and didactic literature on the flute, violin and voice, in a search for ideas and insights into new techniques. In addition I reexamined sources that related music to the spoken word for the possible insights they might provide on the possible relationship of birdsong to these areas. While the historical sources exerted some influence on my approach to extended techniques, and in fact supplied some of the techniques, the writings on music and speech undoubtedly influenced my view of birdsong.

It was inconceivable not to have included Messiaen in my considerations of music based on birdsong, but although his works are wonderfully inspiring, his statements about song are not. While his passion and belief in the power of birdsong is unarguable, what he said about song seems more frequently to have been spoken for the way it reflected on himself than out of deep consideration for his avian subjects. Nevertheless Messiaen remained in the background of my research as an example of how the investigation of birdsong could inform a musical language.

Remembering that Messaien's musical language was in great part a synthesis between studying and listening to, for example Indian music, plain chant and birdsong, there is a degree of inconsistency is Messiaen's writings about his methods of synthesis. Though available at the time of even his earliest birdsong compositions, Messiaen did not use either the tape recorder or the sonograph. In other words, its transcriptions and relocations of birdsong into music are more closely related to the musical conventions of oral dictation. Thus, Messiaen was "free" to manipulate and appropriate birdsong in a relatively highly transposed manner. My own method was similarly aural in nature, but more closely aligned with a desire to emulate (note, not imitate) the sound world of a sounding bird. I therefore refer to Messiaen as an example of a birdsong-influenced composer rather than being a key influence on the evolution of my own musical language.

More pragmatic investigations were undertaken in the search to establish an improvisational system and to develop a sonic vocabulary. The material relating to

extended techniques, atonalities and microtonalities is treated in sections **2.2** and **2.3**, but the starting point of this phase of research was Erno Lendvai's *Symmetries of Music.*[113] Lendvai presents persuasive theories on the symmetrical unities underlying all tonal systems and it was these theories that initially led me to explore the effectiveness of atonal systems as a basis for improvisation.

Other musical sources examined included *On Sonic Art* by Trevor Wishart, Edwin Prevost on improvisation, and Schoenberg's writings.[114] While these writings might have been effective in helping to form new concepts they did not, apart from Schoenberg's ideas, contribute materially to my research. One of the reasons for this is that, unlike the acutely perceptive and visionary thought of artists such as Kandinsky (who admired and corresponded with Schoenberg) in the early 20th century, these writings are inward looking; concerned solely with the expositions of the authors' ideas and practices.

Only one musician's writing had an immediate, practical and lasting effect on my work: an American jazz pianist called W.A. Mathieu. Mathieu's two books are not about a particular style of music but of making music at the most human level, whether one is a musician or a listener.[115] Among many practical approaches to making music, he outlines some simple techniques for developing improvisations. One of these techniques, the one minute improvisation, became fundamental to the development of my improvisational work. The great strength of Mathieu's exercises is simplicity and his profound love of the sounds that surround us. His passion is not the basis of a particular musical style, but the foundation of a deep appreciation of the world as a musical environment and, of music as a fundamental human attribute.

5.2 Reflections on birdsong, music and language

'*Songbirds are one of the very few animal groups with a similar behavioural substrate as that used for human language.*'[116]

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[113] E. Lendvai, *Symmetries of Music: An Introduction to Semantics of Music* (Kecskemét: Kodály Institute, 1993).
[114] T. Wishart, *On Sonic Art*, rev. edition ed. by S. Emmerson (The Netherlands: Harwood Academic Publishers, 1996); E. Prévost, *No Sound Is Innocent: AAM and the practice of self-invention* (Essex, England: Copula, 1995); A. Schoenberg, *Fundamentals of Musical Composition* (London: Faber and Faber 1970), *Theory of Harmony*, trans. R.E. Carter (London: Faber and Faber 1983), and 'The Relationship to the Text', in *The Blaue Reiter Almanac*, pp.90-102.
[115] W.A. Mathieu,The Listening Book: *Discovering Your Own Music* (Boston: Shambala Publications, 1991); and *The Musical Life: Reflections on what it is and how to live it* (Boston: Shambala Publications, 1994).
[116] From *The Bioacoustics Team* Home Page: [http://www.cb.u-psud.fr/cb/page17.html].

At least one authority on birdsong has advanced persuasive arguments to suggest that the motivation of birdsong could be similar to that of human music making.[117] I would like here to reflect on some strands of thought that preceded and accompanied my research, in particular thoughts concerning the relationship between avian and human sound making.

5.2.1 Sources of expression and points of intersection

The deepest point of intersection between the sounds made by birds and by human beings is that they function in both creatures as forms of emotionally motivated communicative expression. An essential feature of emotion is the changes it makes to the way the body functions, in particular muscular movement from the smallest to the largest. Thus what birds and human beings feel will change the way they produce sounds and consequently shape those sounds in a way that reflects their emotions.

A threatened or angry bird may speed up its song, increase the dynamic range and, if it has a small vocabulary such as wrens and tits do, reiterate the song more frequently. Birds with a large vocabulary, such as blackbirds and song thrushes have a much greater range of possibilities, being able to change timing, speed, rhythm, pitch, dynamic range and timbre, etc.

Hartshorne argues that emotions are essential for the learning and development of song.[118] Emotional changes affect the flow of information through the entire body and inevitably the sounds a bird produces will be affected by those changes. Those changes will in turn be recognizable to other birds both within and across species depending on the type and relevance of the information conveyed.

Historically, in Western classical music, the role of the inner movements of the body in creating musical expression was well understood. It was also recognized that music shared the prosodic features of speech and that it could be subject to the organizing forces of rhetoric. Baroque performance practice sources frequently state that musicians must perform music in the same way as an actor or orator delivers a text. In the 18th century music was drawn from and modelled on patterns and constructions of speech. It was regarded as a form of sonic rhetoric, a language of the emotions, and treated as the

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[117] C. Hartshorne, *Born to Sing: An Interpretation and World Survey of Bird Song* (Bloomington and London: Indiana University Press, 1973); see Chap. 3, 'Bird Song Compared to Human Music', pp.35-57.
[118] Hartshorne, *Born to Sing*.

movements of the mind made audible through pitch and rhythm, tempo and dynamics, melody and harmony.

The affective powers of timbre, dynamic shape, speeds and rhythms of movement and the use of the breath or the violin bow are dealt with in considerable detail by some of the most influential vocal and instrumental method books of both the 18th and 19th centuries. One series of exercises in dynamics from a 19th century vocal method book[119] resembles transcriptions of individual notes of birdsong (see Fig.5.1).

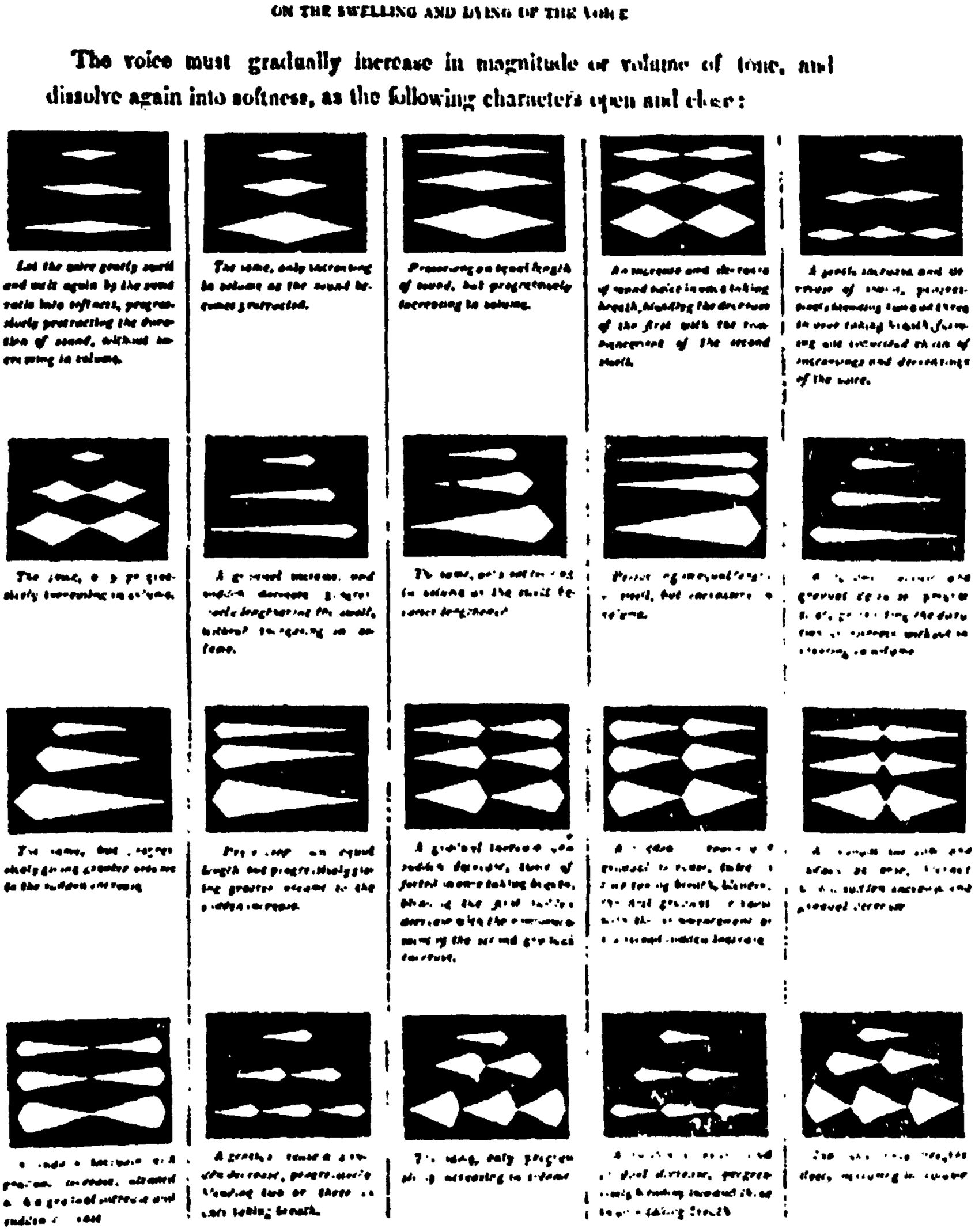

Fig. 5.1

A series of exercises in dynamic control (from Nathan).[120]

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[119] I. Nathan, *Musurgia Vocalis: An Essay on the History and Theory of Music and on the Qualities, Capabilities, and Management of the Human Voice*, 2nd edn (London: Fentum 1836; repr. with an introduction by Edward Foreman [no place of publication]: Pro Musica Press, 1968).
[120] Nathan, *Musurgia*, p.153.

The relationship between music and speech was not lost on those who studied language. One English writer, Joshua Steele, developed a system of musical notation to convey the expression of language (see Fig.5.2).[121]

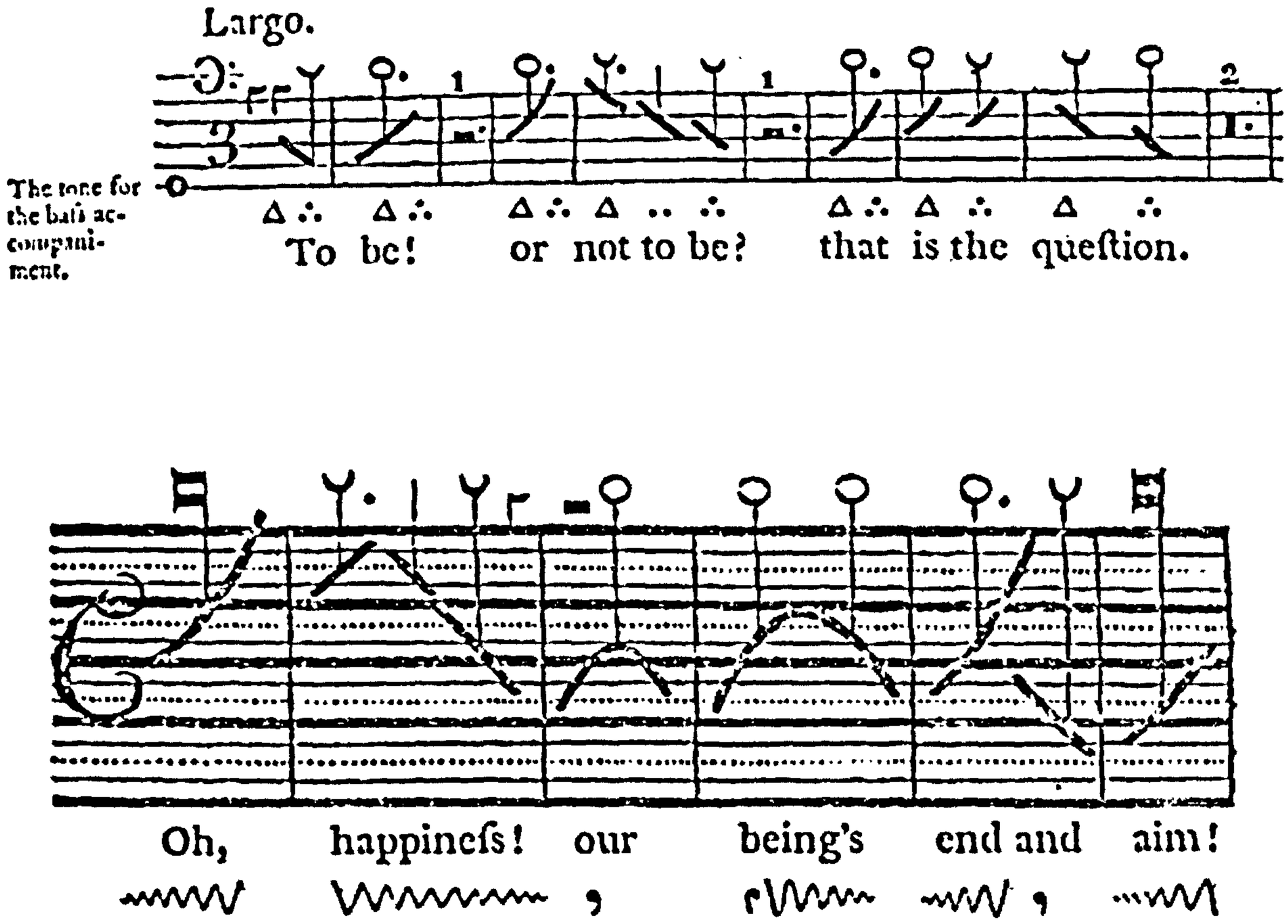

Fig. 5.2

Examples of speech notated as music (from Steele).[122]

Another 18th century English writer, Thomas Sheridan, deals at some length on the primacy of sound in expressing meaning as opposed to meaninglessness of simply pronouncing words without pitch or dynamic inflection.[123]

What is relevant is not that there was a supposed relationship between the intellectual meaning of words and the notes of music, but that musical expression and meaning were communicated through both feeling and knowledge: music was rooted primarily in the

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[121] Steele, J., *Prosodia Rationalis* (London: J. Nichols, 1779; repr. Hildesheim; New York; Georg Olms, 1971).
[122] Steele, *Prosodia*, pp.13 & 40.
[123] T.A. Sheridan, *Course of Lectures on Elocution: together with Two Dissertations on Language; and Some other Tracts relative to those Subjects* (London: W. Strahan, 1762; repr. New York: Benjamin Blom, 1968). See Lecture VI: *Tones*, pp. 93-111.

body of the musician and the listener, and secondarily in the mind, and it was understood that emotion and intellect would be mutually reinforcing.

This is not to suggest that, by analogy, birds use a kind of speech with pitches equivalent to words any more than it is to claim that because music can be shaped like spoken language, it therefore has the same potential for meaning as words. I suggest that what avian sound-making might have in common with human sound-making is the spontaneous, unmediated sensations and emotions of the body, which shape and give meaning to individual and collective sounds before the interposition of intellect. It is this shared source of the expressive patterning of sounds that is the point of common origin, where the avian and human sonic worlds intersect. If the motivating source is the response of the emotions to particular internal and external events, then it may not be unreasonable to assume that birdsong shares some of the most basic expressive attributes of human speech and music.

Hartshorne presents a persuasive argument for avian sound being shaped by emotion[124], suggesting that it is the feeling of pleasure which encourages birds to learn to sing and to improve their song. Recent ethological research lends support to the idea that emotions are in some degree a feature of higher animals. Research by the neuroscientist Candace Pert, in relation to her work on peptides, indicates that all living creatures share the same 'informational molecules that code for communication for the information exchange that runs all systems in all living systems, whether that communication is inter- or intra-cellular, organ to organ, brain to body, or individual to individual.' [125]

The means of communication in these systems are 'the peptides and their receptors' which Pert refers to collectively as the 'molecules of emotion'. She gives as an example research demonstrating that a single-celled micro-organism, the tetrahymena, makes many of the same peptides as humans, 'including insulin and the endorphins'. The tetrahymena has 'opiate receptors just like the ones in our brains' and possesses 'the same basic informational network' as in human beings. Pert argues this as the case for the unity of all life and the sharing of a common heritage - 'the molecules of emotion ... with the most modest of microscopic creatures'.[126]

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[124] Hartshorne, *Born to Sing.*
[125] C. Pert, *Molecules of Emotion: Why You Feel The Way You Feel* (London: Simon & Schuster UK, 1997), pp.193-4.
[126] Pert, *Molecules.*

There is much that must be instinctive about human sound-making, and the sound-making imperatives of birds regarding sex and territory cannot be that different from those of human beings. In addition, scientific research has demonstrated that with some songbirds song is not instinctive but learnt, and that such birds possess specialized neurological abilities for learning and developing song.[127]

5.2.2 The energy of birdsong

The energy levels of avian songs and calls are highly expressive. Threat and alarm calls inevitably convey a sense of physical tension. This cannot be anything but the case, for if a bird is alarmed or upset, if it is feeling threatened or is warning another bird off, the state of its muscles will change to reflect the tensions of its feelings, which will be made audible through the way sound is produced.

The territorial imperative of some species demands a singular announcement of a bird's presence. Simply being present and simply announcing presence is not sufficient to keep rival birds out of the territory, a sonic proclamation must convey a sense of the power of the territory holder. The energy required of robins to maintain their territories is reflected in their songs. They spend so much of the year disputing and holding territory that a weak and unvarying song would fail them completely; it would cease to be heard distinctly and would soon become one more unnoticeable thread in the web of the sonic environment.

5.2.3 Human sound making as birdsong

Musicians

Human sound-making has much in common with birds. One has only to consider those who produce sounds for a living, i.e., professional musicians. Depending on the type of music they make, musicians must carve out and hold a territory entirely by virtue of their sound-making abilities – if we ignore the politics and the non-sonic side of creating and maintaining a career.

Classical musicians, particularly orchestral players, must compete and prevail in a world where everyone has to play in an almost identikit way, which means to be successful, an individual must demonstrate technical superiority above all things; while leading rock musicians, although benefiting from a strong technique, can themselves establish an

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[127] See C.K Catchpole & P.J.B. Slater, *Bird Song: Biological themes and variations* (Cambridge, Cambridge University Press. 1995).

original voice through their creative abilities – or failing that, as canny exploiters of whatever the current musical fashion is.

Further shared characteristics are, that musicians learn through imitation, and thrive through technique and invention. Talented musicians, like birds, transform the music they imitate, relocating it in the context of their own performance styles. Musicians, particularly non-classical musicians, learn new musical dialects relocating them in their own repertoire. Musicians also form flocks, gathering together to share and possess the most typical sounds of the flock. There are all kinds of names for different types of flocking, such as bands and orchestras, clubs and festivals. Non-musicians also flock to hear and see these gatherings perform.

I find it interesting to reflect on my own career, when I took up playing the baroque flute, and the reasons for doing so. Did the work I undertook stem simply from a desire to investigate the music I was playing more closely, or was the creation of a new sound itself and the reshaping of my musical language a significant part of the process? Perhaps I was unconsciously trying to extend my sonic territory by creating a new one. Whatever the underlying reasons, the result was that I became prominent as a musician who made music in a new way and became one of a handful of musicians who dominated a particular sector of the music profession. I achieved professional pre-eminence through the possession of a clearly distinguishable and different voice, and by speaking in a new musical dialect. Professional pre-eminence is another form of territorial dominance. This is particularly obvious in commercial music, especially in rock and pop.

Hearing difference

People use music to create identities and boundaries for themselves defined by their preferences for different styles and performers. There are endless gradations of difference, for example between Western classical and popular music, Eastern and Western musical languages, etc.; and one must include not just the different compositional styles but the even more infinite gradations in performance between one performer and another.

One need look no farther afield than the many styles of rock and pop, folk, blues and jazz. The profusion of styles, and the sometimes very small differences between them, should teach us not to underestimate what birds may understand by what they hear. Human beings

thoroughly versed in their chosen music can easily distinguish between performers and genres on the basis of sonic cues that are indistinguishable to the uninitiated.

If, from the slightest changes in basic drumbeats, we can distinguish one dance rhythm from another, should we not assume that birds may get far more information from listening to each other than we can guess. We can distinguish one performer from another through such things as tiny clues of vocal timbre; through the ease with which a phrase is executed; from the use of vibrato or breathing, or from barely perceptible nuances and inflections of timing and emphasis. How much more should birds be sensitive to subtleties of sound when that is their principle form of communication. The hidden quantities of song is a subject explored in depth by Edward Armstrong in his remarkable book, *A Study of Bird Song.*[128]

Mobile phones

As for other areas relating to the role of human sound production as birdsong there are a number of interesting examples. One of these is the proliferation of mobile phones. As a classical musician, one of the features of mobile phones that has aroused my curiosity, is the widespread use of classical music for personalized ring tones.[129] One most often hears them used by people who would not dream of going to a classical music concert. The reason people choose to 'own' snatches of melody from compositions they probably would not pay to listen to, is presumably because it is a sonic proclamation of superiority which increases the sound owner's sense of individuality and power.

It is ironic that because so many ring tones are taken from the classical music repertoire, a railway carriage can sound like a surreal concert hall. There is more to this than the concert hall, however, as mobile phone owners are not only being informed of incoming communications by their ringing tones, but they are also forcibly communicating information about themselves to whoever is within earshot. Concert hall audiences tend to dislike receiving sonic information not related to the performance and performers even more deeply resent the audible announcement of any individual presence other than their own – except of course at those culturally agreed moments when silence would be even more bitterly resented than out of place sonic intrusions.

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[128] E.A. Armstrong, *A Study of Bird Song* (London: Oxford University Press, 1963).
[129] The fashion in phone rings has changed since these observations were made.

It is the mobility of mobile phones that have made us more obviously like birds than we once seemed to be. Mobility allows us to carry our territories with us and to invade the territories of others. We can chirrup and call, chatter and argue, woo and threaten like birds sending messages to all who can hear us. Motor vehicles also mobilise our territories but they are relatively mute territorial statements. Some car drivers however, give these mute statements a voice in one way or another, for example, through very loud music, through engine and even tyre noise. In this respect the silence of an expensive vehicle also becomes a sonic proclamation.

Tones of voice

Territorial dominance through sound also belongs to those human beings who have highly distinctive powers of speech or voices that compel people to listen to them. Politicians work hard to demonstrate power and dominance in their voices, Margaret Thatcher being a notorious example, but from other professions the comic stereotype of the voice of the drill sergeant provides a raw statement of the same dominating urge.

Many of the most successful film stars have powerfully distinctive voices while possessing an otherwise physically limited expressive range, John Wayne being a classic example. It is notable that with the advent of sound, the careers of some silent film stars were wrecked by the inadequacy of their voices, a point made light-heartedly in the film musical *Singing in the Rain.*

A distinctive voice, coupled with particular vocal inflections, is also a great asset to comedians, which is well illustrated by comic partnerships such as Laurel and Hardy, whose film careers blossomed with the advent of sound; the Marx brothers – Groucho, Chico and Harpo – to whom voice was so much an indicator of racial stereotype that one of them (Harpo) does not speak at all; and the British comedy duo Morecombe and Wise, in which Eric Morecombe has the vocal tones of eager and often perplexed amateur, while Ernie Wise adopts the firm, level tones of the all-knowing professional. As with birdsong, although it is the tones of voice that usually hold the attention, utterances are often accompanied or replaced with highly skilled physical gestures.

The character of the voice and the development of expressive vocal inflection was a feature of singing and acting at least up to the 19th Century. As one mid-18th century French vocal method observes:

'When people are moved by whatever emotion, they double the articulating letters, or do the equivalent of preparing or extending the letters. This is in order for the feeling to be expressed not only in each word, and in each syllable, but in addition expressed in each letter. Also, this ensures an agitation in the viscera, where the body movements which produce the sounds of the letters are made to last a bit too long, and therefore guarantees the double sounding of the articulating letter. This is the only true way of attaining this. In cases of violent emotion, a great disturbance is manifest in our visceral organs. This is why the prolongation of the visceral movements of which we were just speaking will be the cause of the strong doubling of the letters. In cases of more peaceful emotion, only a little disturbance is manifest in our interior organs; its smaller consequence results in only weak doubling of the letters. From these principles, one can deduce this rule: One must double the letters in all situations and moments marked by emotion.' (Les personnes émues par quelque passion, doublent, ou ce qui est le même, préparent ou retiennent ordinairement les lettres dans l'articulation, soit que le sentiment veüille se peindre non'seulement dans chaque mot, dans chaque syllabe, mais encore dans chaque lettre: soit qu'il regne alors un certain trouble dans les Organes, qui fait que les mouvemens d'où résulte la prononciation des lettres, persevére trop long-tems, suel & vrai moyen de rendre deux fois le son d'une lettre. Dans les passion violentes, il regne un trouble extrême & une grande agitation dans nos Organs: c'est pourquoi la continuation des mouvemens don't nos venons de parler, sera cause que les lettres seront alors doubles fortement: dans les passions tranquilles, il ne regne que peu de trouble dans nos Organes; aussi la persévérance de des mêmes mouvemens sera que les lettres seront doubléels foiblement. De ces principes, on peut déduire cette régle: On doit doubler les lettres dans tous les endroits marques au coin de la passion.)[130]

The pre-eminence of sound was remarked on in 1762 by Sheridan in his sixth lecture on language and speech entitled *Tones* .[131] He equates the communicative utterances of human beings and animals, pointing out that the spoken word is meaningless without expressive inflection, and that when animals make sounds, they also have a similar emotional basis to them.

Human life used to be filled with much more vocalization than it is now. When people lived in very close proximity and there was not so much noise that their voices were drowned, then they could call to each other and their voices in conversation could be heard.[132] Singing, humming and whistling were once commonplace in public. Nowadays when we see someone apparently talking to themselves, our first reaction is that they are unbalanced, but we immediately pronounce them sane if we see that they are using a mobile phone. We have lost the ability to sing and hum out loud unselfconsciously, not just in public, but also in situations like a music class. In England, it is rare even to hear people

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[130] J-A. Bérard, *L'Art du chant* (Paris. 1755; Geneva, Minkoff Reprints, 1984). Trans. M.J. Lotz
[131] See Sheridan, *Lectures*, pp. 93-111.
[132] For an interesting historical perspective see B.R. Smith, *The Acoustic World of Early Modern England* (University of Chicago Press, 1999).

whistling: we are losing our naturally healthy, stress-relieving ability to warble. We need to learn from the birds.

Movement and periodic rhythm

Another area of expression shared by human beings and birds is in the use of periodic rhythm. Rhythmic movements and sounds are numerous in the bird world, for example, the extended courtship dances of ducks bobbing and dipping; the bobbing and swaying of parrots; the pulsed bubbling and crackling sounds of starlings; the screeching of jays; the sinister swaying of two robins confronting each other with arched head and tail; and the ticking alarm calls of many species.

While the organisation of pitch depends on rhythm, rhythm is not dependent on pitch and can be perfectly well expressed by the body in silence. Regular rhythms are induced by, and induce, strong physical-emotional responses, which can be expressed as dance, without the necessity of either voice or instrument. Birds and humans share common ground in expressing themselves through physical movements and sound, either in combination or separately.

Mimicry, relocation and transformation

In the development of my own music for this research, I had to learn to put aside my inherited musical culture, and to allow myself to be led by my feeling for making music. I used my flute, my body, my mind and my sensations: I drew on all the sounds I knew and searched for sounds which I did not yet know, and explored ways of using them. The driving force behind this research was not imitation but translation and transformation.

My work started off as crudely attempted imitation as, unlike those birds who use mimicry to increase their repertoires, I possessed no meaningful structures in which to locate the sounds I heard and through which to transform them into my own music. (When human beings mimic sounds it is not at all the same thing as when birds do).

Human mimicry of birds is usually a relatively pointless act of imitation, done either for amusement or for a pragmatic purpose such as hunting. Birds on the other hand have a communicative function for the sounds they imitate, and are relocating mimicked sounds in the context of a larger meaning. Even if the sound a bird mimics is unchanged and

exactly resembles its source, the significance of that sound is transformed from its original meaning into an avian meaning.

Like a bird learning to sing, I was constantly attempting to make my own distinguishing sounds – sounds that fulfilled my felt responses as I listened to avian song. Although I was not aiming at mimicry, mimicry and imitation at first presented themselves as the most obvious, and even necessary, methods of learning.

Human beings often seem more able to appreciate the skill of mimicry than creative ability. What is this to do with, and how does it help us, this intense enjoyment we get out of the ability to copy? Clearly it is a useful attribute, and the quickest way to learn and to pass on what we know. Also, when we like a particular sound, such as the playing of a particular musician or a piece of music, we want to possess it; to carry it around with us; and to be like the people or person who makes that sound. Mimicry makes us feel we are equal to the original possessor of the sound: it is seductive.

Also, like birds, I attempted to use imitation as a way of enlarging and developing my repertoire in order to help me define and establish a sonic identity. Through relocation of avian sound in a language of human musical meaning I sought the means for carving out a new territory within old boundaries. This was not to be successful, however, as the boundaries of human music were already too firmly established, if not in fact then at least in my own mind. What was needed was the identification and occupation of a totally different sonic territory.

Thus, finding the conceptual means of escaping from imitation and moving to translation and transformation was a problem that needed to be solved urgently. Until there was a conceptual change it was impossible to create a language that could translate what I heard in such a way that it could be invested with meaning. This was an arduous task and one that was solved partly by the concept of songs as models of sounds, structures and forms, and partly by pursuing the qualities of birdsong rather than the simply trying to capture the sonic quantities. Birdsong is language and music of subtlety and complexity – it is protean sound making.

By taking a sound into its repertoire a bird can challenge or at least answer the source of that sound, by my doing the same thing I am challenging concepts of what music is. In

making that sound its own perhaps a bird divests the original sound source of some of its power and transforms an unknown quantity into one that is familiar.

The relocation, translation and transformation of sound is how music changes and explores new musical meanings, and it is the means by which it increases in complexity and technical accomplishment. In fact to some extent, it is part of a polishing process, the acquirement of sophisticated accomplishment. But unlike birds, human beings are always in danger of sacrificing the meaning of the sounds they make to the means by which they make them. The relationship between birds and humans, between their music and language has much to tell us, not just about ourselves and birds, but about animate life in its entirety.

5.3 Problems of conception, perception and reception

One of the problems in basing music on birdsong is that while it is easy to invent bird-like noises and effects, it is extremely difficult to create music that both satisfies oneself and at the same time convinces others. The reason for this possibly rests in our culture and on the fact that the means of translating the spirit of avian sound truthfully as music has never been a significant part of Western musical tradition.

The result is that each musician must form their conceptions afresh and begin working from scratch if they wish to create a language based on birdsong. That they can choose to follow in the footsteps of a particular composer (Messiaen being the most obvious), does not change the essential fact that there is no traditional body of ideas and resources which have been developed and distilled over centuries, and which can be changed, extended or rejected.

The problem of a lack of tradition on which to draw applies with equal force to the listener. Apart from those who are experts, it appears that almost everybody has a highly subjective sense of birdsong and that they feel they 'know' how birdsong should sound when it is translated into music - however sketchy their real knowledge. Consequently music based on birdsong is perceived, received and conceived primarily in the way each individual 'knows' to be right and unfortunately that may tend to be clichéd.[133]

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[133] This kind of knowledge is like the strong preconceptions people hold about the past, and 'know' what it really was and was not like, without actually possessing any real knowledge at all. Umberto Eco writing about reactions to his book *The Name of the Rose* comments, '*there is one matter that has amused me greatly: every now and then a critic or a reader writes to say that some character of mine declares things that are too modern, and in every one of these instances, and only in these instances, I was actually quoting fourteenth-century texts. And there are other pages in which readers appreciated the exquisitely medieval quality whereas I felt those pages are illegitimately modern. The fact is that everyone has his own idea,*

Only real knowledge (as opposed to pseudo-knowledge) can change those modes of thought, but even then and even with experts, I am convinced that there is an over-riding subjective bias to our relationship with birdsong and our feelings about it. That this relationship remains narrow and virtually hidden from view is because we have never explored it in our art. It is as if human beings need to use birdsong to provide a precedent for the way they make music, just as they use acoustics to prove that the music they make is based on immutable natural laws.

This bias is directly significant for the creation of music and it is particularly apparent with regard to Messiaen. It can be seen in the ambiguity about whether or not Messiaen 'accurately' represented the birds he heard.[134] Apart from those ornithologists who found his interpretations unrecognizable, Messiaen himself is principally responsible for the problem, arising as it does from his own contradictory statements about the accuracy of his transcriptions of song. While Messiaen spent most of his life listening to birds, he remained apparently unclear about the vital difference between the perception of birdsong and its interpretation and translation into music, whether his own or other composers – unless his contradictory statements were mere posing? It is not just that he appears to have had a problem with his own music but that he was also unable to hear the truth of an earlier period, embodied for example in François Couperin's interpretation of a nightingale in the keyboard piece *Le Rossignol en amour*.[135] The question is, what was Messiaen expecting to hear in Couperin's interpretation: what was he listening for?

It appears that Messiaen was expecting Couperin's nightingale to fit absolutely his own conceptions of what the bird should sound like as music, which were probably not dissimilar from the expectations of the uninitiated listener lacking the perspective of an interpretive tradition. Messiaen of course was burdened with the additional confusion of mistaking his own knowledge for objectivity. I believe the cause of this ambiguity is

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usually corrupt, of the Middle Ages. Only we monks of the period know the truth, but saying it can sometimes lead to the stake.' U. Eco, *Reflections on The Name of the Rose* (London: Minerva Paperback, 1994), pp.70-1.

[134] See for example Robert Sherlaw Johnson, *Messiaen* (London: J.M. Dent & Sons, 1989), who writes (p.117): '*Some commentators have tended to exaggerate the accuracy with which Messiaen transcribes birdsong in his music...* '; and Patricia Althaparro-Minck who says: '*Scores written after 1950 notate the bird-song precisely...*', in a liner note to Messiaen, *Catalogue d'oiseaux. Petites esquisses d'oiseaux.* 1997. Compact disc. Naxos. 8.553532-4. p.3.

[135] Messiaen stated that Couperin could never have heard a nightingale, which is patently absurd not only because of the evidence in the music itself, but also because he assumes Couperin would somehow have managed to avoid hearing one of the most ubiquitous of caged songbirds and that he would never have heard one singing in the country envirions of Paris.

twofold. As I have suggested, firstly it arises from our highly subjective relationship with birdsong, to which Messiaen was clearly no exception; secondly it arises from the absence of an interpretive musical tradition surrounding avian sound.

This absence leaves us unable to develop a perspective on music that interprets birdsong – unlike the many ways we have developed of perceiving and interpreting the visible world through the visual and plastic arts, for example, landscape painting. Thus while we are convinced by twittery, flute-like sounds because they mesh easily with our expectations of birdsong, we have problems with music that doesn't sit comfortably with our pre-conceptions.

These observations arise from the realization of how they shaped my own approach, predisposing me to take certain directions and to work towards certain results. Furthermore, when discussing my work with others, whether layman, musician or biologist, I am constantly reminded of people's expectations in regard to music based on birdsong; and in talking with those who know Messiaen's work, how he becomes a measure for the representation of birdsong in music.

5.4 Future developments

This research has opened up several interesting possibilities for future development not only related to ecosonic performance based on birdsong on the baroque flute, but to a number of other areas related to the ecosonic system, performance and the exploration of the musical possibilities of bioacoustics.

5.4.1 Content, form, structure and meaning of birdsong

There are many areas of birdsong of relevance to improvisation, these include the types, content, forms and structures of solo song, duetting and chorus singing. There is much to be learnt from understanding the different systems that birds use to convey meaning in their songs, for example, through imitations of natural and man-made sounds; and through variations in temporal organisation achieved through, for example, rhythmic shaping of single sounds and phrases, speed of delivery and length of phrases, and the length of silences interlacing the song (cadence, as it called by biologists). Knowledge of the interactions relating to the production and shaping of song could provide a rich source of improvisational material.

5.4.2 Other bioacoustic models

The productive results from using birdsong as a model for making music indicate that bioacoustics will provide a fertile field for musical investigation. There are numerous sources of sound production to be explored from a musical point of view in the natural world – from insects and amphibians, to mammals and fish. It is with this in mind that I am planning to undertake further experimental work with electroacoustics.

5.4.3 Ecosonic techniques on other instruments

A limited amount of research has been done into transferring the ecosonic system to the violin. The initial success of this work would indicate that the system will transfer successfully to other instruments, although clearly not in the precise form that it takes on the baroque flute. An example of work in progress are the ecosonic improvisations with a violinist included on **CD3:21-23.**

5.4.4 Ecosonic improvisation ensemble

Duetting has proved a most fertile musical area and it is intended to extend this type of improvisational practice to a larger ensemble. It is hoped that the models for ensemble improvisations will be provided by other, more extensive forms of bioacoustic communication, such as the chorus singing of birds. The creation of such an ensemble is one of the reasons for finding ways of adapting the ecosonic system to other instruments.

5.4.5 New compositions

A number of composers have expressed interest in the ecosonic system and several projects are in the early stages of planning.

5.4.6 Electroacoustic improvisation

Experimental improvisational work has been undertaken with an electroacoustic group at City University, London. The experiments have been with the creation of computer laptop programmes in which there can be a three-way interaction, i.e., between the live performers, the laptop and the composer. These programmes are created from 'patches' using the Max programme.

5.4.7 Duetting

One of the results of this research was the forming of a baroque flute duo *Nodneeya* in 2003, which has since given a series of concerts in Britain and the United States. The duo

is an ideal medium for using research on birdsong, particularly into duetting and the behaviour of birds, as this information can readily be translated in terms of the behaviour of two musicians in performance. In order to develop this aspect of performance I plan to explore these ideas further.

5.5 The Flute as Syrinx

The ecosonic system provided one final and very satisfying resolution to one of my earliest and most ambitious objectives. I had considered from the start of my research that one ideal outcome would be to find a way to play the flute that brought the instrument into a similar relationship to the player's body as the syrinx is to the bird's, i.e, that the flute would function as an organ of the player's body rather than as an instrument.

On the one hand, the barrier to achieving this is that a flute is an inorganic object – it <u>is</u> only an instrument. On the other hand, a musical instrument is but one part of a system that is otherwise organic; and it acts as an extension of the mind, feelings and body of the musician. In performance – knowledge, skill and imagination may certainly create a sense of organic integration between the musician, the instrument and the music, but there still remains the potential barrier of the musical language itself.

Ultimately a performance can only be as organic as a musical language allows it to be. A different approach to the instrument coupled with a new musical language might change this relationship between player and music. Playing with freedom and fluency for a 'classical' musician means playing with consummate command but does not usually mean playing organically except, possibly, for a very few unique individuals performing their own music, Paganini for example. The relationship between Western classical music and the instruments on which it is performed is highly artificial.

No matter how naturally or idiomatically a composer writes for an instrument, the perception of naturalness is usually based only on those qualities that conform to the highly selective requirements of a closed musical system, i.e., the writing is idiomatic according to the culturally received treatment of that instrument. Even when a composer employs the natural qualities of an instrument the language of the composition is not 'natural'. The historical proof of this is quite evident in the ever increasing mechanization of instruments. In this respect alone the baroque flute was a far more appropriate instrument for researching a music based on birdsong than the Boehm flute.

Until the ecosonic system was finally developed, the answer to finding a new musical language had proved elusive. The solution had appeared to lie in the ability to produce new types of sound, particularly those of extended techniques, placed within the framework of a pitch-based system. It took some time to recognize that the failure to find a solution lay in attempting to work with pitch-based systems.

The continued endeavour to find a language was a process of gradual realization that pitch-based systems were in fact closed in a way that could never satisfy the qualities I was seeking. One is bound by the degree to which a system is closed. This fact prevented me from attaining the qualities of avian sound production I identified during the process of my research. A 'syringeal' language was not to be found by working within closed musical systems.

This only became apparent when approached from a completely different direction, i.e., from the point of view of the ecosonic system. The infinitely small changes and inflections of pitch, timbre and volume, coupled with real fluency of fingering and the lack of predictability in the ecosonic system made me aware of just how closely all elements of a musical system must be integrated. Thus, allowing one can to play in the most organic way possible, i.e., not just as if an instrument is an extension of the body but actually part of it.

Birds, including non-oscines (those that are not song birds), produce a remarkably wide range of sounds, which they structure in so many different ways, from the simplest reiterations to the most complex elaborations. Some birds possess great powers of mimicry, being able to reproduce accurately the sounds not just of other avian species but also of human artefacts such as the motor wind of a camera, a car alarm and even a chain saw.[136] The syringeal system of songbirds is diversely exploited by different species to produce variations and contrasts in timbre, pitch, sonority, volume, rapidity, complexity, duration, and rhythm – providing the richest source of sounds of any living creature. The development of the ecosonic system created the means to draw directly on this rich avian sound world. This was achieved not through imitation or mimicry but through researching the means and qualities of both avian and instrumental sound production. The result was

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[136] The Superb Lyrebird (*Menura novaehollandiae*). See D. Attenborough, *The Life of Birds* (London: BBC Books, 1998), p.213. See also the episode *Signals and Songs* from the film series, David Attenborough, *The Life of Birds*. 2002. BBCDVD1020.

the creation of a musical language in which the flute could be played in a way that paralleled a bird's syrinx.

5.6 Conclusions

From the outset of my research, the work was both speculative and (to some extent) confirmatory. I began my research with a strong desire to develop new techniques for performance by a baroque flautist. I already knew that the single-keyed baroque flute was likely to produce a greater variety of microtonal effects simply because the sliding of fingers on open holes provided more flexibility in pitch-bending. Added to this was the body of existing advanced performance techniques on the flute, some of which being applicable to performance on the older pre-Boehm instrument.

The research was poly-modal in approach and method. Firstly, I had to examine the current repertoire in and for alternative fingerings and breathing on the flute. This I had already done in some depth as a trained flautist on the modern instrument. I also studied treatises and musical example from the baroque period and compared them with modern techniques for the concert flute together with contemporary applications relating to the authentic performance of baroque music for the flute, in our own time.

However, it was as an amateur ornithologist that I first realised that a systematic study of birdsong might offer me new possibilities in the generation of new music on my instrument. This was in no small way assisted by the body of analytical writings (and notations) on birdsong by ornithologists from the 20th century in particular. Many had commented on the likelihood of birdsong having a close relationship with/to human music. But I must also emphasise that a considerable amount of my research was conducted by means of field-work listening and notation.

At no stage did I consider it necessary (or desirable) to 'imitate' birdsong'. This remains a physical impossibility given the pitch-range of many birds and the complexity of the bird syrinx as a mechanism for the generation of sonic utterances. Consequently, whilst early experiments did incorporate a degree of direct re-modelling of avian sound to my instrument, experiments in microtonality (a key feature of a great deal of birdsong) moved away from notions of transcription and modelling to the devising of a new system for making innovative sounds on the baroque flute.

At this point (roughly half way through my research), I worked as much as a composer as a performer. These compositional experiments sought to create a repertoire of techniques and performance-effects that could be utilised in live performances/improvisations. However, even at this stage, I wanted to interrogate and test possible pedagogical applications of these new techniques. I worked in close association with a postgraduate flautist under my supervision, and taught her the new techniques as and when they evolved during the progress of my research. Not only did this enable a cross-checking of the viability of these new techniques but it also ran parallel to one of the main ways in which birds make their 'songs' ie., by means of processes of duetting.

During the latter part of my research, I studied various numerical systems as a means of devising a set of tabled scales and modes suitable for performance using alternative techniques on the baroque flute. The result of these studies was the production of a system of scales and fingerings (together with special breathing and tonguing techniques) that I now call the **ecosonic system** of flute-playing. The coupling of the shortened version of *ecology* with the word *sonic* is a form of taxonomy that seeks to locate this kind of musical language within the aegis of parallel studies in musical performance with studies from the living world in general; birdsong in particular.

This written thesis attempts the telling of the chronology of the evolution of econsonic performance techniques. The CDs are illustrative of both the teaching of the system to others and the application of these techniques within performance work in a recital arena. I have concluded that a study of birdsong has given me the ideal base from which and in which to ask key questions about the nature of new techniques on the baroque flute. Listening to birdsong has revealed a language involving highly complex modalities; phrase structures; together with rhythmic and timbral variation. At this stage, the ecosonic system remains a method of generating new fingerings and breathing techniques. It represents a systematic and tabulated primer for the acquisition of extended techniques on the baroque flute.

However, ongoing research- teaching and performance, is likely to produce tablature and technique transferable to other instruments. In any event, my ongoing practice will seek these outcomes together with (via an ongoing study of birdsong) new compositions involving the use of the ecosonic system of flute-playing.

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The sources that are listed here include many that provided a background of ideas and inspiration for the formulation of both theory and practice. This bibliography is not intended to be exhaustive, however, as there are many sources that were consulted simply to provide a larger picture, for example, handbooks on bird identification containing brief details of songs and calls, and writings that contain information about birds and birdsong, animal behaviour and communication; historical sources on performance practice and technique; popular science books on physics, chaos theory, and the brain. In order to allow an overview of the areas I looked into, I have arranged the sources roughly into categories.

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Internet

There are a great many sites on the internet devoted to one or more aspects of ornithology and bioacoustics. I have listed just a very few examples here.

Animal bioacoustics. http://asa.aip.org/ani_bioac/index.html
Avibase – The World Bird Database. http://www.bsc-eoc.org/avibase/avibase.jsp
BIO 554/754. http://www.biology.eku.edu/RITCHISO/birdcommunication.html
The Bioacoustics Team. http://www.cb.u-psud.fr/cb/page17.html
Bioacoustic links. http://www.zi.ku.dk/zi/bioacoustics/baclinks.html
Bird Links to the World. http://www.bsc-eoc.org/links/links.jsp
Bird Songs and Bird Brains:http://www.williams.edu:803/Biology/hwilliams/finches.html
Bird song display list: wav files. http://www.mbr-pwrc.usgs.gov/id/songwav.html
The Borror Laboratory of Bioacoustics. http://blb.biosci.ohio-state.edu/
IBAC - International Bio-Acoustic Council. http://www.unipv.it/webcib/ibac.html
Neurobiology of birdsong. http://www.sas.upenn.edu/~marcschm/

APPENDICES 1 – 5

Apart from the photographs of the ecosonic super-row, the following appendices consist of attempts to work on particular problems graphically.

Appendix 1: Birdsong notations

Appendix 2: Music notations

Appendix 3: Technique sketches

Appendix 4: Ecosonic fingerings from zero to 63

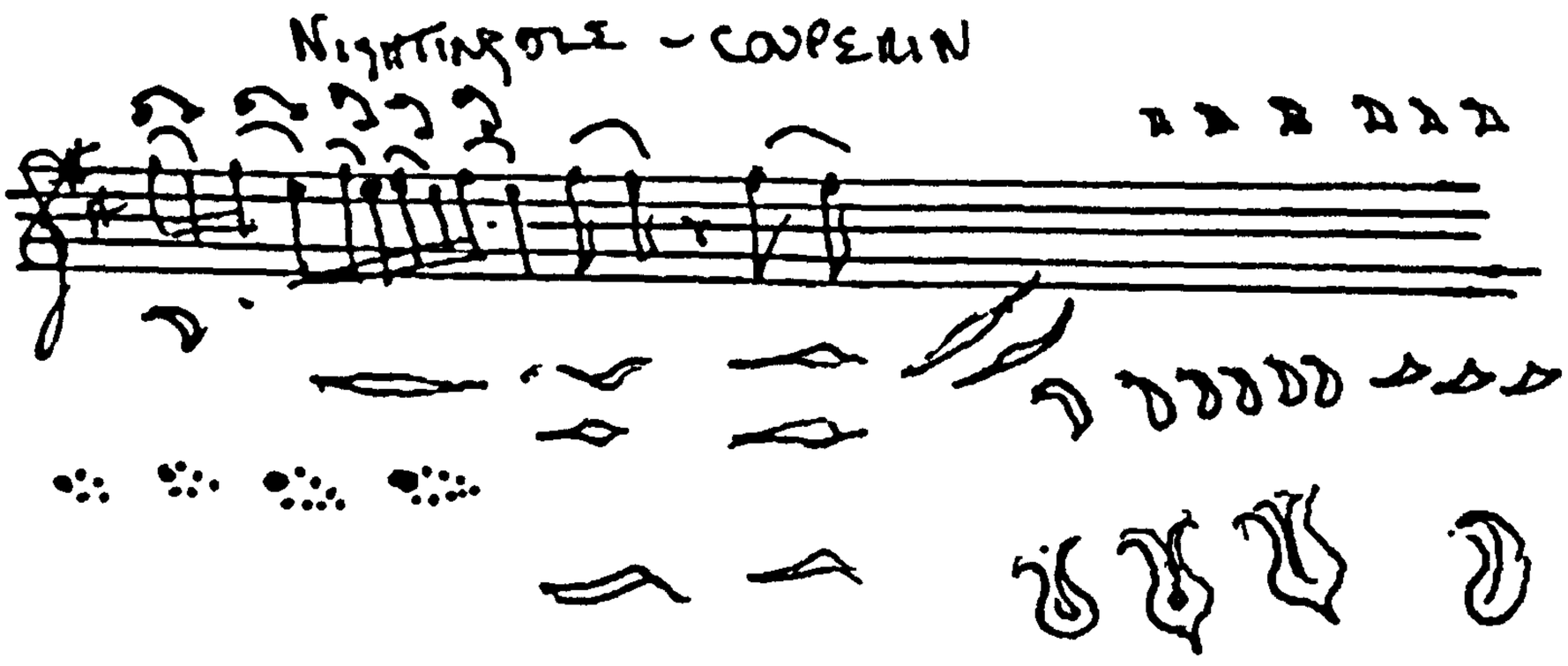
Appendix 5: CD's 1 – 4 Track Listings

Appendix 6: List of Illustrations

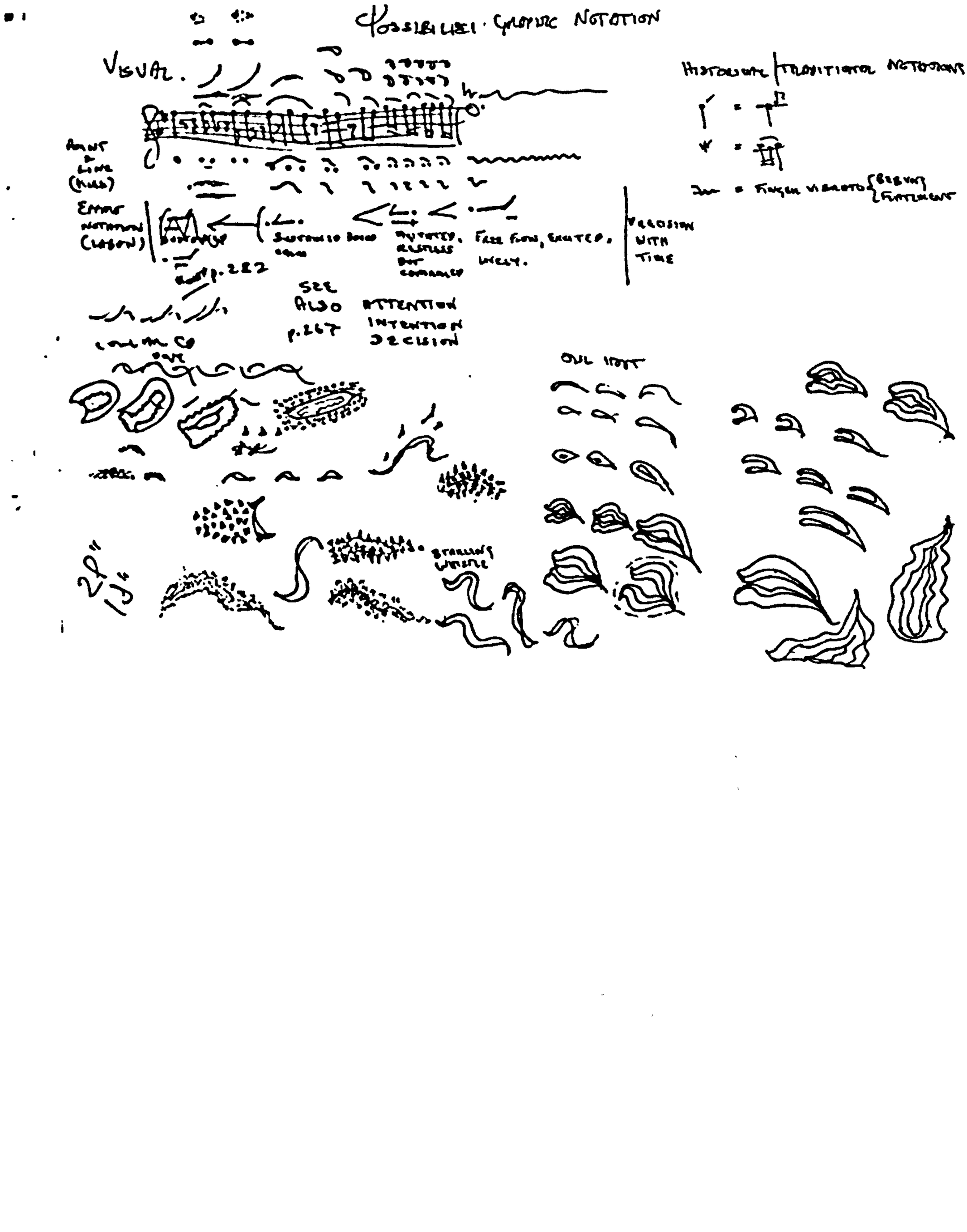
Appendix 1: Birdsong notations

At the outset of my research I needed to deepen my insight into birdsong and to observe how this process took shape. Pursuing this graphically was the most appropriate method. Thus I used recordings of song, transcribing as I listened. The nine notations are given here in chronological order: the first two were experiments in transcribing the sound of the flute when playing the musical notation of Couperin's *Le rossignol en amour*.

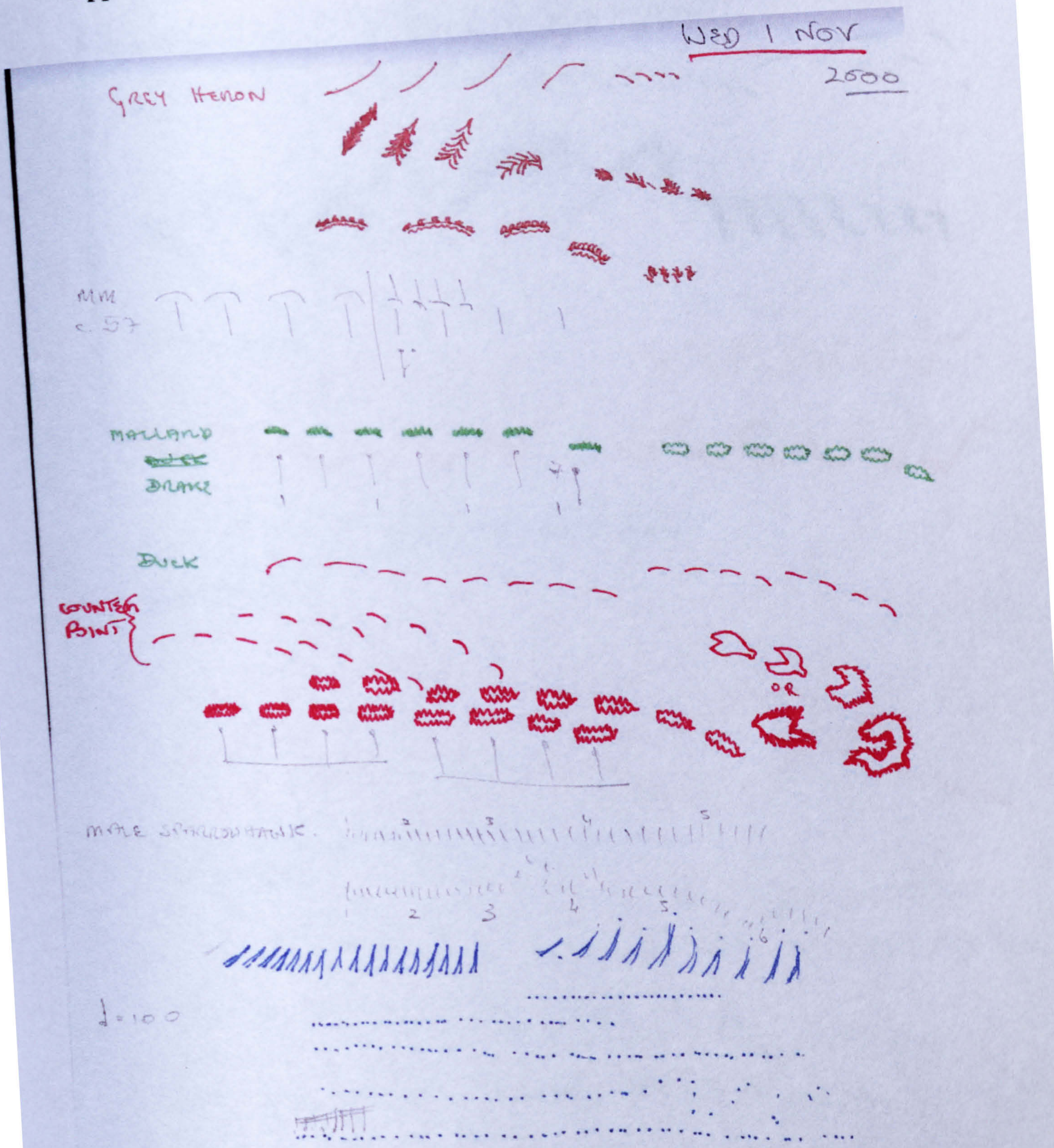
Appendix 1.1



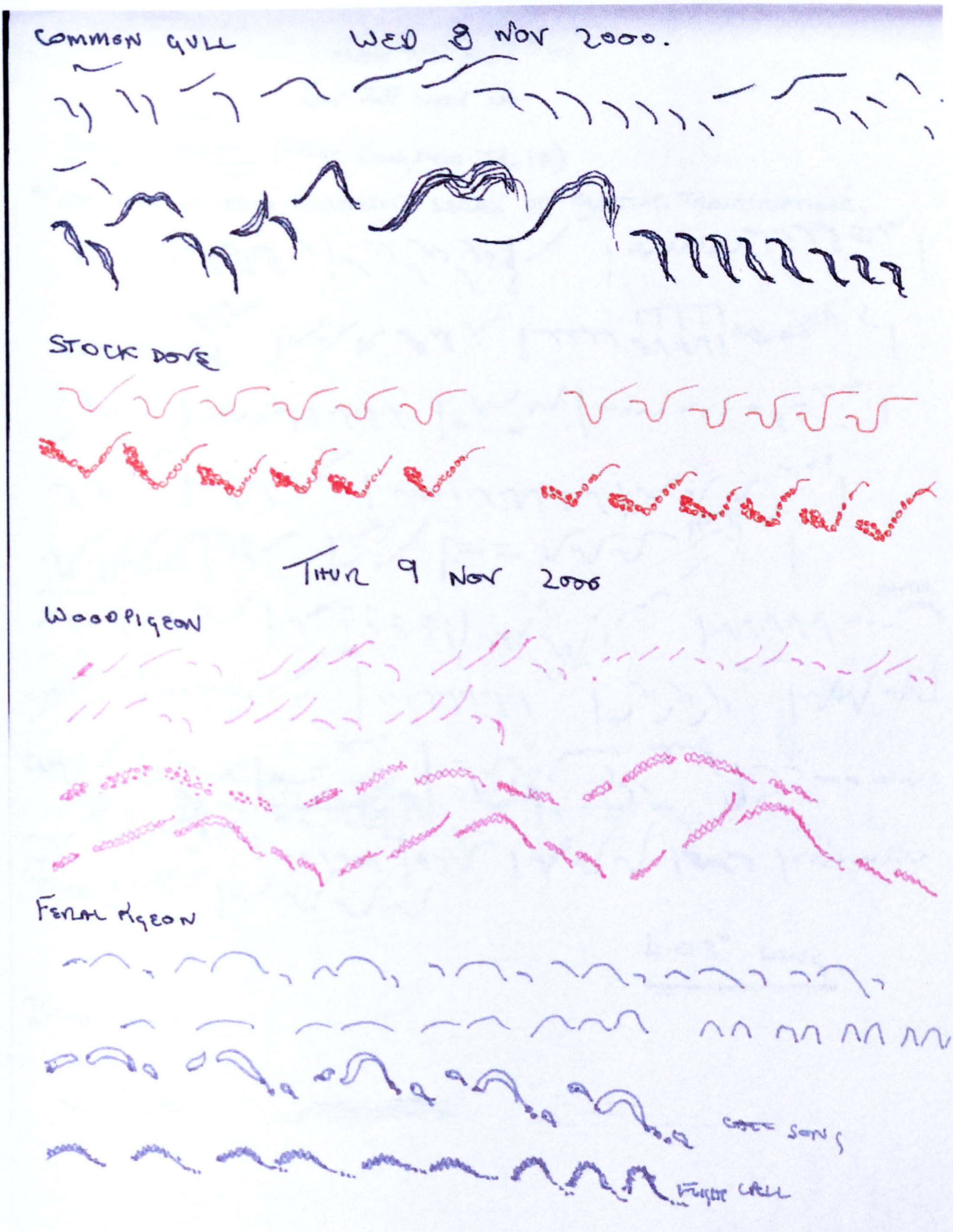
Appendix 1.2


Possibilities · Graphic Notation
Visual.
Historical / Traditional Notations
Aural
Time
(Rules)
Event
notation
(Cage)
Boundary
Succession
Intensity,
Rubbles
but
Continuity
Free flow, Fluctuation,
Decision
with
Time
p.222
See
also
p.267
Attention
Intention
Decision

Appendix 1.3


WED 1 NOV
2000
GREY HERON
MALLARD
DRAKE
DUCK
COUNTER
BIRD
MALE SPARROWHAWK.
1 2 3 4 5.

Appendix 1.4

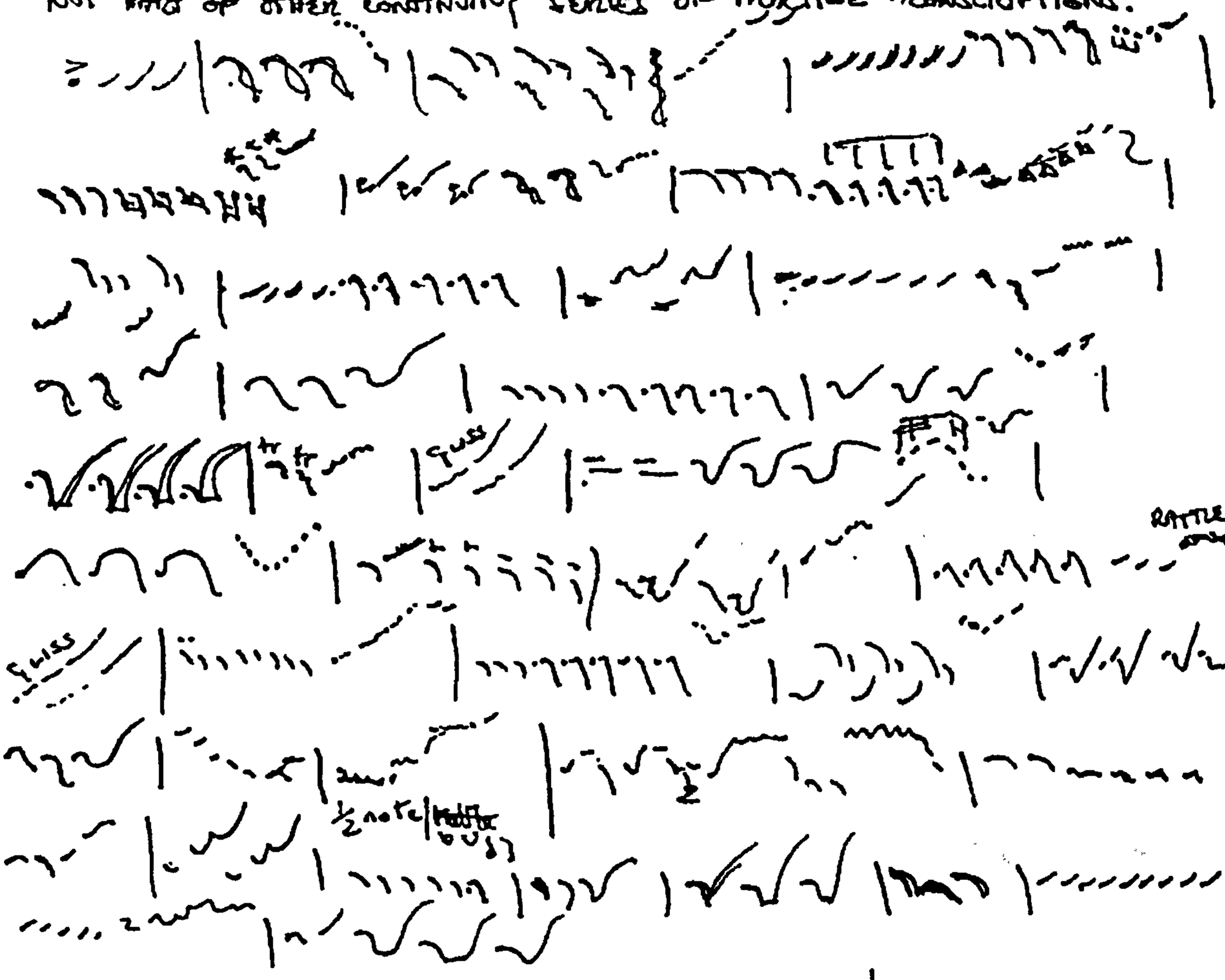

COMMON GULL
WED 8 NOV 2000.
STOCK DOVE
TUE 9 NOV 2000
WOODPIGEON
FERAL PIGEON
COO SONG
FLIGHT CALL

Appendix 1.5

SAT 25 NOV 00

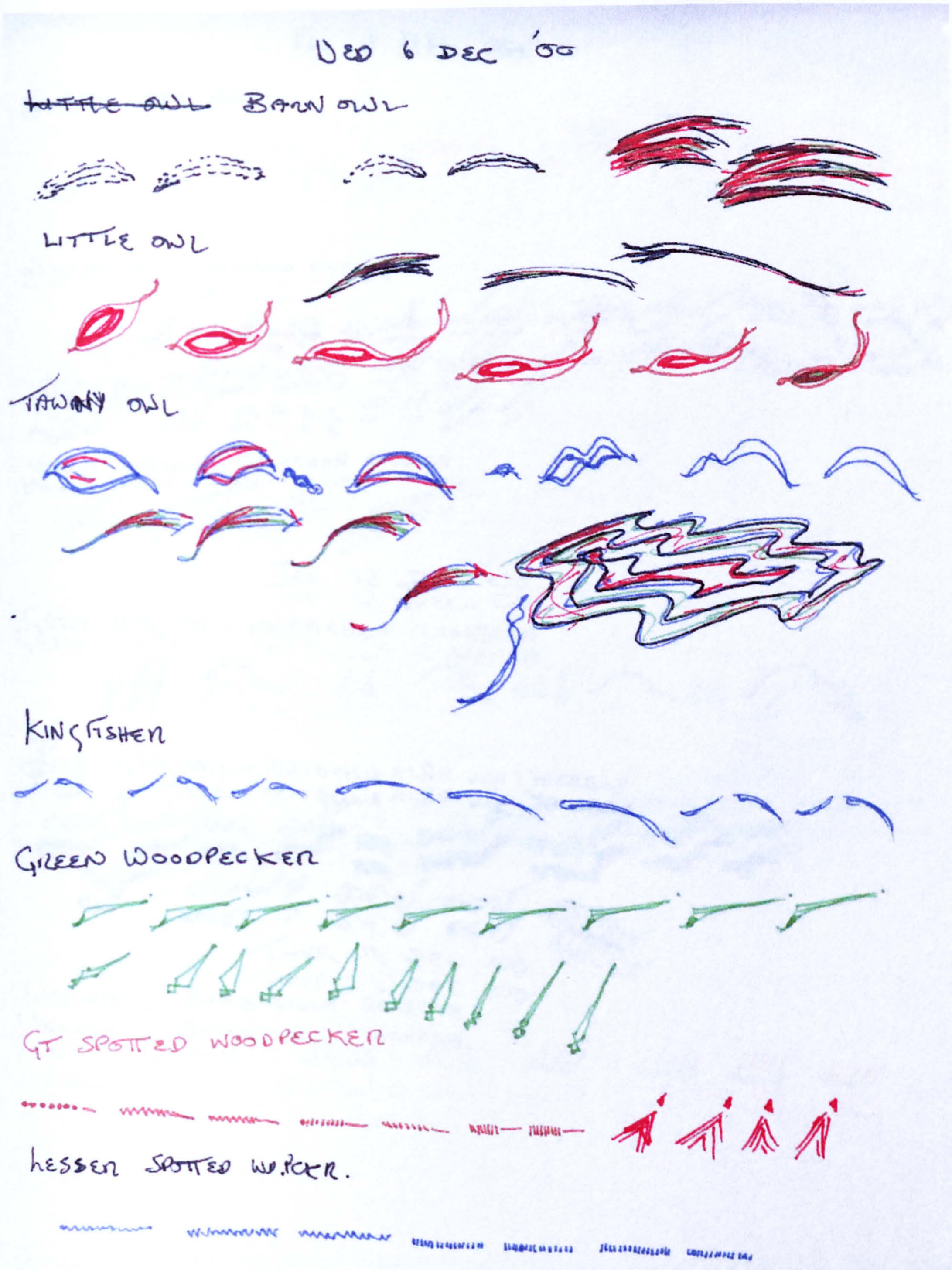
SONG THRUSH (FROM SONGBIRDS TR. 17).

* NOT PART OF OTHER CONTINUING SERIES OF PRACTISE TRANSCRIPTIONS.

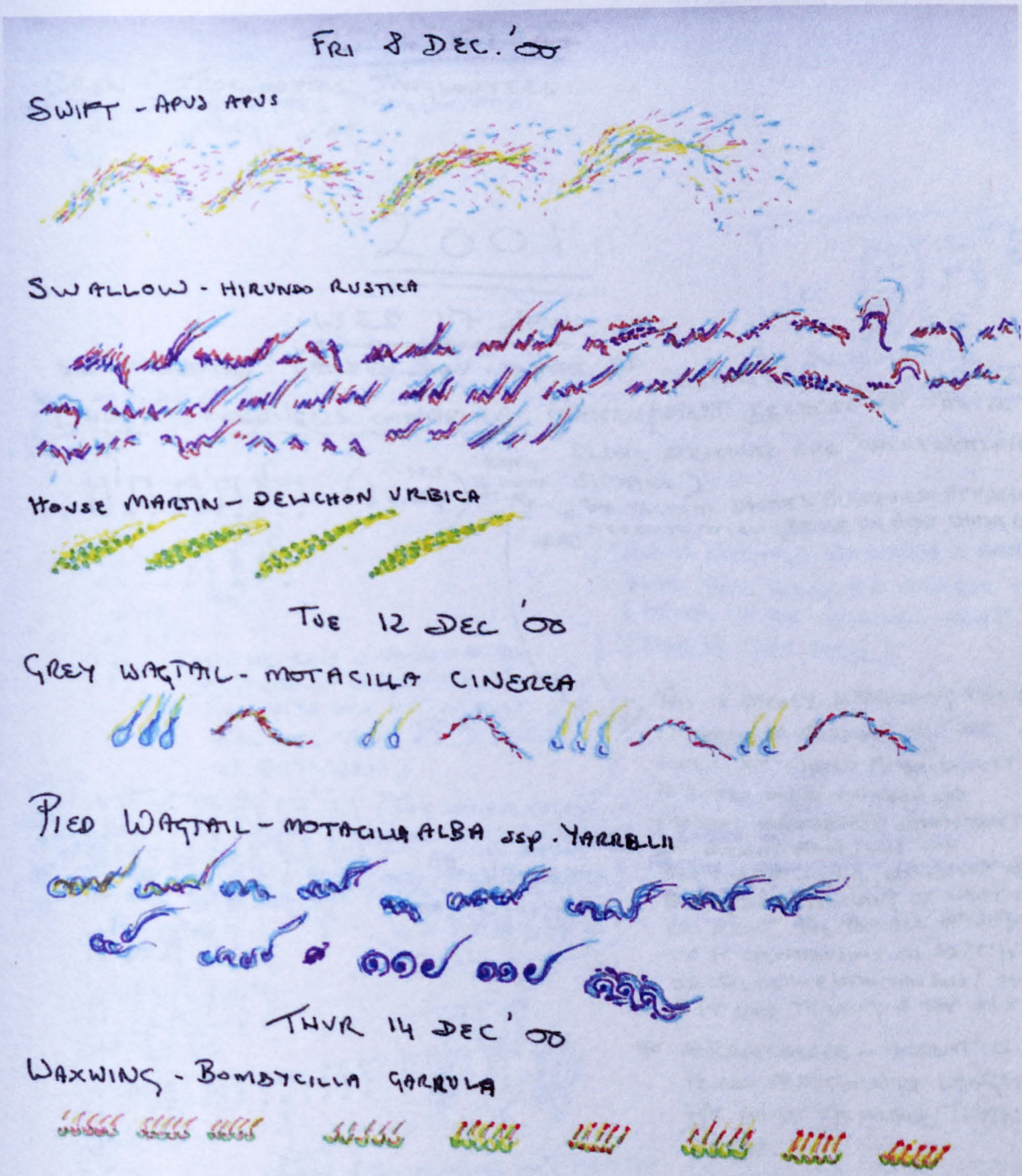


4'03" LONG.

Appendix 1.6


UEA 6 DEC '00
~~LITTLE OWL~~ BARN OWL
LITTLE OWL
TAWNY OWL
KINGFISHER
GREEN WOODPECKER
GT SPOTTED WOODPECKER
LESSER SPOTTED WOODPECKER.

Appendix 1.7


FRI 8 DEC. '00
SWIFT - APUS APUS
SWALLOW - HIRUNDO RUSTICA
HOUSE MARTIN - DELICHON URBICA
TUE 12 DEC '00
GREY WAGTAIL - MOTACILLA CINEREA
PIED WAGTAIL - MOTACILLA ALBA ssp. YARRELLII
THUR 14 DEC '00
WAXWING - BOMBYCILLA GARRULA

Appendix 1.8

THU 14 DEC '00

WREN - TROGLODYTES TROGLODYTES

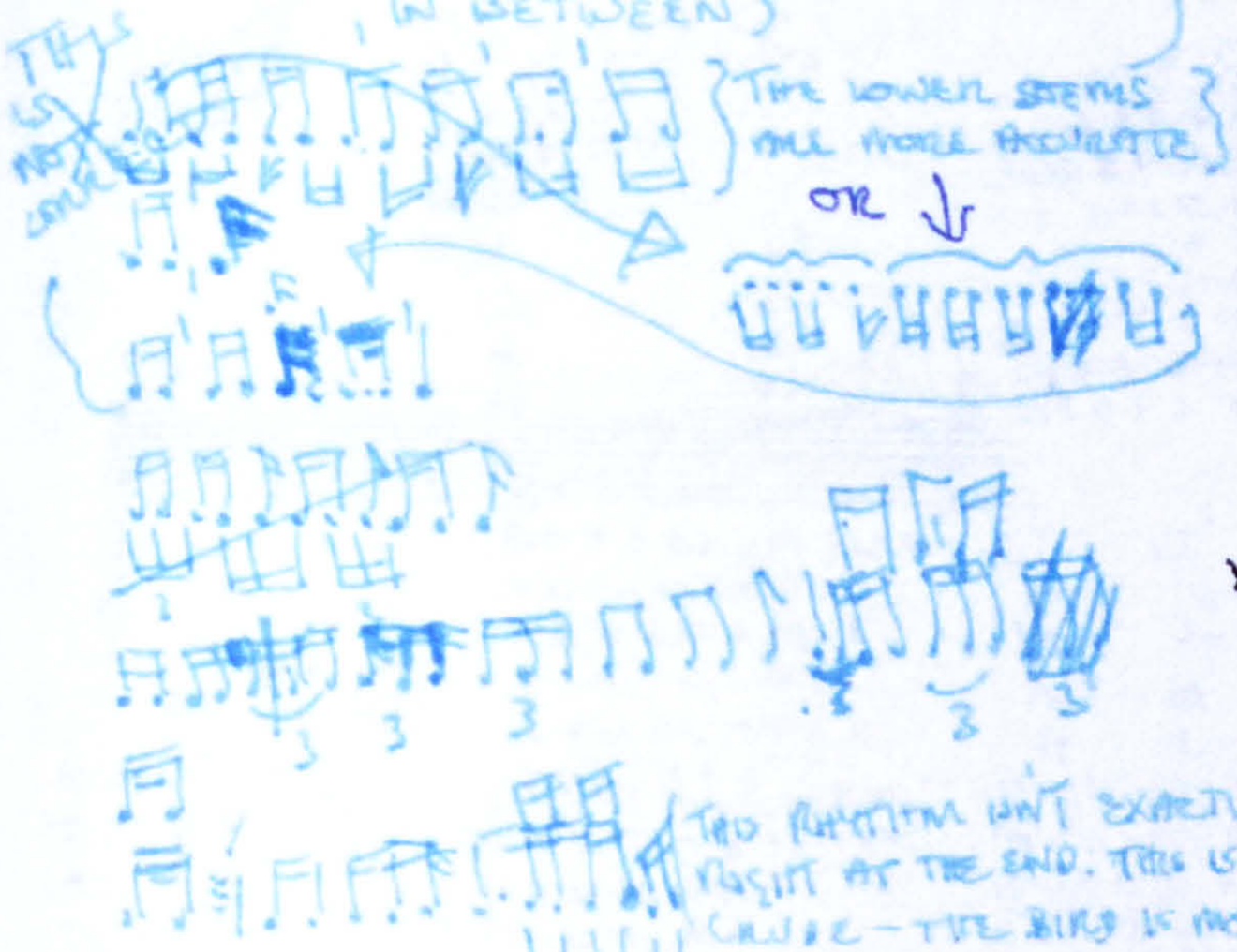
2001

WED 17 JAN

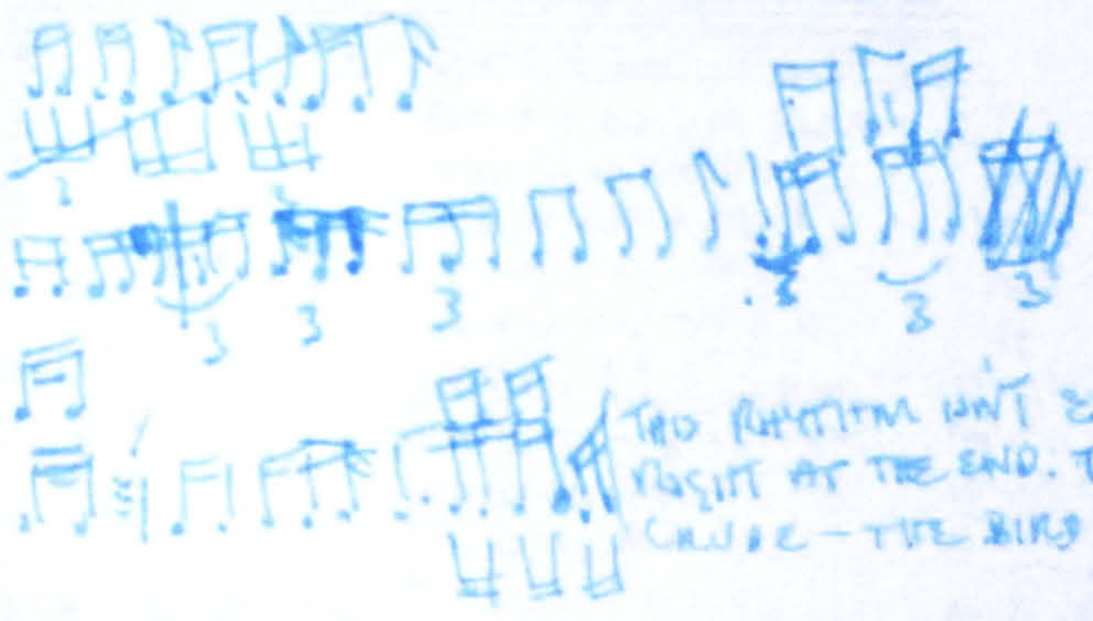
GARDENBIRDSONGS.COM GARDEN BIRD SONGS. CO

LINNET - CARDUELIS CANABINA (TAKEN FIRST BECAUSE OF THEIR RHYTHMS CLEAR STRUCTURE AND 'CONVERSATIONAL SITTING)

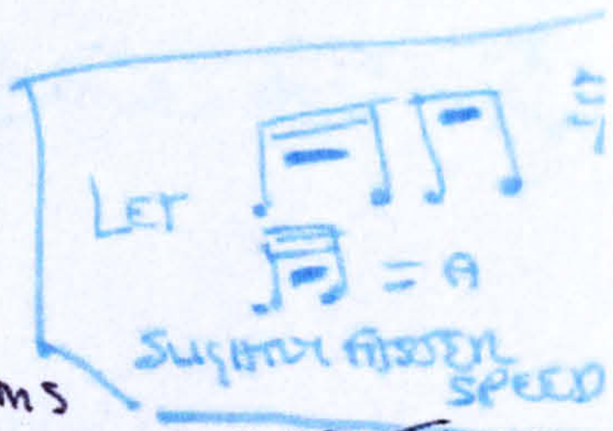
TEMPO IS HARD TO FIX.

(JUST AS TONE IS VARIED IN QUARTER DEGREES SO IS RHYTHM. THESE TWO NOTES ARE NOT IN FACT ♪♪ NOR ARE THEY ♪♪. THEY'RE IN BETWEEN)

THE LOWER SEEMS THE MORE ACCURATE

OR ↓



THIS RHYTHM ISN'T EXACTLY RIGHT AT THE END. THIS IS TOO LONG — THE BIRD IS MORE SUBTLE.



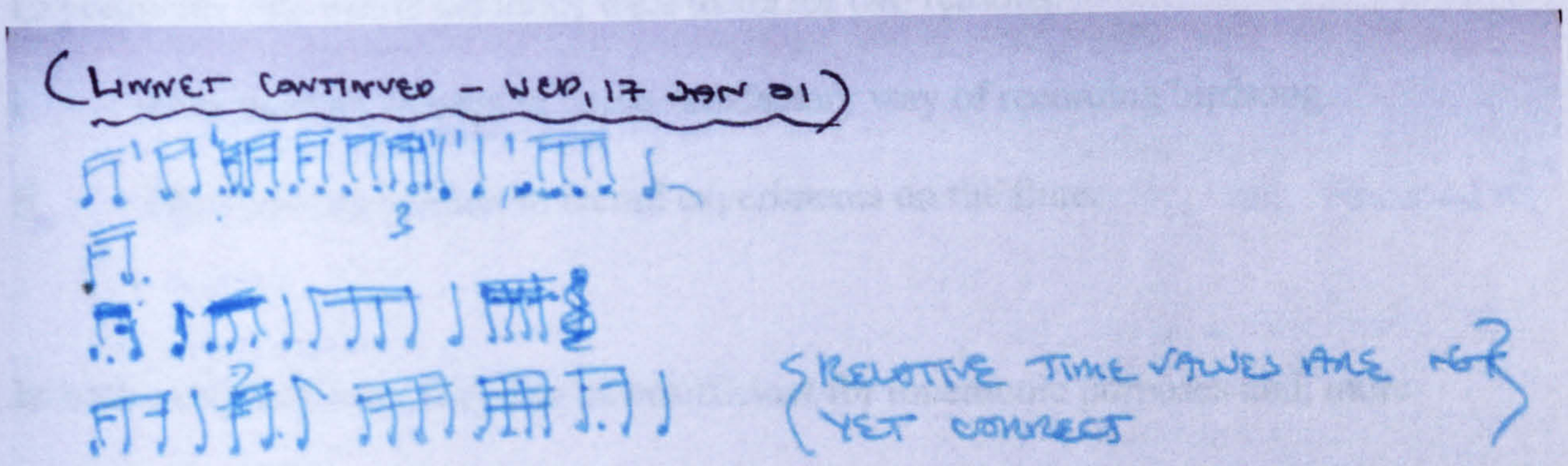
* THE VERTICAL DASHES PRECEDES APPARENT ACCENTUATION (BASED ON PITCH CHANGE (COLOUR CHANGE BECAUSE I CAN HEAR THE SONG AS BLACK - I HEAR IT AS YELLOW - BUT YELLOW'S TEST POOR)

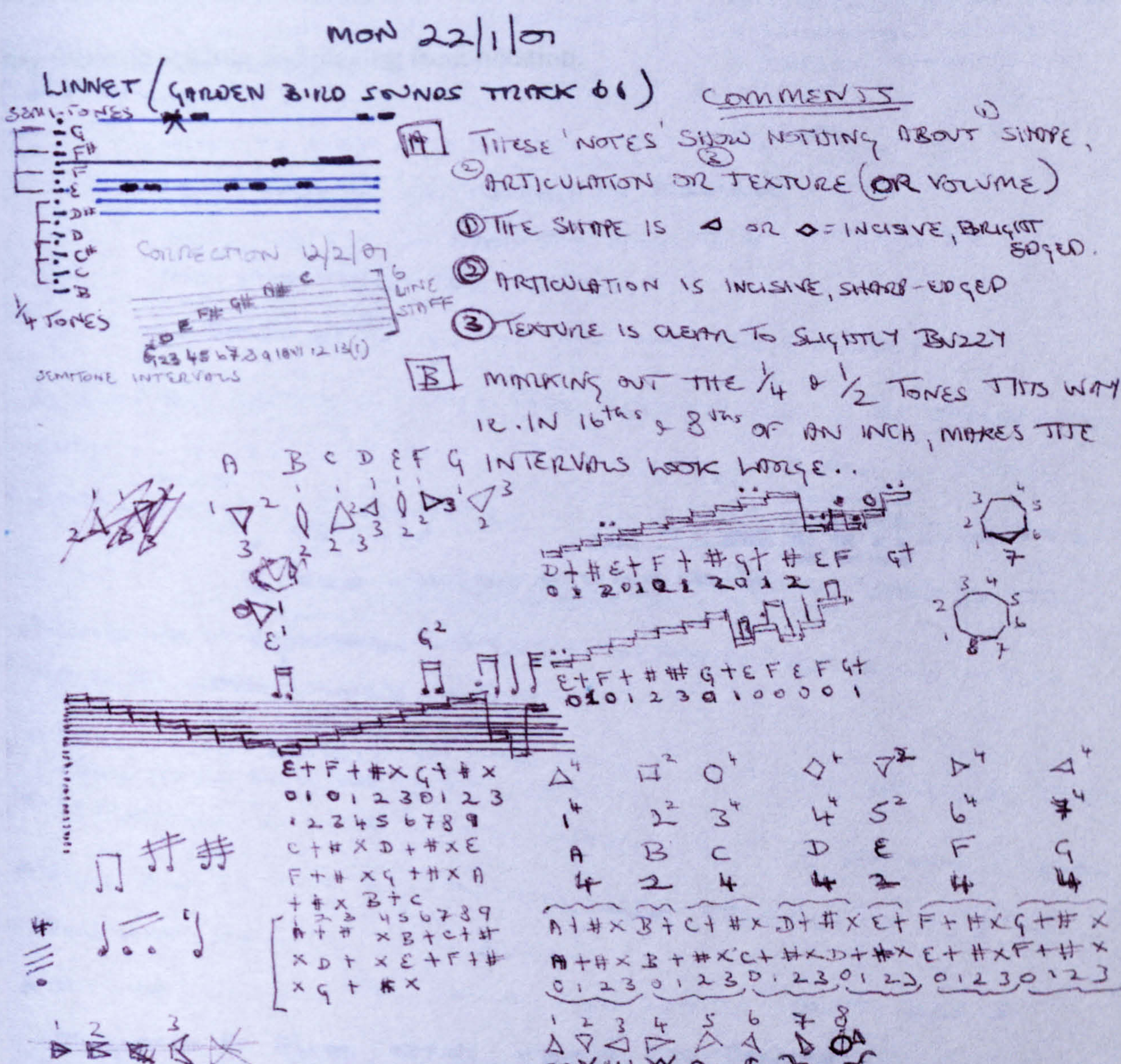
** THIS IS HARDLY SURPRISING FOR A NUMBER OF REASONS eg. THE SONG IS NOT PURELY PHYSICAL - IT IS BASED ON A NUMBER OF FUNCTIONS ~~ASSOCIATED~~ DEPENDENT ON BRAIN FUNCTION — SENDING A SIGNAL, LISTENING FOR A RESPONSE, THINKING OF WHAT TO DO NEXT. THE PROCESS OF SINGING - IS IT SPONTANEOUS OR SELECTIVE OR SELECTIVE/SPONTANEOUS? ONE IS IT LIKE TURNING A TAP ON?

** *REMEMBER - ACCENT IS PERCEIVED THROUGH LENGTH AS MUCH OR MORE THAN PITCH.

CONTINUED OVER

Appendix 1.9


(LINNET CONTINUED - WED, 17 JAN 01)
{RELATIVE TIME VALUES ARE NOT YET CORRECT}


MON 22/1/01
LINNET (GARDEN BIRD SOUNDS TRACK 01)
COMMENTS
SEMI-TONES
¼ TONES
CORRECTION 2/2/01
6 LINE STAFF
SEMITONE INTERVALS
A B C D E F G INTERVALS LOOK LOOSE..

Appendix 2: Music notations

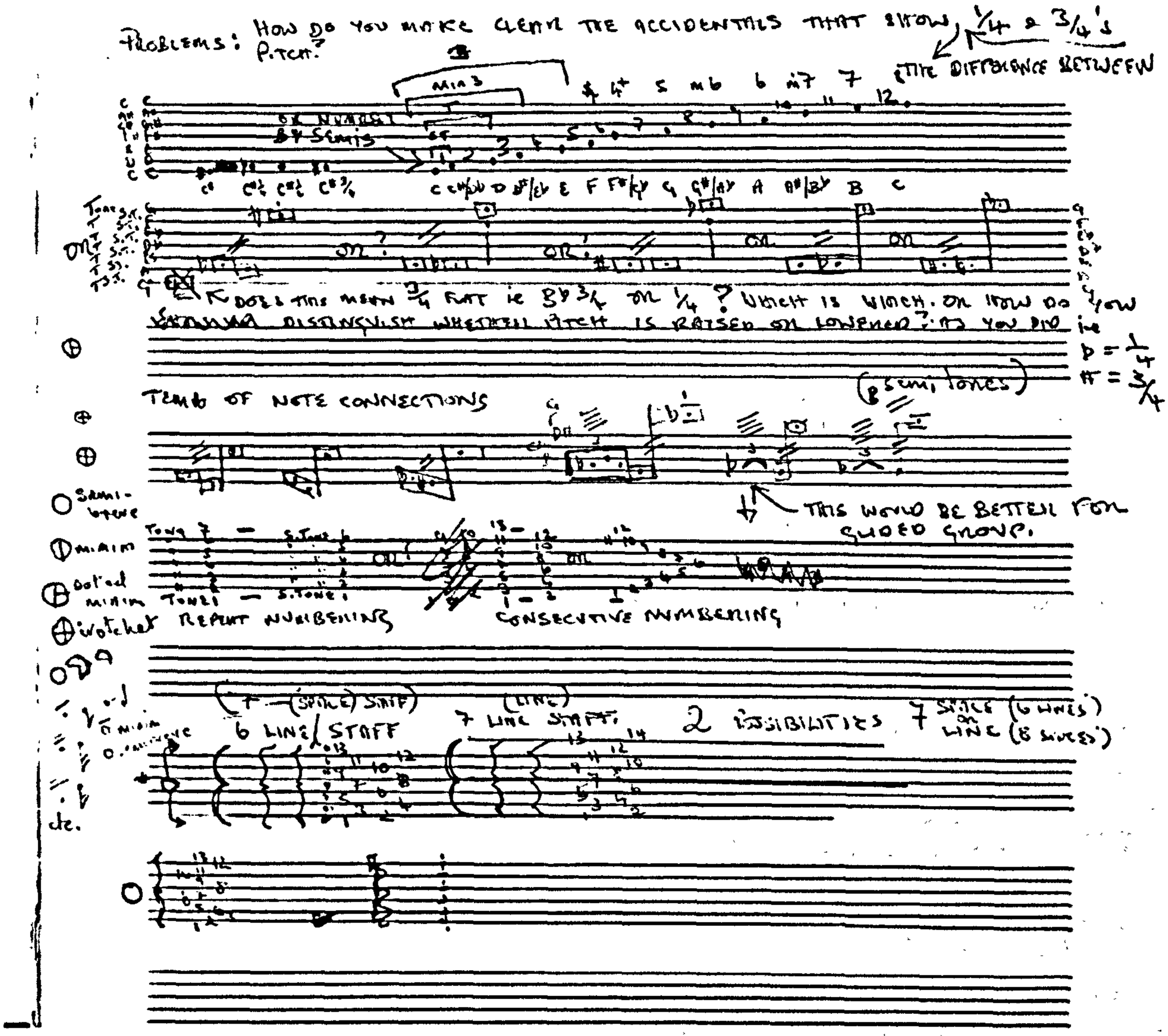
Experiments with music notations were made for two reasons:

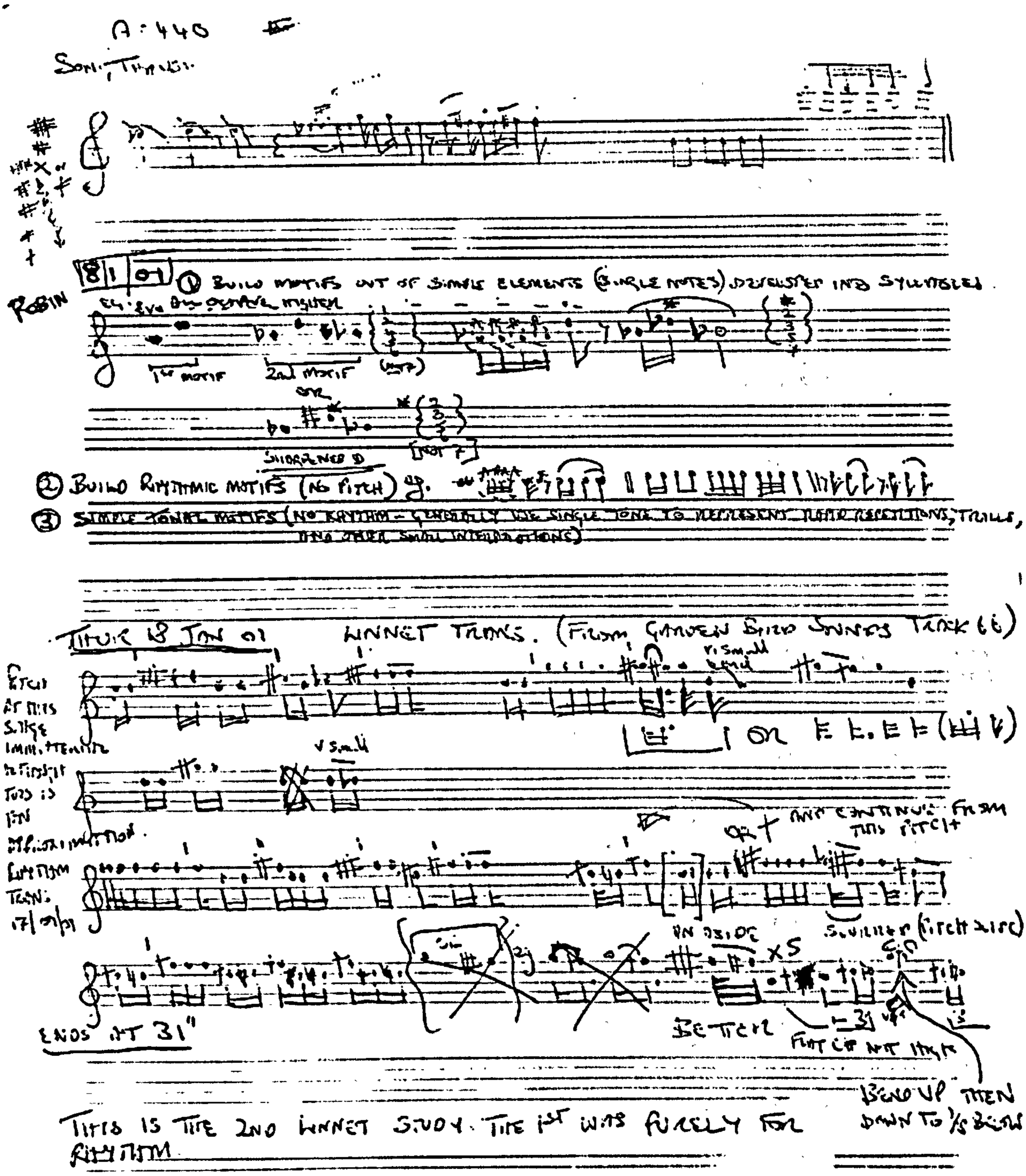
i They were an attempt to find a satisfactory way of recording birdsong.

ii They were an attempt to record experiments on the flute.

In both cases they were found to be insufficient for mnemonic purposes and, more importantly, they were incompatible with the concept of improvisation – tending to hold my focus on reading and playing from notation.

Appendix 2.1

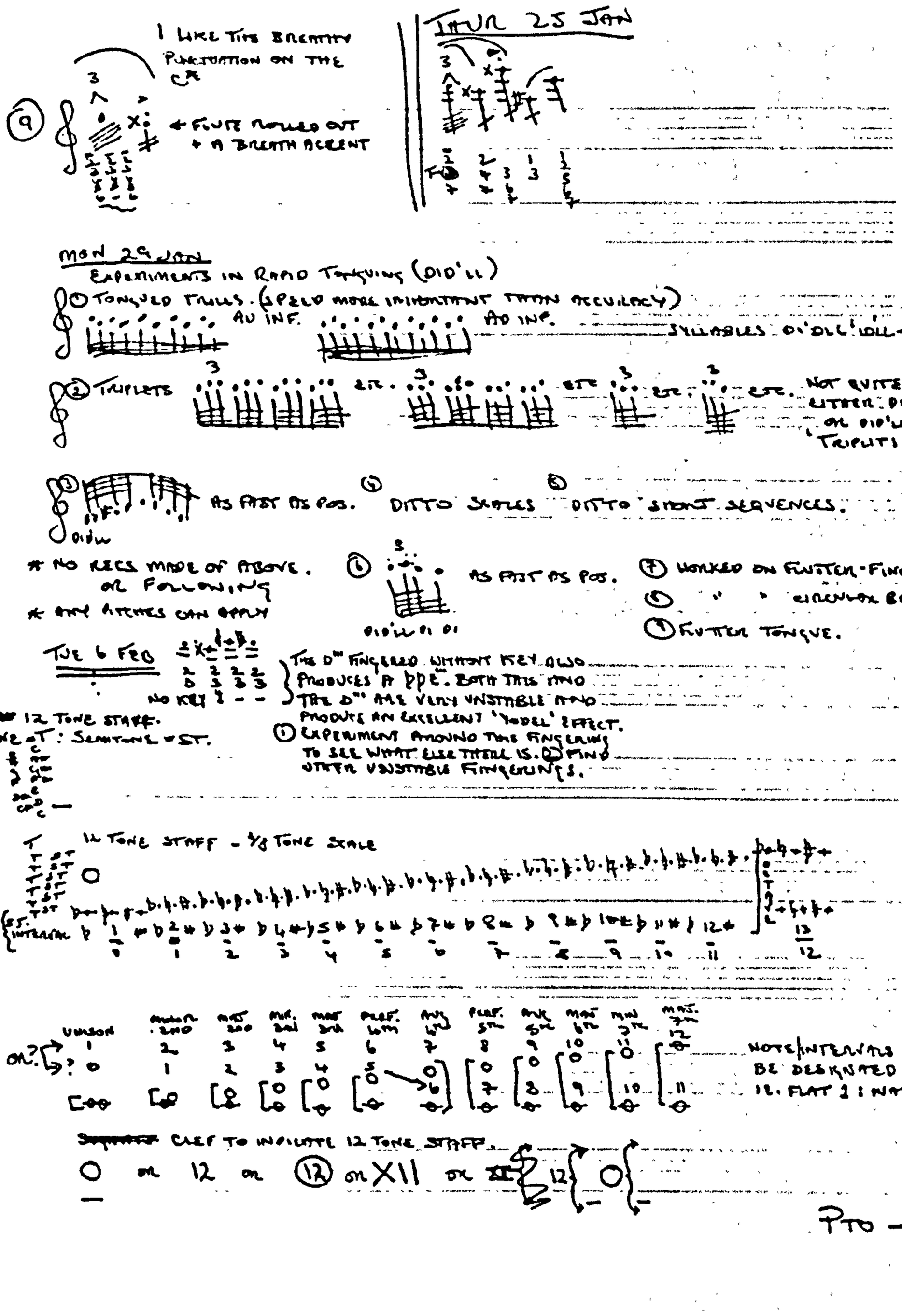

PROBLEMS: HOW DO YOU MAKE CLEAR THE ACCIDENTALS THAT SHOW PITCH?
THE DIFFERENCE BETWEEN 1/4 & 3/4's
DOES THIS MEAN 3/4 FLAT IE B♭ 3/4 OR 1/4 ? WHICH IS WHICH. OR HOW DO YOU DISTINGUISH WHETHER PITCH IS RAISED OR LOWERED ? IF YOU DID
TEMPO OF NOTE CONNECTIONS
(8 semi tones)
THIS WOULD BE BETTER FOR SLOPED GROUP.
REPEAT NUMBERING
CONSECUTIVE NUMBERING
6 LINE/STAFF
7 LINE STAFF
2 POSSIBILITIES
7 SPACE (6 LINES) OR LINE (8 LINES)

Appendix 2.2

A=440
SOUNDTRACK
ROBIN
① BUILD MOTIFS OUT OF SIMPLE ELEMENTS (SINGLE NOTES) DEVELOPED INTO SYLLABLES
1st MOTIF
2nd MOTIF
② BUILD RHYTHMIC MOTIFS (NO PITCH)
③ SIMPLE TONAL MOTIFS (NO RHYTHM - GENERALLY USE SINGLE TONE TO REPRESENT FLUTE REPETITIONS, TRILLS, AND OTHER SMALL INTERJECTIONS)
TITLE IS JUST 01 WINNET TRIMS. (FROM GARDEN BIRD SONGS TRACK 66)
PITCH AT THIS STAGE IMMEDIATELY
TRILL
ENDS AT 31"
BETTER
BEND UP THEN DOWN TO ½ BELOW
TITLE IS THE 2ND WINNET STUDY. THE 1ST WAS PURELY FOR RHYTHM

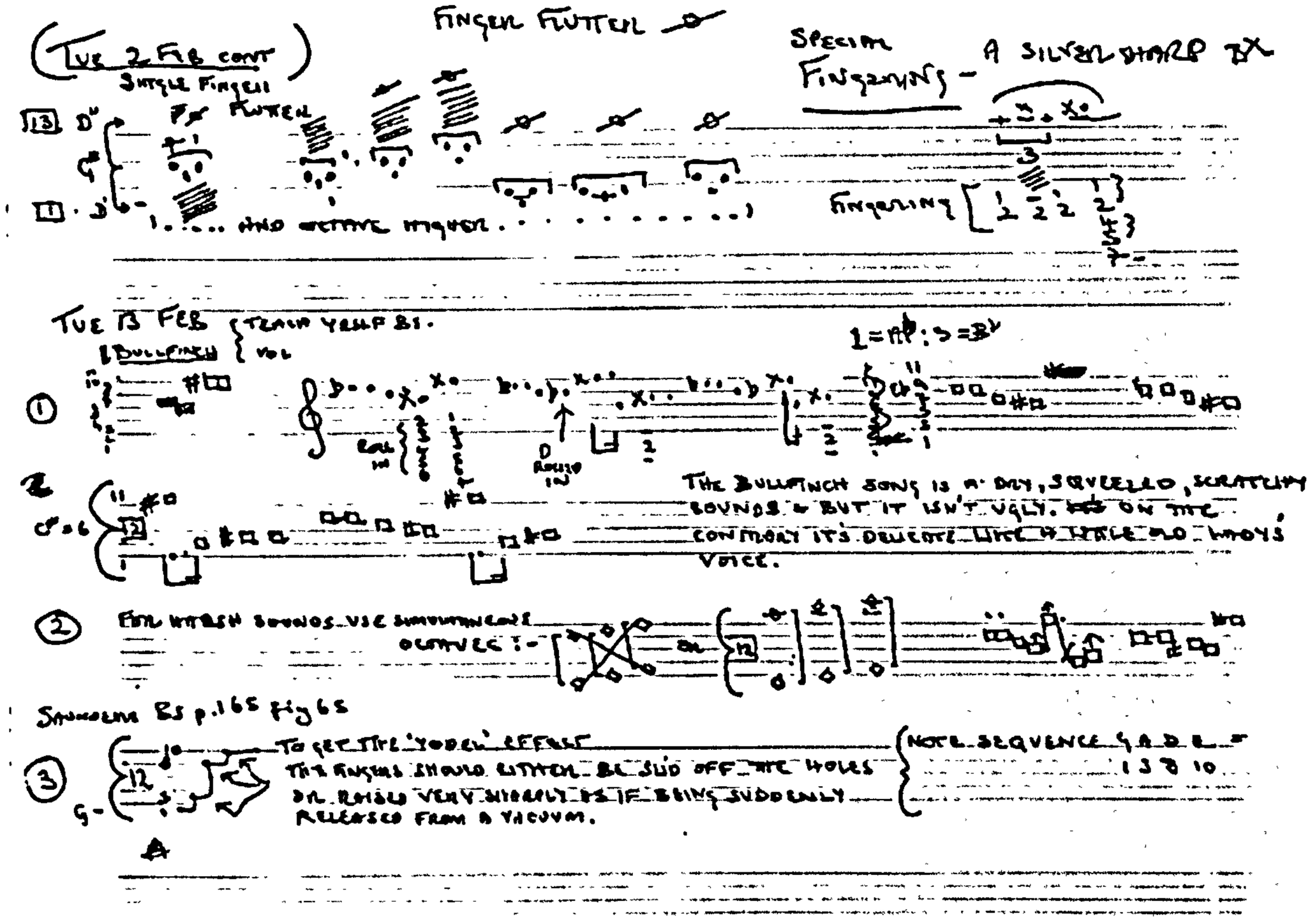
Appendix 2.3

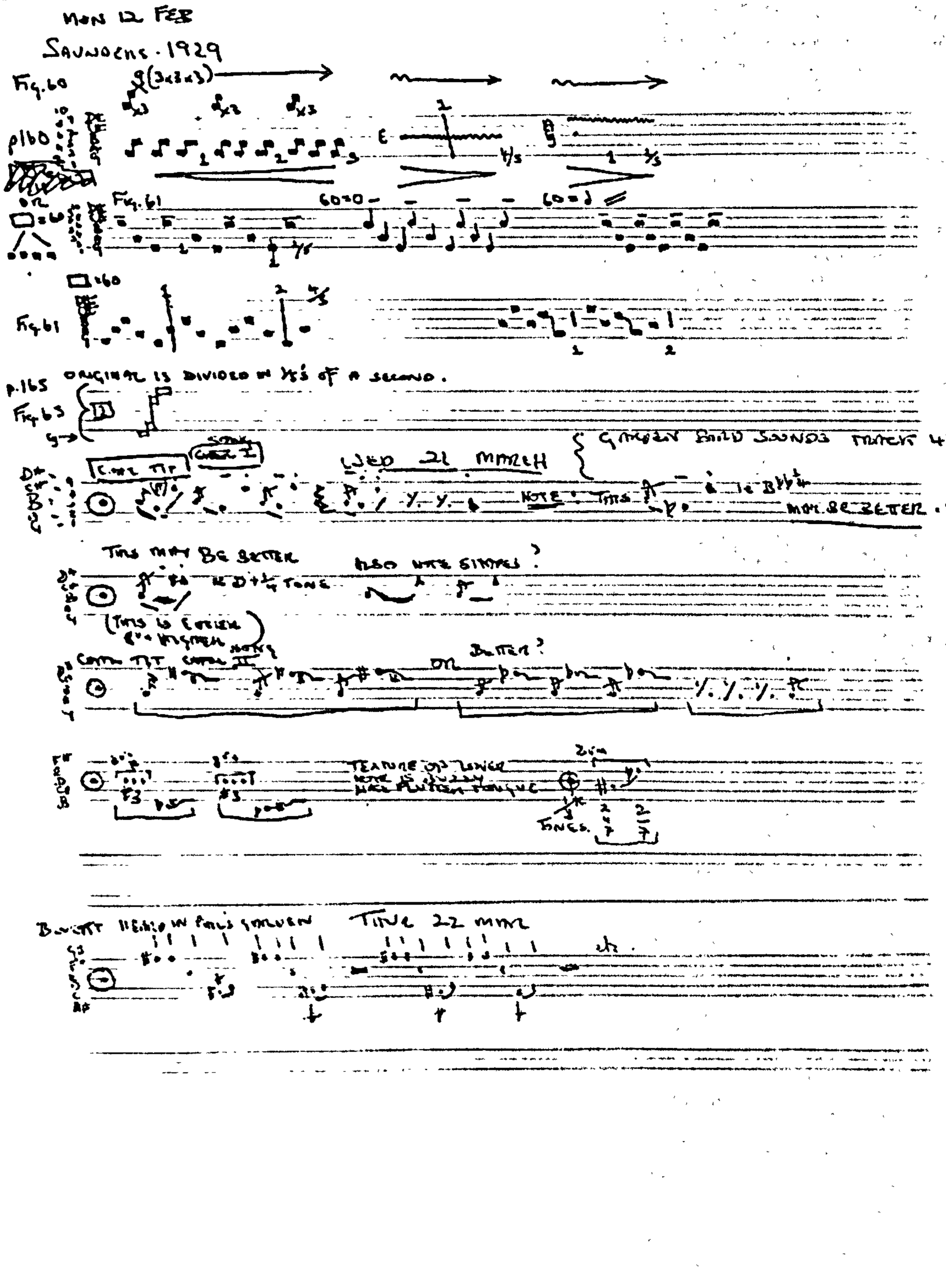
USED 24 JAN 01
ELEMENTS & SYLLABLES TWOS. ROBIN JONS L
{ THESE ARE RECORDED ON MINI CD.
VARIANT
1A
TRIPLET V. BRIGHT SOUND
V. CLEAR-EDGED ARTICULATION
LEFT 1ST FINGER
VERY BRIGHT INCISIVE TRILL
THE ELEMENT IS THE TRIPLET
LIFT 3RD FINGER
NB PREFER X TO ## FOR THE 3/4 TONE.
OVERBLOWN MODE
3. SOUNDS THE SAME AS
2. RAISING THE 3rd FINGER HAS THE SAME EFFECT AS RAISING THE 1ST
BUT RAISING MIDDLE FINGER, HOWEVER NARROWLY, PRODUCES A HIGHER NOTE eg. B♮ or A##
* THIS SET HAS A LOVELY THROATY SOUND.
* THIS TRILL FINGER 1 ON 4 LINKS WTO THE ET FINGERING VERY SMOOTHLY.
5
etc.
IN THE LOW REGISTER THESE FINGERINGS ALL HAVE A DISTINCTLY DIFFERENT EFFECT
THEY MAKE AN INTERESTING PATTERN WHEN PLAYED ALTERNATELY IN SOME REPEATED SUCCESSION.
PUTTING TOGETHER A SEQUENCE LIKE THIS PRODUCES A SWALLOW-LIKE CHATTERING.
THERE IS LESS DIFFERENCE THAN WITH G AS THE BASE.
THIS IS BETTER
BUT THIS ON THE RECORDER.

Appendix 2.4


I LIKE THIS BREATHY PUNCTUATION ON THE C#
FLUTE MOVED OUT + A BREATH ACCENT
THUR 25 JAN
MON 29 JAN
EXPERIMENTS IN RAPID TONGUING (DIDDLE)
TONGUED TRILLS. (SPEED MORE IMPORTANT THAN ACCURACY)
AU INF.
AD INF.
SYLLABLES DI'DLE! DLE-DLE
TRIPLETS
ETC.
NOT QUITE JUST EITHER DIDLE DI OR DIDLE-DIDLE 'TRIPLETISED'
AS FAST AS POS.
DITTO SCALES
DITTO SHORT SEQUENCES.
DIDLE
* NO RECS MADE OF ABOVE. OR FOLLOWING
* ANY HINTS CAN APPLY
DIDLE DI DI
AS FAST AS POS.
WORKED ON FLUTTER-FINGERING
" " CIRCULAR BREATHING
FLUTTER TONGUE.
THE D''' FINGERED WITHOUT KEY ALSO PRODUCES A ppp E'''. BOTH THIS AND THE D''' ARE VERY UNSTABLE AND PRODUCE AN EXCELLENT 'YODEL' EFFECT.
EXPERIMENT AROUND THIS FINGERING TO SEE WHAT ELSE THERE IS. 2) FIND OTHER UNSTABLE FINGERINGS.
THE 6 FEB
NO KEY
12 TONE STAFF.
TONE=T : SEMITONE=ST.
12 TONE STAFF - 1/3 TONE SCALE
UNISON
MINOR 2ND
MAJ 2ND
MIN 3RD
MAJ 3RD
PERF 4TH
AUG 4TH
PERF 5TH
MIN 6TH
MAJ 6TH
MIN 7TH
MAJ 7TH
NOTE/INTERVALS COULD BE DESIGNATED FI:NI:S' 12. FLAT 2 : NATURAL 1: SHI
CLEF TO INDICATE 12 TONE STAFF.
or 12 or (12) or X11 or XII
PTO

Appendix 2.5

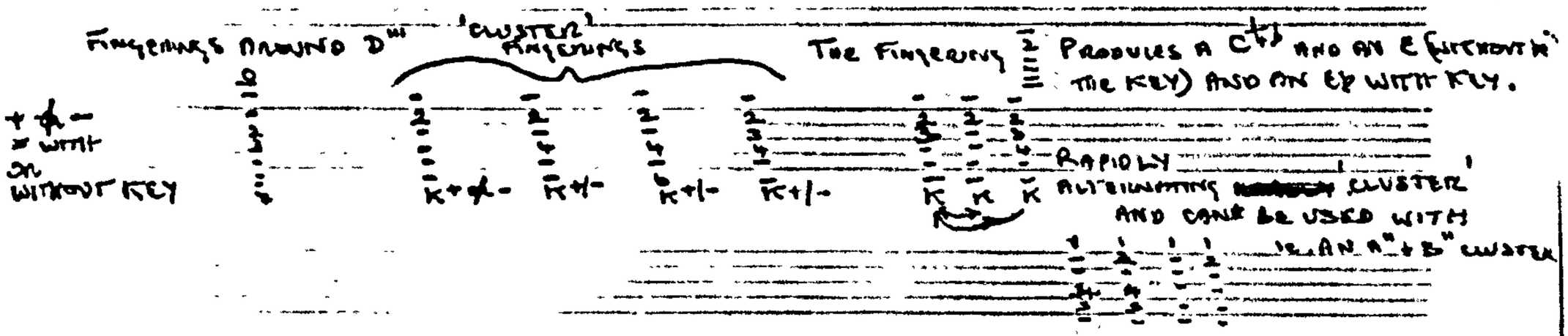

(TUE 2 FEB cont)
SINGLE FINGER FLUTTER
FINGER FLUTTER
SPECIAL FINGERINGS - A SILVER SHARP ETC
FINGERING
AND ACTIVE HIGHER
TUE 13 FEB
BULLFINCH
1=F♯ : 5=B♭
THE BULLFINCH SONG IS A DRY, SQUEELLO, SCRATCHY SOUNDS - BUT IT ISN'T UGLY. ON THE CONTRARY IT'S DELICATE LIKE A LITTLE OLD LADY'S VOICE.
FOR WELSH SOUNDS USE SIMULTANEOUS OCTAVES :-
OR
SAXOLOGY BS p.165 Fig 65
TO GET THE 'WOOD' EFFECT THE FINGERS SHOULD BOTH BE SLID OFF THE HOLES OR RAISED VERY SHARPLY AS IF BEING SUDDENLY RELEASED FROM A VACUUM.
NOTE SEQUENCE GRADE
1 3 8 10

Appendix 2.6

NOV 12 FEB
SAUNDERS · 1929
Fig. 60
Fig. 61
Fig. 61
Fig. 63
p. 165
ORIGINAL IS DIVIDED IN ½'s OF A SECOND.
USED IN MARCH
GIVEN BUILD SOUNDS FASTER 47
NOTE: THIS MAY BE BETTER · OR
THIS MAY BE BETTER
ALSO NOTE SLIPPED ?
BETTER ?
TEMPO OF LENGTH
NOTE IS PLAYED
HALF PLAYING TEMPO
BUILT HERE IN PARIS SUMMER
TIME 22 MINS

Appendix 2.7

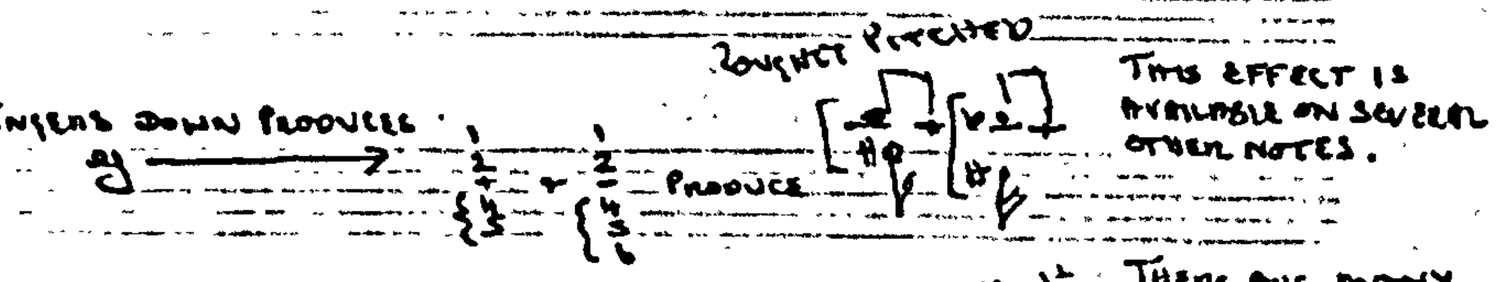
THU APRIL 5 :

OVER THE LAST 2 DAYS I HAVE BEEN RANDOMELY EXPLORING THE EFFECTS OF $\frac{1}{4}$ TONE FINGERINGS (AND 'ARBITRARY' FINGERINGS - MOSTLY AT SPEED, USING VERY RAPID TONGUING AND INSISTENT REPETITION. THE RESULTS HAVE BEEN EXCELLENT - CONSTANTLY PRODUCING UNEXPECTED AND BEAUTIFUL EFFECTS.

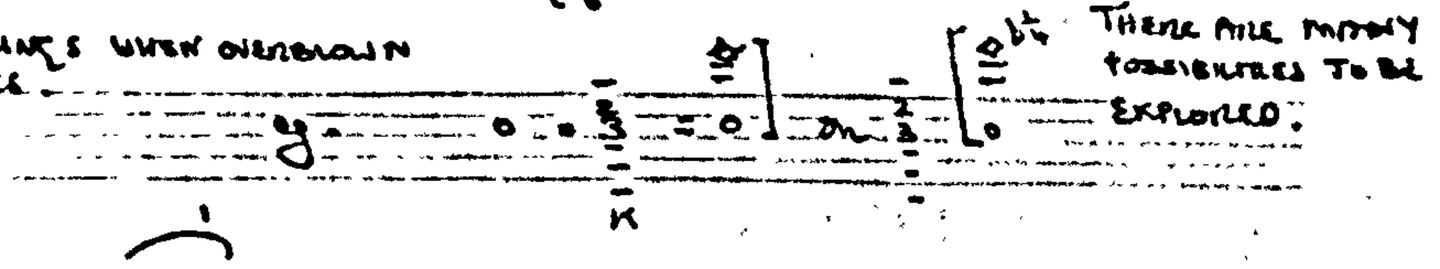


$\frac{1}{4}\flat$ FINGERING ALSO PRODUCES $\frac{1}{4}\flat$ AND $\frac{1}{4}\sharp$

- "FLOPPING" THE RH. FINGERS DOWN PRODUCES LOWER PARTIALS

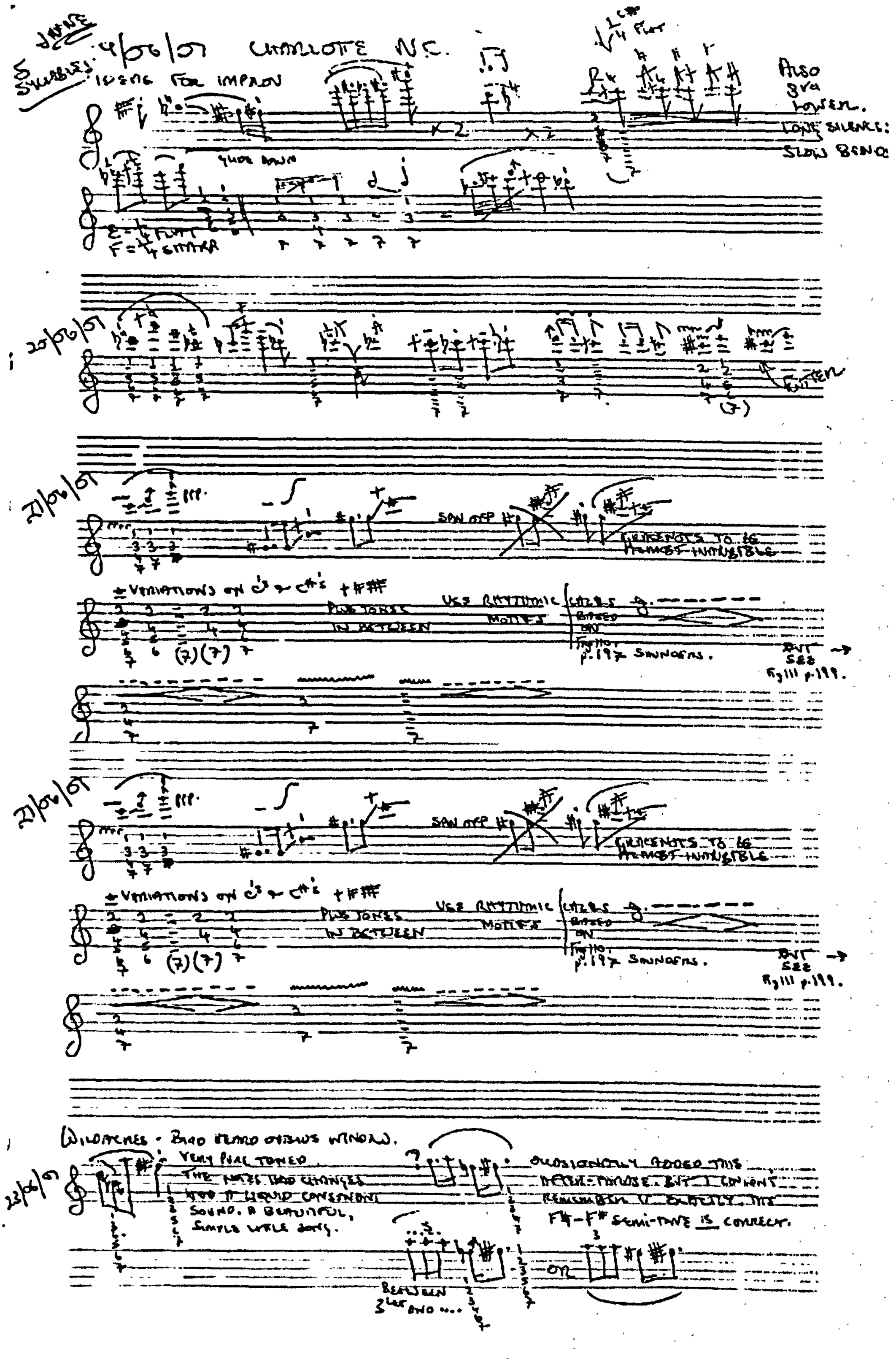


A NUMBER OF CROSS-FINGERINGS WHEN OVERBLOWN PRODUCE NON-HARMONIC NOTES.



A SINGLE 'FLOP' PRODUCES A VERY RESONANT EFFECT

Appendix 2.8


CHARLOTTE N.C.
ALSO 8va LOWER.
LONG SILENCE: SLOW BEND
PLUS JONES IN BETWEEN
USE RHYTHMIC MOTIFS
SEE p.197 SAXOPHONES.
SEE Fig III p.199.
SAX OFF
CRICKETS TO BE ALMOST INAUDIBLE
WILDERNESS - BIRD BEHIND OTHERWISE WINDOW.
VERY PURE TONED
THE NOTES HAD CHANGED
AND IT LIKED CONSONANT
SOUND. A BEAUTIFUL,
SIMPLE LITTLE SONG.
OBSESSIONALLY FORGOT THIS
INTERLUDE. BUT I CONSIDER
REMEMBERING IT CORRECTLY. THE
F♮-F♯ SEMI-TONE IS CORRECT.
BETWEEN
SAX AND ...
OR

Appendix 3: Technique sketches

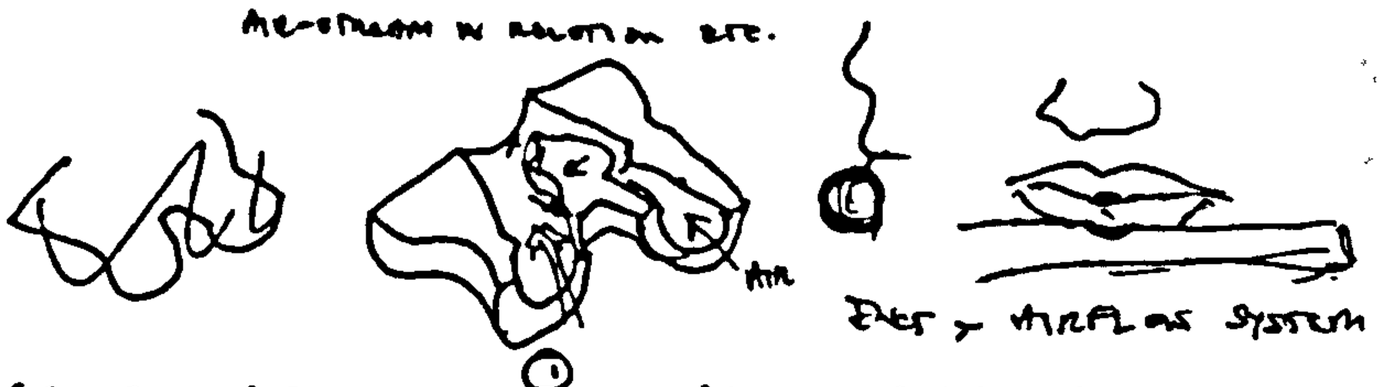
These sketches were attempts to envisage the production of birdsong and playing the flute as analogous physical processes.

Appendix 3.1

TECHNIQUES ~ RULES ~ CONSIDERATIONS FOR THE TECHNICAL FACTORS OF PERFORMANCE

BASIC SOUND PRODUCTION.

① UNLIKE ☎ THE HH SOUND IS INSTRUMENTALLY INSPIRED. ie IT IS THE RESULT OF A HUMAN-GENERATED AIR-STREAM IN MOTION ETC.

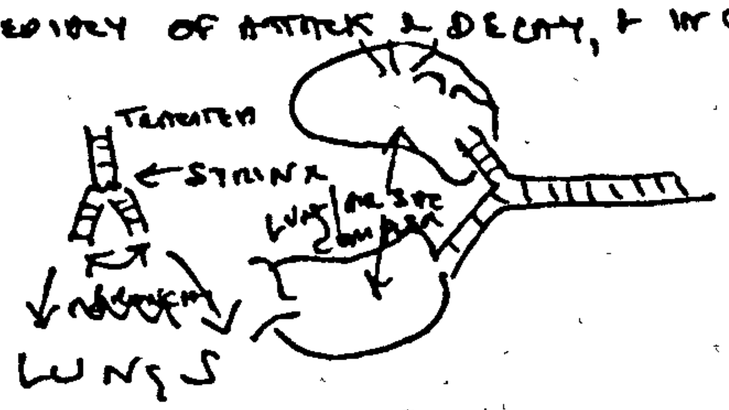


ETC ~ VARIOUS SYSTEMS.

ESSENTIAL DIFFERENCES IS IN THE QUALITY, RESONANCE & IMMEDIACY OF ATTACK & DECAY, & IN OVERALL IMMEDIACY & SUBTLETY OF CONTROL.

② THE SYRINX RECEIVES AIR FROM TWO TUBES

③ HAS SEVERAL VIBRATING MEMBRANES WHICH CAN BE CONTROLLED INDIVIDUALLY

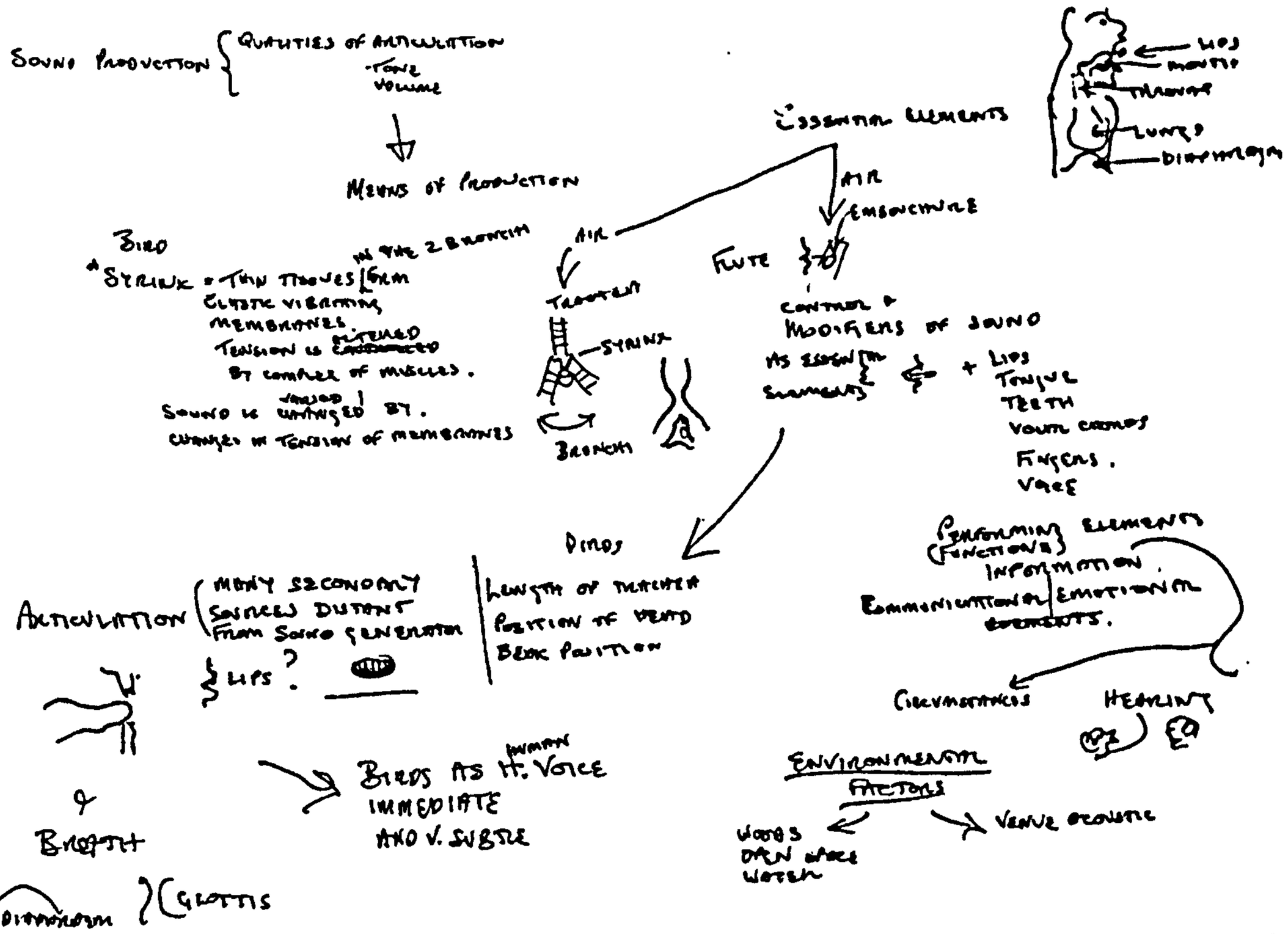


MODIFIERS

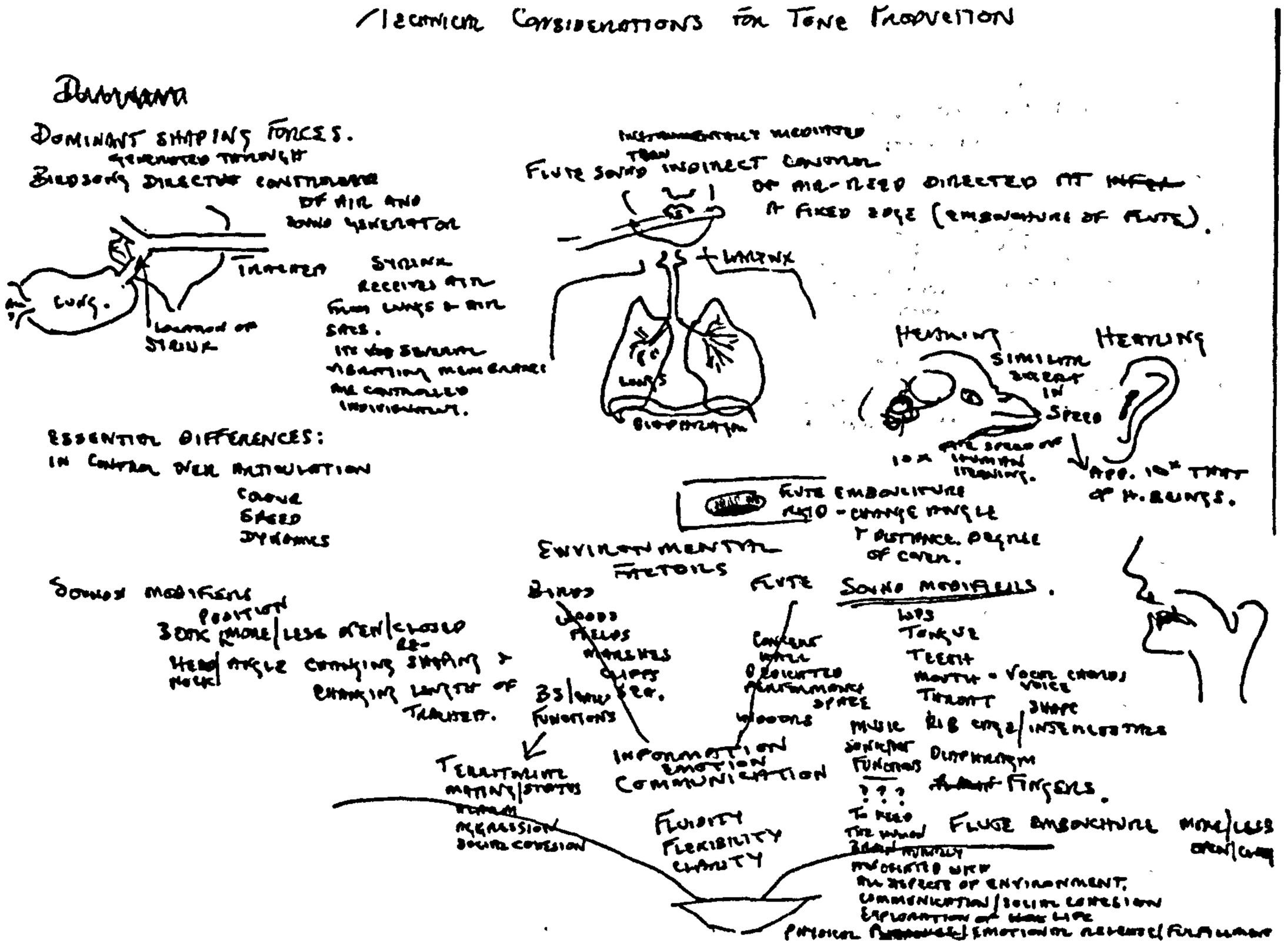
IN BIRDS BEAK - OPENING/CLOSING
HEAD } SIZE/LENGTH
NECK } OF TRACHEA

BESIDE
AIR - MANNER OF EXPULSION

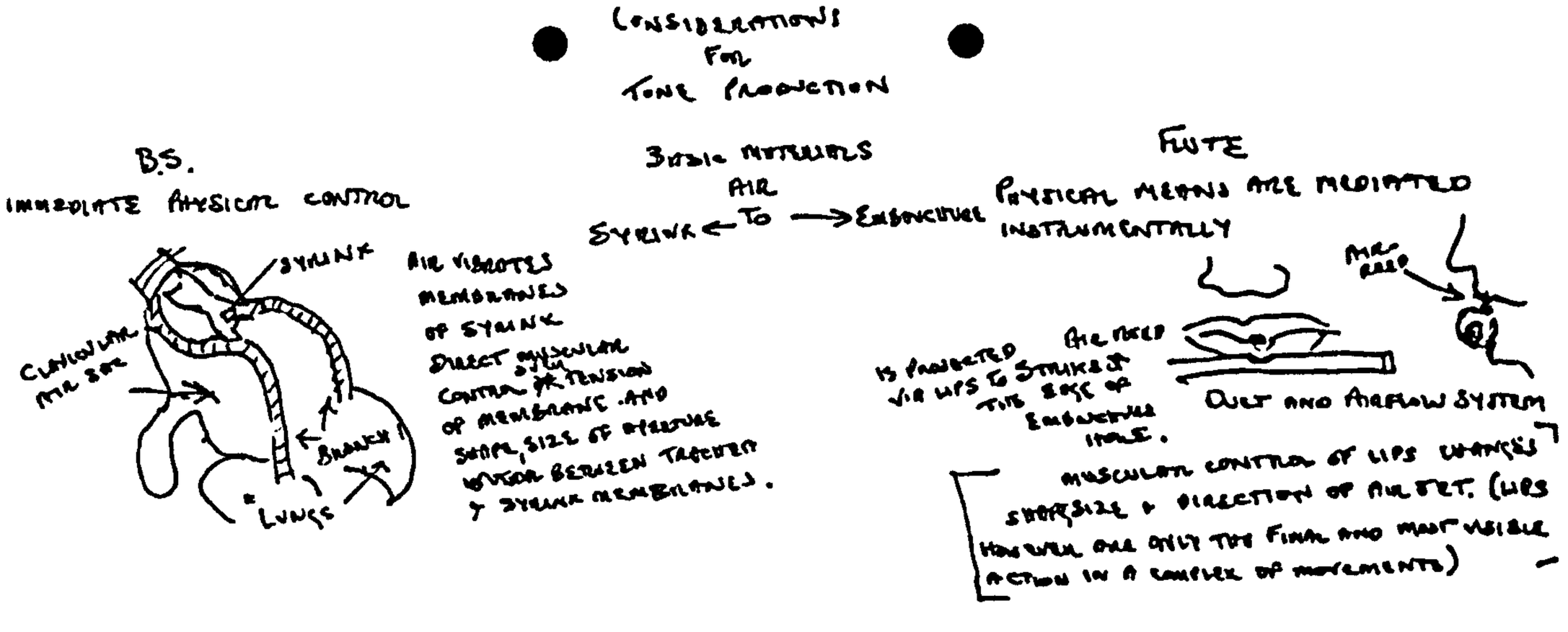
Appendix 3.2


SOUND PRODUCTION
QUALITIES OF ARTICULATION
TONE
VOLUME
MEANS OF PRODUCTION
BIRD
SYRINX = THIN TISSUES FORM ELASTIC VIBRATING MEMBRANES IN THE 2 BRONCHI
TENSION IS CONTROLLED BY COMPLEX OF MUSCLES.
SOUND IS VARIED BY CHANGES IN TENSION OF MEMBRANES
ESSENTIAL ELEMENTS
AIR
EMBOUCHURE
AIR
TRACHEA
SYRINX
BRONCHI
FLUTE
CONTROL & MODIFIERS OF SOUND
AS ESSENTIAL ELEMENTS
+ LIPS TONGUE TEETH VOCAL CHORDS FINGERS. VOICE
LIPS
MOUTH
THROAT
LUNGS
DIAPHRAGM
PERFORMING ELEMENTS (FUNCTIONS)
INFORMATION.
COMMUNICATION OF EMOTIONAL CONTENTS.
CIRCUMSTANCES
HEARING
ENVIRONMENTAL FACTORS
WOODS OPEN SPACE WATER
VENUE ACOUSTIC
ARTICULATION
MANY SECONDARY SOURCES DISTANT FROM SOUND GENERATION
LIPS?
PITCH
BREATH
DIAPHRAGM
GLOTTIS
BIRDS AS H. VOICE
IMMEDIATE AND V. SUBTLE
DIRECTION
LENGTH OF TRACHEA
POSITION OF HEAD
BEAK POSITION

Appendix 3.3


TECHNICAL CONSIDERATIONS FOR TONE PRODUCTION
DIAPHRAGM
DOMINANT SHAPING FORCES.
GENERATED THROUGH
BIOLOGICAL DIRECTED CONTINUANCE OF AIR AND SOUND VIBRATION
TRACHEA
LUNG.
LOCATION OF STRAIN
STRAIN RECEIVES ATTN FROM LUNGS & AIR SACS.
ITS VIBRATIONAL MECHANISMS ARE CONTROLLED INVOLUNTARILY.
FLUTE SOUND INDIRECT CONTROL OF AIR-REED DIRECTED AT FIXED EDGE (EMBOUCHURE OF FLUTE).
LARYNX
LUNGS
DIAPHRAGM
HEARING
SIMILAR AMOUNT IN SPEED
HEARING
APP. 10% THAT OF H. BEINGS.
ESSENTIAL DIFFERENCES:
IN CONTROL OVER ARTICULATION
VOLUME
SPEED
DYNAMICS
FLUTE EMBOUCHURE MOD - CHANGE ANGLE & DISTANCE. ANGLE OF CUTS.
ENVIRONMENTAL FACTORS
SOUND MODIFICATIONS
BODY POSITION
HEAD/NECK
MORE/LESS OPEN/CLOSED RE-
ANGLE CHANGING SHAPING & CHANGING LENGTH OF TRACHEA.
BIRDS
WOODS
FIELDS
MARSHES
CLIFFS
SEA.
BS/NW FUNCTIONS
FLUTE
CONTENT WITH DESIRED PERFORMANCE SPACE
WOODS
INFORMATION EMOTION COMMUNICATION
TERRITORIAL MATING/STATUS
AGGRESSION
SOCIAL COHESION
FLUIDITY
FLEXIBILITY
CLARITY
SOUND MODIFIERS.
LIPS
TONGUE
TEETH
MOUTH - VOCAL CHORDS VOICE
THROAT
SHAPE
MUSIC
RIB CAGE/DIAPHRAGM
SENSORY FUNCTIONS
INTERCOSTALS
FINGERS.
? ? ?
TO FEED THE WIND
FLUTE EMBOUCHURE MORE/LESS OPEN/CLOSED
PHYSICAL PERFORMANCE/EMOTIONAL REFLECTS/FULFILLMENT

Appendix 3.4


CONSIDERATIONS FOR TONE PRODUCTION
B.S.
IMMEDIATE PHYSICAL CONTROL
SYRINX
CLAVICULAR ARCH
LUNGS
BRONCHI
AIR VIBRATES MEMBRANES OF SYRINX
DIRECT MUSCULAR CONTROL OF TENSION OF MEMBRANE AND SHAPE, SIZE OF APERTURE
BASIC MATERIALS
AIR
SYRINX ← TO → EMBOUCHURE
FLUTE
PHYSICAL MEANS ARE MEDIATED INSTRUMENTALLY
AIR JET
AIR IS PROJECTED VIA LIPS TO STRIKE AT THE EDGE OF EMBOUCHURE HOLE.
AIR REED
QUILT AND AIRFLOW SYSTEM
MUSCULAR CONTROL OF LIPS CHANGES SHAPE, SIZE & DIRECTION OF AIR JET. (LIPS HOWEVER ARE ONLY THE FINAL AND MOST VISIBLE ACTION IN A COMPLEX OF MOVEMENTS)

Appendix 4: Ecosonic fingerings from zero to 63

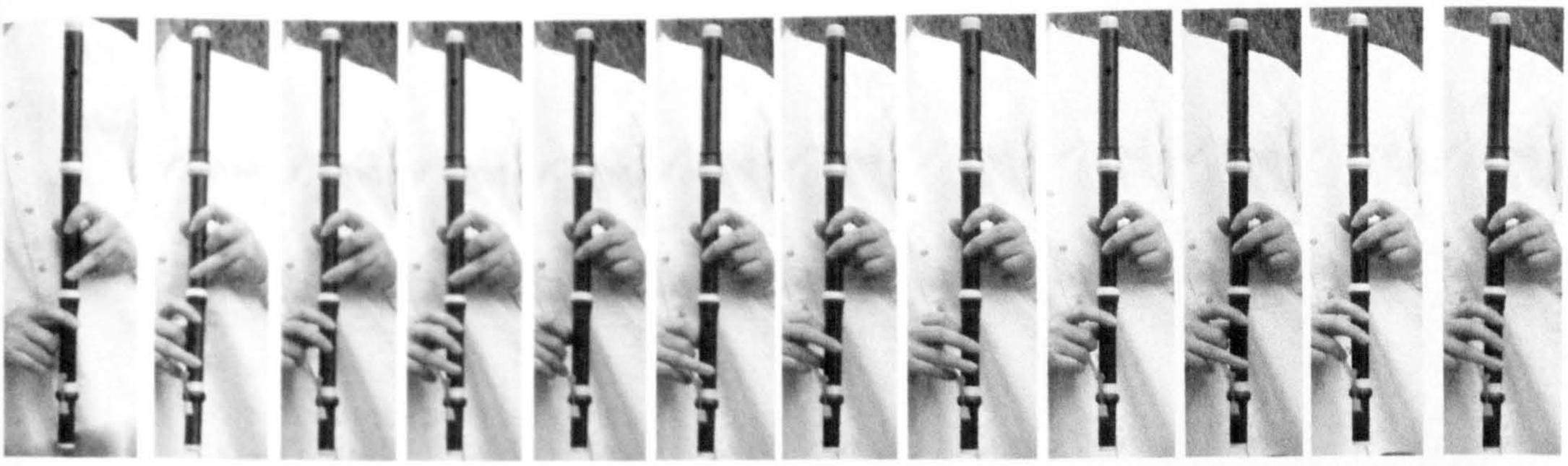
The illustrations of the super-row fingerings from zero to 63 should be read from left to right starting at the top left corner, ie:

App. 4.1	Fingerings
1st row:	**0 – 10**
2nd row:	**11 – 21**
3rd row:	**22 – 32**
4th row:	**33 – 43**

App. 4.2	Fingerings
1st row:	**44 – 55**
2nd row:	**56 – 63**

Appendix 4.1

Appendix 4.2



Appendix 5: CD's 1 – 4 Track Listings

CD1
Exercises & Experiments

TRACK		TIME
1	Warm-up; microtones on D, descending	4:46
2	Warm-up; microtones on D, ascending	4:42
3	Upper register microtones	1:45
4	Quartertone ex.	1:24
5	Exercise on glides	2:03
6	Double octaves (multiphonics)	3:06
7	Tongued trills	1:16
8	Circular breathing ex.1	3:33
9	Circular breathing ex.2	1:08
10	Circular breathing ex.3	1:22
11	Finger flutter ex.1	1:44
12	Finger flutter ex.2	2:00
13	Finger flutter ex.3	0:45
14	Finger flutter ex.4	1:59
15	Syllables and triplets	0:46
16	Fingering variants, triplets on G	0:36
17	Triplets on A	0:35
18	Triplets on A, low register	0:10
19	Rapid triplet resolution	0:12
20	Short phrases	0:35
21	Rapid triplet ex.	0:33
22	Tongued triplet ex.	1:15
23	"Sparrow" triplets	0:10
24	Nightingale figure ex.	2:42
25	Nightingale accaciatura ex.	2:42
26	Blackbird motif	0:14
27	Slonimsky, Interpolation of one note	1:42
28	Slonimsky, Symmetric Interpolation of one note	0:53
29	Slonimsky, Ultrapolation of one note	0:24
30	Slonimsky – improvisation	2:20
31	Multiphonics on 8	0:44
32	Multiphonics on 24	0:34
33	Multiphonics on 33	1:18
34	Super-row in three registers	0.57

These recordings are examples taken from a general documentation of work. They illustrate the developments of techniques as exercises and as potential material for use in improvisation. Some of the examples represent early stages of work, for instance, the quarter tone, circular breathing and Slonimsky exercises.

CD2
Solo Improvisations

TRACK		TIME
1	Robin improvisation 1on 48	0:53
2	Robin improvisation 2 on 48	1:00
3	Robin improvisation 3 on 48	1:06
4	Robin improvisation 4	1:05
5	Robin improvisation 5	0:27
6	Free improv slow	2:08
7	Free improv with multiphonics	2:01
8	Free improv with multiphonics/key percussion/circular breathing	1:00
9	Free improv	2:03
10	Free improv	2:26
11	Free improv with circular breathing	2:04
12	Free Improv	2:05
13	Thrush improv 1	0:51
14	Thrush improv 2	0:24
15	Thrush improv 3	0:38
16	Thrush improv 4	0:10
17	Thrush improv 5	0:58
18	Thrush improv 6	0:46
19	Improv with key	1:02
20	Improv with vibrato/glide/flutter tongue	1:00
21	Improv with key/ flutter tongue	1:01
22	Improv with key/vibrato	0:59
23	Improv with key/glide	1:03
24	Improv – tongued articulation throughout	1:01
25	Improv with slow/vibrato/glide/use of silence	0:59
26	Improv with flutter finger	1:00
27	Improv – using unstable notes	1:02
28	Improv with tongued articulation/quartert tones/multiphonics	1:01
29	Improv with tongued articulation/quarter tones	1:00
30	Improv with accel. tonguing to flutter tongue/multiphonics	1:01
31	Improv with flutter fingering	1:01
32	Improv with key/multiphonics	1:02
33	Improv – slow with vibrato	1:01
34	Improv with finger flutter	1:01
35	Improv with multiphonics	1:03
36	Improv with quarter tones	1:03
37	Improv – slow with flutter tongue	1:03
38	Improv – thrush-like with vibrato	1:03
39	Improv with multiphonics	1.04
40	Improv – rhythmic with tongued articulation/ flutter tongue	1:04
41	Improv – thrush-like	1.02
42	Improv – frenetic with flutter finger	1.03
43	Improv – free	3:23
44	Improv – Tropical Boubou	3:33

These improvisations were pursued as exercises, hence the almost constant adherence to a one minute duration. In many cases just one or two techniques were explored in an

improvisation, with varying musical results. Using robin song as a model was extremely demanding, while modelling improvisations on the repetitions of the song thrush was not always sufficiently rigorous. In both cases it is a question of balancing content, form and structure, and there is little room for misjudgement in the case of robin song.

CD3
Duetting
Stephen Preston with Amara Guitry

TRACK		TIME
1	Exploration – quarter tones against semitones	2:27
2	Tropical boubou with metronome	2:45
3	Calling	1:06
4	Frenetic	0:22
5	Shrike	1:59
6	Boubou	2:37
7	Simple antiphonal 1	1:19
8	Simple antiphonal 2	1:17
9	Antiphonal	4:38
10	Slow antiphonal	1:03
11	Patterned antiphonal	1:02
12	Slow, close intervals	5:01
13	Fast patterned antiphonal	0:33
14	Ostinato	4:00
15	Mixed antiphonal	5:59
16	Frenetic tongued	2:00
17	Ballistic1	0:18
18	Ballistic2	0:45
19	Slow calling	3:04
20	Trio (2 flts + vn) – slow	2:07
21	Trio (2 flts + vn) – frenetic	2:05
22	Trio (2 flts + vn) – calling	3:15
23	Duo – Ballistic3	1:20

These duetting examples are drawn from explorations and rehearsals although there is not always a clear distinction between the two. Rehearsals are just a deepening of the exploratory process, while the process of exploration can sometimes produce some very satisfactory work because of its freshness. The rehearsals themselves were preparations for performance of the duetting ensemble *Nodneeya*, which evolved out of the initial explorations with two flutes. Extracts of *Nodneeya*'s performances are given on CD 4.

CD4

Humans duetting in concert performances (Nodneeya)

&

Three birds duetting (Plain Wren; Spotted Morning Thrush; Tropical Boubou)

TRACK		TIME
	Humans duetting	
1	Dawn chorus 1	3:04
2	Antiphonal 1	2:36
3	Wrangling wrens 1	1:27
4	Nightsounds 1	3:03
5	Callsigns 1	1:57
6	Evening chorus 1	2:59
7	Dawn chorus 2	2:54
8	Antiphonal 2	2:18
9	Wrangling wrens 2	0:50
10	Nightsounds 2	3:16
11	Callsigns 2	2:11
12	Evening chorus 2	3:01
13	Dawn Chorus 3	9:31
14	Wrangling wrens 3	1:20
15	Nightsounds 3	2:48
16	Callsigns 3	3:16
17	Evening chorus 3	3:07
	Birds duetting	
18	PlainWren	0:08
19	SpottedMorningThrush from J. Roché, *WorldBestBirdsong*	0:59
20	Tropical Boubou from J. Roché, *WorldBestBirdsong*	0:55

The human duetting tracks are taken from concerts performed by the duetting ensemble *Nodneeya* (Stephen Preston and Amara Guitry), which was formed as part of this research. Performances took place in Colorado, Ohio, Georgia and North Carolina, USA.

Of the birds duetting the Plain Wren duet is reproduced with the permission of P.J.B. Slater; and the Spotted Morning Thrush and Tropical Boubou duets are from The *Worlds Best Bird Songs* recorded by J. Roché, reproduced with permission from www.wildsounds.co.uk

Appendix 6: List of Illustrations

FIGURES

Fig. 1.1 A comparison of baroque and Boehm flutes.

Fig.1.2 Disposition of hands and fingers on the baroque flute in relation to the embouchure and key. (redrawn from Delusse *L'art de la flute*).

Fig. 1.3 Cross-fingerings on Gb, G and G#/Ab (from Mahaut *Nouvelle méthode*).

Fig. 1.4 Fingering chart showing the standard baroque flute tessitura D_4 to A_6. and the use of figures to indicate fingering (from Quantz *On Playing the Flute*).

Fig. 1.5 Extract of fingering chart using filled and open circles to show closed and open holes.

Fig. 1.6 Figures showing the embouchure in a 'normal' position and when it is rolled inwards (from Schwedler *Flöte und Flötenspiel*).

Fig. 2.1.1 Examples of sliding or gliding the fingers from: (a) Monteclair's cantata *Pan et Sirinx* (sic), the flute is requested to imitate the voice if possible; (b) the 19th century English virtuoso Charles Nicholson, showing the famous (or notorious, depending on whether you were an admirer or a detractor) 'Nicholson glide'; (c) from John Luther Adams *Songbirdsongs*.

Fig. 2.1.2 The cadenza-like nightingale passage from Couperin's *Le Rossignol en amour*, (from the last five measures of the air).

Fig. 2.1.3 The chart of harmonic fingerings from Delusse's *L'art de la flute*.

Fig. 2.1.4 Examples of flutter tonguing from: (a) Edward Cowie's *Four Frames in a Row*, and (b) *Songbirdsongs Book II* by John Luther Adams.

Fig.2.1.5 (a) 19th century example of vibrato from Nicholson; (b) contemporary example of finger vibrato on the second A (*flatt*) in the last bar of the example below, John Thow's *Flute Lure*: (the indication *flatt*. is an abbreviation for *flattement*, the French Baroque term for finger vibrato).

Fig. 2.2.1 Examples of scale progressions with interpolations of (a) one, and (b) interpolations of two, three and four notes based on the tritone progression C-G#-C, (from Slonimsky's *Thesaurus*).

Fig.2.3.1 The quartertone scale from *L'art de la flute* by Delusse.

Fig. 2.3.2 The 43 note scale of Harry Partch.

Fig. 2.4.1 One of a number of charts made when mapping the fingerings of the flute.

Fig.3.1 The Fu Xi arrangement of the 64 I Ching hexagrams (after Huang).

Fig. 3.2 Hexagram 20 from the I Ching compared to the fingering of A on the flute, as notated by Quantz.

Fig.3.3 The Fu Xi square rearranged to represent the 64 fingering patterns of the super-row.

Fig. 3.4 The fingering of the diatonic scale of D major starting from C#. (From Tulou).

Fig. 3.5 Example of binary code in relation to ecosonic fingering on the flute. The number of the fingering shown is 1.

Fig.3.6 The decimal number equivalents to the position of the holes in the binary code sequence.

Fig. 4.1 The sonogram of the plain wren recording on CD4:18.

Fig. 4.2 Examples from observational diary entries recording song material as potential improvisation model.

Fig. 4.3 Examples from an observational diary entry transcribing the rhythms of robin song elements.

Fig. 4.4 Example of binary code in relation to ecosonic fingering on the flute showing the fingering 1.

Fig. 5.1 A series of exercises in dynamic control (from Nathan).

Fig.5.2 Examples of speech notated as music (from Steele).

TABLES

Table 3.1 The super-row as the binary arithmetic sequence zero to 63.

Table 3.2 An example of a finger-row with the fixed-fingering pattern 101.010 combined with the moving-finger pattern 010.101.

Table 3.3 Fixed-fingerings in left hand and right hand.

Table 3.4 Fixed-fingerings in both hands.

Table 3.5 Moving-finger sequences in left and right hands.

Table 3.6 Examples of moving-finger sequence progressing from left to right, and from right to left hands.

Table 3.7 Moving-finger sequence on fixed-fingering patterns.

Table 3.8 Moving-finger sequences: a) moving from left to right: b) from closed holes moving right to left: c) from closed holes moving left to right.

Table 3.9 A finger-row of six moving-fingers, each finger closing one hole at a time.